

The Effectiveness of Classroom Code-Switching in Malaysian Science Classrooms

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Abstract

In 2003, English for Teaching of Mathematics and Science policy was implemented in Malaysia, requiring teachers to teach these subjects in English through primary to tertiary education. However, this policy was abolished in 2011, leaving schools to decide for themselves the medium of instruction (MOI) for these subjects during the soft-landing period. By 2022, all primary and secondary education is expected to complete the reversion of MOI to Malay. However, this is not applicable to both pre-university and tertiary education where students will continue to learn Mathematics and Science in English. Under such circumstance, it is foreseen that students and teachers in higher education will have problem learning and teaching these subjects when the reversion of MOI to Malay is completed as students will have learnt the subjects fully in Malay before entering higher education. As Malaysia is a multilingual country and most teachers and students speak both English and Malay, the researcher is interested to investigate the effectiveness of classroom code-switching (CS) and the possibility of adopting it as a strategic teaching tool in science classrooms.

This research was carried out in three schools in Malaysia in 2013. Lessons conducted by two science teachers from each school were observed and audio-recorded for four hours. Three of these teachers were teaching science in English medium (EMI) whereas the other three had bilingual classrooms, teaching in both Malay and English (BMI). The recordings were then transcribed and analysed for instances of CS and their functions. These teachers were also interviewed about their language and education backgrounds. Students in each class were asked to complete a questionnaire by providing their language background and preferences of MOI for the teaching of science. Having compared both EMI and BMI classes, it is found that CS in EMI classes does provide strategic functions for classroom management and transmit of content knowledge. Students also appear to be very receptive to classroom CS and even view it as a way to improve their language skills.

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Transcription Conventions

The following conventions are adapted from Seedhouse (2004).

T:	Teacher
S:	Unidentified student
S1:	Identified student within the same episode
SS:	Several or all students simultaneously
word (<i>translation</i>)	Non-English words are bolded and followed by italicised English translation in parentheses
(.)	Short untimed pause
(...)	Long untimed pause
--	Abrupt cut off
?	Rising intonation, not necessarily a question
!	Animated or emphatic tone
,	Low-rising intonation, suggesting continuation
.	Falling (final) intonation
(?)	Unintelligible word
(??)	Stretch of unclear or unintelligible speech
(guess)	Indicates transcriber's doubt about a word
((SS laugh))	Non-verbal actions or observer's comments

Chapter 1 Introduction

1.1 Introduction

In recent years, the Malaysian education system has been experiencing a few changes in the language policy. It all started in 2003 when *PPSMI (Pengajaran dan Pembelajaran Sains dan Matematik dalam Bahasa Inggeris, English for Teaching Maths and Science, ETeMS)* was introduced. Under this policy, maths and science are to be taught in English (originally it was in *Bahasa Malaysia*, Malay language). The implementation of *PPSMI* received various socio-political reactions. Although most parents and teachers welcomed such decision, different political parties still flagged their concerns. After many meetings and weighing the overall benefits for all Malaysian students, the government decided to abolish the policy in 2011. However, in order to improve the English language proficiency of students and also to provide a soft landing period for the change of language of instruction for maths and science, *MBMMBI (Memartabatkan Bahasa Malaysia dan Memperkukuh Bahasa Inggeris)* to uphold the Malay language and to strengthen the English language was proposed. This policy allows *Bahasa Malaysia* to be brought back to schools as the language of instruction. At the same time, schools are given the authority to decide on which language of instruction they want to adopt. They can either go straight into using *Bahasa Malaysia*, or continue using English for those who have started learning under *PPSMI* or use both English and *Bahasa Malaysia* to teach. Therefore, it can be said that schools are at a time where there is great stress or pressure incurred by teachers for whichever option a school opts. Consequently, the investigation of classroom language use at this period is deemed both timely and practical to assess the implications within the Malaysian education system.

1.2 Statement of Problem

As mentioned in the introduction, Malaysia is now undergoing a change of language policy within the national education system. Both teachers and students have to slowly adapt to the growing changes and accept Malay as the Medium of Instruction (MOI) in schools (for science subject). Although we are unable to assess the immediate effect of such change, it is foreseen that should this policy stay, future batch of students may struggle once they enter *Form Six* education. The following tables explain such predicament:

Table 1.1 MOI for science in primary school during soft-landing period

Primary School							
	2010	2011	2012	2013	2014	2015	2016
Standard 1	O	X	X	X	X	X	X
Standard 2	O	O	X	X	X	X	X
Standard 3	O	O	O	X	X	X	X
Standard 4	O	O	O	O	X	X	X
Standard 5	O	O	O	O	O	X	X
Standard 6	O	O	O	O	O	O	X

O: Mathematics and Science in English

X: Mathematics and Science in Malay

Table 1.2: MOI for science in secondary school during soft-landing period

Secondary School							
	2016	2017	2018	2019	2020	2021	2022
Form 1	O	X	X	X	X	X	X
Form 2	O	O	X	X	X	X	X
Form 3	O	O	O	X	X	X	X
Form 4	O	O	O	O	X	X	X
Form 5	O	O	O	O	O	X	X
Form 6	O	O	O	O	O	O	O

O: Mathematics and Science in English

X: Mathematics and Science in Malay

From the table given above (Table 1.1 & 1.2), it can be noted that students who will complete their Form 5 study in 2021 are the first cohort who are affected by the *MBMMBI* policy in 2011, i.e. to study Maths and Science in Malay. If they continue their secondary education in national schools (*Sekolah Kebangsaan*), they will have learnt maths and science in Malay for 11 years before entering Form 6. Bearing in mind that maths and science in Form 6 and university education are (and will continue to be) taught in English, these students are expected to face difficulty in Form 6 as they will have to go through the transition of learning maths and science in Malay to English.

1.3 Research Aims and Research Questions

Having seen the current problem posing in Malaysia in the previous section (Section 1.2), this research is proposed not to justify the benefits of using either *Bahasa Malaysia* or English as the MOI. In fact, now that the decision regarding MOI has been made, it is hoped that this policy is here to stay in order to reduce the stress and changes both teachers and students will have to witness every time there is a change of policy. However, the predicament of Form 6 students having to go through a transition period of change of MOI still exists and is calling for preparatory measures to overcome this problem.

As the proponents of classroom code-switching (CS) believe that such classroom interaction is useful for bilingual education (see Section 3.4.4.2 for detailed discussion about the benefits of classroom code-switching), this research is undertaken in hope that the usefulness of classroom code-switching in future Form 6 classes will be investigated further. In order to do this, the aims of this study have been given below:

- To investigate and describe CS practice in science classrooms
- To examine in what context and for what purposes CS occurs
- To study the beliefs, opinions and attitudes of both teachers and students towards CS

In order to achieve the above aims, the following research questions have been formulated:

1. Do science teachers CS in class?
2. How often do science teachers CS in class?
3. In what context and for what purposes do science teachers CS in class?
4. What are students' views towards teachers' CS?

1.4 Structure of the Thesis

Moving from the introduction, the remaining part of this thesis is structured into 6 chapters. Chapter 2 provides research background for this study where an overview of the Malaysian education system is described. The language policy changes in Malaysia will also be discussed as this explains the motivation behind this research.

Chapter 3 reviews the literature of previous studies relevant to this research. The first section of this chapter describes bilingualism and bilingual education in general before looking into bilingual education specifically in Malaysia. Then, the issues in the choice of MOI in multilingual societies are investigated. Special focus is given to Brunei, Singapore and Hong Kong as these countries, like Malaysia, are also part of the post-colonial countries of which the education system is being affected by the English language. Similarly, these countries are also close to Malaysia geographically and share similar socio-cultural background. The study of code-switching is detailed next where different definitions, types and functions of CS are discussed. This section also studies the different frameworks used to analyse the pragmatic motivations of CS in general before focusing on classroom CS. This is followed by a comparison between bilingual education, translanguaging and classroom code-switching. This chapter ends with a review on the conventionalised forms of action in science classroom.

The research design and methodology is described and explained in chapter 4. It details the research design which includes the sampling of subjects, research instruments for data collection and procedure for collecting and analysing data. Some ethical considerations and context for analysis are also discussed in this chapter.

Chapter 5 presents the results and analysis of this research. It is split into two main sections: EMI classrooms and BMI classrooms. In each section, data collected from three teachers will be analysed and the functions of their CS will be quantified and categorised. The students' views on classroom CS will also be tabulated and analysed.

Chapter 6 makes further discussion and interpretation of the research findings presented in Chapter 5. It compares how the functions of CS are different across EMI and BMI classrooms and also across the different episodes found within a science lesson. Some possible reasons for these similarities or differences are also presented and discussed. This chapter ends with a discussion of students' views on classroom CS and how it sheds positive light on the benefits of CS in the science classroom.

Lastly, chapter 7 provides a summary of the major findings emerging from this study. It makes some suggestions of possible contributions of the findings to classroom CS in the Malaysian science classrooms, along with the strengths and limitations of this study. Finally, some directions for future research are also discussed towards the end of this chapter.

Chapter 2 Research Background¹

2.1 Introduction

There has been a strong debate on what should be the medium of instruction (MOI) for the teaching of Mathematics and Science subjects in Malaysian schools. When the policy to use *Pengajaran dan Pembelajaran Sains dan Matematik Dalam Bahasa Inggeris (PPSMI, English in Teaching Mathematics and Science, ETeMS)* in schools was implemented in 2003, many had different opinions on the matter. The debate is on-going even though the government decided in 2009 to reverse the policy by using the National language, *Bahasa Malaysia* (Malay Language), as the medium of instruction for teaching these subjects. However, many parents still argue that using English as the medium of instruction is preferable and that the government should not have made such a decision (Goon, 2012; Liong, 2012).

This chapter is split into 6 sections. In section 2.2, an overview of the Malaysian education system is presented. Section 2.3 details the language policy changes Malaysia has experienced since independence. Next, section 2.4 describes the reasons for the implementation of English for the Teaching of Mathematics and Science policy (ETeMS) and the socio-political reactions to such national decision. In section 2.5, the abolishment of ETeMS is explained and a summary is provided in section 2.6.

2.2 Overview of Malaysian Education System

Malaysia is a multiethnic and multilingual country. There are three main ethnic groups: the Malays and other indigenous groups (who considered themselves as *bumiputera*, which literally means “princes of the earth” – the true owner of the soil), the Chinese and the Indians. Due to the diversity of cultures, schools have different mediums of instruction. Since independence (1957), primary schools which cater for students aged 7–12 in Malaysia are basically divided into *Kebangsaan* (National) and *Jenis Kebangsaan* (National Type) schools. The National schools which are fully supported and funded by the government, use Malay as the medium of instruction whereas the National-type schools, also known as the

¹ Part of this chapter has been submitted to proceedings of BAAL conference 2013

vernacular schools, are partially supported by the government, either use Mandarin or Tamil. I will discuss the history of these schools in the next section. Vernacular schools exist primarily to fulfil the parental choice option in the multilingual Malaysia (David & Govindasamy, 2005). As for the secondary level (for students aged 13-17), all students are required to attend National schools which use *Bahasa Malaysia* as the medium of instruction. There are, however, parents who choose to send their children to privately run Chinese independent high schools or international schools that adopt Mandarin and English respectively as mediums of instruction.

Whatever primary school parents may choose, students need to take a National examination when they are in standard six (final year in primary school). The *Ujian Penilaian Sekolah Rendah, UPSR* (Primary School Evaluation Test) has exam papers in Malay, Mandarin and Tamil in order to cater to different language needs. As for students in secondary National schools, they face two major examinations during their third and fifth form respectively: the *Penilaian Menengah Rendah, PMR* (Lower Secondary Assessment) and *Sijil Pelajaran Malaysia, SPM* (Secondary School Leaving Certificate). *PMR* was abolished in 2014 and substituted with *PBS, Pentaksiran Berasaskan Sekolah* (School-based Continuous Assessment). Both *PMR* and *SPM* were conducted in Malay until the recent changes in the language policy in 2003. Upon completing their studies in National secondary school and passing the *SPM* examination, students who wish to further their studies can then move on to Form Six. This is a one and a half year course (divided into Lower Six and Upper Six) which prepares students for the *Sijil Tinggi Persekolahan Malaysia (STPM, Malaysian Higher School Certificate)*, a compulsory pre-university examination for all students who wish to enter the local universities. On the contrary, students in Chinese schools have two extra major examinations throughout their secondary education, the Unified Examination Certificate (UEC) for Junior Middle Three and Senior Middle Three (third and sixth year of secondary education). Students normally sit for these exams at the end of their junior middle three and senior middle three. However, this examination certificate is not recognised by the Malaysian government. Therefore, it is almost impossible for students with this certificate to enrol in the country's local universities. Hence, it is at the discretion of the school to decide if the students should be prepared for the National examinations, as the pressure these students will have to bear is immense. Upon completing the UEC for Senior Middle Three, students in Chinese Independent Schools usually either opt for private colleges which offer pre-university courses such as A-Levels, International Baccalaureate (IB) and South Australian

Matriculation or to study abroad. Many of them who obtain good results in UEC will use this result and continue to further their studies in Singapore, Taiwan and China. However, if the student takes the SPM examination because the school adopts the SPM syllabus on top of the UEC syllabus, then the student may enrol in Form Six. The figure below shows a summary of the education system in Malaysia.

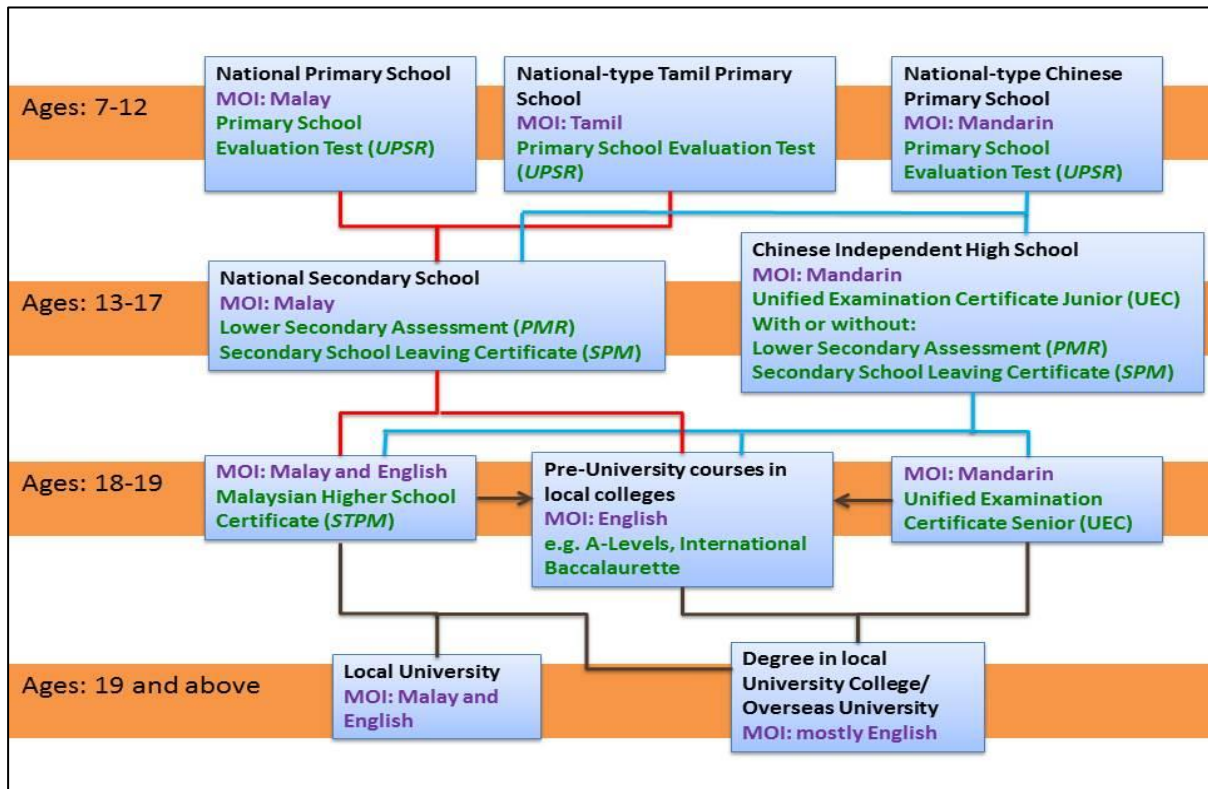


Figure 2.1 Summary of the education system in Malaysia

2.3 Background to Language Policy Changes in Malaysia

Malaysia was colonised by the British between 18th and 20th century. Prior to the British period (before 1771), local schools were set up to meet the different needs of each ethnic community (Gill, 2004). For example, the Chinese community established Chinese schools by following the curriculum in mainland China, which focused on Mathematics and business, while the Malay schools paid more attention to religious teaching and the Tamil schools adopted the curriculum from India.

During British colonisation in the 1800s, English was made the official language and English schools were seen mushrooming in the nation especially in urban areas. Nonetheless, English

schools still coexisted peacefully with the vernacular schools; only a handful of Malay individuals opposed the idea of sending their children to the English schools for fear that the teachers would convert their children to Christianity since most of the English schools at the time of British colonisation were run by missionaries (Chan & Tan, 2006). As time passed, the English schools became the preferred education provider, especially among the Chinese and Malay elites, as many felt that being educated in an English school promised their children a better future. As Asmah aptly puts it, “a certificate from the English school promised jobs in the government and in the private sector... (whereas the vernacular schools only) produced literate farmers, carpenters and small time shopkeeper” (2003, p. 102). As such, English was gaining popularity in the nation while the local languages were sidelined.

In 1946, after the Japanese occupation, the Cheeseman Plan was introduced (Hassan, 2005). This was a policy advocating parallel bilingualism in which “two school systems use two different languages” (Hassan, 2005, p. 5). This policy encouraged free primary education in all languages. As for secondary education, there were four different types of schools using four distinct media of instruction, English, Malay, Mandarin and Tamil. At the same time, English language was a compulsory subject in all vernacular schools and “mother tongue” classes was made available in all English schools. However, this policy was abandoned in 1949 as it neglected the need of integration in the nation because even though English was a compulsory subject in school, as the language of the coloniser, it was felt to be unable to promote unity among different ethnicities.

Soon afterwards, in 1950, the Barnes Report was published and had the main focus of investigating the situation of Malay education. This eventually brought upon a radical change in the education system. The Committee proposed that all schools should become National schools where students from all ethnic groups should be taught in Malay first, then English (Hassan, 2005). This recommendation was strongly opposed by the Chinese and Indian communities as they saw it as a way of eliminating their languages and cultures. Consequently, the Fenn-Wu Committee was formed in 1952 to look at the plight of Chinese and Indian education. It was then reported that the Chinese and Indian did not reject the idea of having English and Malay as the media of instruction as long as they were able to keep their mother tongue classes in schools as well. A review of the education policy, the Razak Report, was prepared in 1956. This report introduced Malay as the National language and all schools, regardless of the medium of instruction, should teach Malay (in addition to English).

Thus, National and National-type schools were formed. At the same time, a common syllabus was to be taught in all schools in the hope that common values would be inculcated to achieve the integration of the nation (Hassan, 2005).

Since gaining independence in 1957, Malaysia has experienced language policy change in two distinct periods – the post-independence period (around 1960s–1980s) and the knowledge-economy period (during the 1990s - 21st century) (Gill, 2006).

During the post-independence period, there was a drastic change in the status of English, especially after the ethnic riots in 1969. With the increased urgency to find a common language to unite all the ethnic groups in Malaysia, many Malaysians, especially nationalists, thought that English, which was the colonial language, could not fulfil the conditions required by a National language (Chan & Tan 2006). Moreover, the first Prime Minister of Malaysia, Tunku Abdul Rahman, proclaimed that “as a developing nation we should want to have a language of our own... (a nation without a National language is) a nation without a soul and without a life” (as cited in Wong & Ee, 1975, p. 79). Thus, Malay was made the National language in the country. According to Asmah (2003, p. 103), it was chosen as the National language because of several factors: it was widely spoken among all the different ethnic groups, it had high volume of literature and most importantly, it was historically the important language in administration and diplomacy in the Malay archipelago. Apart from that, the medium of instruction in schools was also changed from English to Malay with the implementation of the National Language Act in 1963. Thereafter, the English language had to make way for the development of the Malay language. English was even relegated to the position of second language in the education system where although it was a compulsory subject in all schools, students did not need to pass the subject to proceed to higher education. The same situation continued for almost 40 years.

In 2002, the then Prime Minister of Malaysia, Tun Dr. Mahathir Mohamad, announced that starting from year 2003, English was to be used as the medium of instruction for the Mathematics and Science subjects in National schools. Under the recommendation of the Ministry of Education, such change would progress beginning with the Standard One (first year of primary school), Form One (first year of secondary school) and Lower Six (first year of Form Six) and subsequently at all other levels (Mahathir, 2002). This change came as a surprise to the teachers, parents and lecturers in universities but many welcomed this

proposal. However, its implementation was not without problems (to be discussed in section 2.5). As a result, the government decided to reverse the policy in 2009. Despite that, the government understood that the need to improve Malaysian students' proficiency in English should be prioritised. Hence, it was proposed that English lessons should be increased in schools and the Education Ministry aimed to recruit some 13,000 English language teachers to ensure that students get all the help in improving their fluency in English. Following that, in year 2010, a new policy, *MBMMBI* abbreviated for *Memartabatkan Bahasa Malaysia & Memperkukuh Bahasa Inggeris* (To uphold Bahasa Malaysia and to strengthen English language) was introduced to replace the ETeMS. This policy had two main objectives: to build the nation towards the goal of 1Malaysia (pronounced as One Malaysia: a concept proposed by Prime Minister Najib to emphasise ethnic harmony, National unity, and efficient governance) and to enable the country to compete nationally and globally (Malaysian Education Ministry, 2010).

2.4 Implementation of English for the Teaching of Mathematics and Science Policy

The policy to teach Mathematics and Science in English (ETeMS) was a top-down decision, driven largely by the former Prime Minister, Tun Mahathir Mohamad (Gill, Nambiar, Ibrahim & Tan, 2010). Therefore, in 2002, Tun Mahathir Mohamad outlined some reasons for the change of medium of instruction in the teaching of Mathematics and Science. One of the main reasons was the influence of globalisation. This influence can be divided into two challenges: the knowledge economy and its implications for human resource capability and the explosion of knowledge and information (Gill, 2005, p. 250). The first challenge came when the National Brains Trust on Education (2002) reported that new standards must be set in order to transform Malaysia into a nation which has the best education system among Third World countries. It further explained that as the world sees a shift from P-economy (production-oriented economy) to K-economy (knowledge-based economy), Malaysia had to produce a world-class K-economy workforce in order to remain competitive at the international level. The second challenge was raised when it was clear that in order to achieve the nation's vision of achieving advanced industrialisation by year 2020, Malaysia needed to develop more knowledgeable workers who are innovative in the field of Science and Technology, and this would only succeed if they had access to the knowledge and information in the field. However, due to the successful implementation of National language policy over the past 2 decades, many graduates of that generation were fluent in the Malay

language but not in English. Thus, this meant that much knowledge and information had to be translated from English to Malay, which is a problem in itself too.

According to Gill (2005), even though the *Dewan Bahasa dan Pustaka* (The Institute of Language and Literature) and the National Translation Agency had been actively translating texts and publishing original works in Malay, “the translation process progressed at a slow pace...there was no way to keep up with the number of books that needed to be translated” (p. 252). This is the second reason behind the change of language policy. With a great number of new English books and articles being published every day, the new generation should not rely solely on the translated version. Instead, they should have the proficiency in English which enables them to retrieve new knowledge directly from the original source.

With English being the new common working language due to globalisation, many graduates of public universities, who had been taught in Malay, had difficulty in securing a job particularly in the private sector. One of the most obvious obstacles to the employment of these graduates would be interviews which were conducted in English. Graduates with low proficiency in English were unable to perform well during the interviews because they were unable to relate their knowledge and experience in English. Furthermore, these graduates would have obtained their degrees solely based on their lecture notes in Malay as they had not been retrieving new knowledge from extensive reading of English resources. As investigated by Yong (2010, p. 9), “Malaysian students...were ambitious and wanted to be the best in their undertakings...they preferred tests and examinations to assignments...usually accepted their teachers’ or lecturers’ statements and ideas with little questioning...often expected to be spoon-fed, using only textbooks and teachers’ notes, rarely engaging in more problem-based learning and voicing their opinions.” This attitude had caused it to be even more difficult for them to secure a job in the private sectors.

Compared with public universities, graduates from private universities were more sought after by companies in the private sector. This is mainly due to their higher proficiency in English, as the medium of instruction for private universities was English. All these reasons had driven the Malay-proficient graduates to throng into the civil services for employment and resulted in Malaysia having one of the largest civil service workforces in Asia (Gill, 2005). Not only that, as only those from the middle-class families could afford to send their children to private universities, with the majority of them being Chinese, and the majority of

undergraduates in public universities were Malays, this had caused serious socioeconomic problems in the nation (Gill, 2004). In 2002, the problem became so serious that there were approximately 44,000 graduates from public universities who were unemployed with most being the Malays (Mohamed, 2002c as cited in Gill, 2004). All of these issues had caused tension in politics where Malays were thought to have fewer advantages compared with other races and this resulted in a strong motivation to reinstate English for the teaching of Mathematics and Science in schools.

When English for the teaching of Mathematics and Science was first proposed in the year 2002, it drew different reactions from politicians, academics and parents. While many parents and teachers welcomed the move, the majority of political groups and educationists objected it.

When the policy was first implemented in the year 2003, many parents agreed that it was the right decision (Goon, 2012; Liong, 2012). Parents had voiced their opinion saying that teaching Mathematics and Science in Malay would not have much value for the students as they would most probably be learning these subjects in English when in universities. Hence, learning these subjects in Malay was actually seen as a struggle for the students and an extra burden to cope with when they enrolled in tertiary education, especially overseas universities. Moreover, teaching Mathematics and Science in English when students are still in school was argued to open the door for students to access information in English at a younger age. This would mean that students could search for information and knowledge through the internet, journals and international conferences which mostly use English as their lingua franca.

However, the politicians and educationists did not agree with them. One of the main criticisms brought forward was due to the concerns in a multicultural and multilingual country about language rights (Chan & Tan, 2006, p. 311). Many thought that using English in Mathematics and Science would violate their rights to use their mother tongue as the medium of instruction in National vernacular primary schools. Having the support from the Malaysian Chinese Association (a component party of the ruling *Barisan Nasional*), the United Chinese School Committees Association of Malaysia (*Dong Zong*) and Chinese Schools Teachers Association (*Jiao Zong*) submitted a memorandum to the Education Minister, suggesting that the policy to teach Mathematics and Science in English should be reconsidered (*Harakah Pas Newsletters*, 16-31 August 2002, as cited in Chan & Tan, 2006).

Furthermore, students from Chinese schools have been known to be well-trained in Mathematics and Science and it has been a core strength of Chinese school curriculum to teach Mathematics and Science in their mother tongue. They believed that this would make it more effective for students to learn the subjects. Thus, when ETeMS was proposed, many Chinese educationists viewed it as an attempt by the government to change the character of Chinese schools. They also feared that their cultural identity was being threatened (Chan & Tan, 2006).

Another concern of the educationists was that teaching Mathematics and Science in English would result in students in vernacular schools in becoming trilingual at an early age. Before this, vernacular school students were exposed to English only in primary year 3. Being a trilingual might seem to be an advantage for the children but as Khoo pointed out, using English to teach Mathematics and Science only had a minor impact on raising the proficiency of English (in Chan & Tan, 2006). This meant that students might after all, not become proficient in the target languages. Apart from that, the intervention of teaching Mathematics and Science in English may even cause unnecessary stress for these young students.

2.5 Abolition of English for the Teaching of Mathematics and Science Policy

In July 2009, the government made a final decision to reverse the policy of teaching Mathematics and Science in English (Math and Science, 2009). The medium of instruction for these subjects was to remain the same as the old system starting from year 2011, under which Malay would be used for National schools and Chinese or Tamil for vernacular schools. However, this move would not affect those in Form Six and Matriculation (Pre-U studies for local universities). To explain the reversal, the Minister of Education Tan Sri Muhyiddin Yassin (2012 deadline on Science and Maths, 2009) mentioned that since the start of teaching Mathematics and Science in English policy, the results in these subjects for students in rural and urban area has shown a significant gap (see Appendix A). As there is very little need for rural students to master the English language and they even consider the language as “alien and of little practical use” (Chan & Tan, 2006:318), these students had no motivation to excel in English language. Therefore, it was seen as a burden for them to learn Mathematics and Science through English.

Besides, it was found that only a small percentage of teachers were sufficiently fluent in English (see Appendix B). The shortage of teachers who were proficient in English had not only affected the teachings in rural areas but also in urban areas. In yet another study, although it was found that teachers were generally keen on the new policy, 81.8% of the respondents admitted having problems explaining difficult mathematical or scientific concepts to their students in English and they reported that they would all choose to use Malay instead (Pandian & Ramiah, 2003).

Another major problem faced by the teachers during the implementation of the policy was shortage of time (Chan & Tan, 2006). From the announcement of policy change to actual implementation, Mathematics and Science teachers had very little time to prepare. Therefore, in addition to normal teaching hours, the teachers had to attend training programmes organised by the ministry of education which were held after school hours and sometimes even during weekends. This had had a direct effect on their work routines and some even faced personal problems such as marital stress for attending the training during the weekends.

Apart from the teachers, the *Jurulatih Utama, JU* (core trainers) for the ETeMS programme had also expressed some concerns. As most of these core trainers were chosen from current practising teachers, they faced almost the same problems as the teachers who joined the training as participants, if not more. Besides the increased workload, the core trainers generally did not have support from their own schools (Lim, 2003). This was mainly due to their frequent absence from school for the purpose of organising training, causing some of the principals to be sceptical about their work as core trainers.

With all the problems mentioned above, the Education Ministry finally decided to abolish ETeMS in 2011. In order to reduce the sudden impact which may be caused by the abolition process, the government adopted a ‘soft-landing’ approach by proposing a new policy, *MBMMBI* (abbreviation for *Memartabatkan Bahasa Malaysia, Memperkukuh Bahasa Inggeris*, in English, ‘to uphold Bahasa Malaysia and to strengthen the English language’).

According to Deputy Prime Minister Tan Sri Muhyiddin Yassin, also the Education Minister, under the MBMMBI policy which started in 2011, students under the ETeMS policy will be able to continue with the syllabus till Form 5 education (Chapman, 2011). Meanwhile, it is at the discretion of the school to decide what medium of instruction will be used for

Mathematics and Science subjects. The schools can choose either English or Malay, or even both languages as the medium of instruction. One school can even have different classes teaching these subjects in different languages. Furthermore, the public examinations such as *UPSR*, *PMR* and *SPM* would still be continued in bilingual mode. Students can opt for any language when answering the questions. Therefore, it is foreseen that Mathematics and Science will only be taught in Malay fully in 2016 for primary schools and in 2021 for secondary schools. The abolishment of ETeMS, however, does not affect the Form Six students. Students in Form Six classes will continue to learn Mathematics and Science in English as these subjects will mainly be taught in English during their university education (see Table 1.1 and Table 1.2 for details of soft-landing period).

2.6 Summary

This chapter has provided an overview of Malaysian education system and discussed how language policy was changed over-time since the colonisation of British. It has also described the implementation and abolishment of the recent English for the Teaching of Mathematics and Science policy (ETeMS) which calls for the investigation of classroom code-switching as a communicative tool to help ease the MOI transition period for future Form 6 teachers and students.

Chapter 3 Literature Review

3.1 Introduction

This chapter is structured into 7 sections. Section 3.2 first explores the different varieties of bilingual education. Then, it looks into the bilingual education in Malaysia. In section 3.3, various issues in the choice of medium of instruction (MOI) in multilingual societies, such as South Africa, Hong Kong and Singapore will be discussed. Section 3.4 provides detail discussion of code-switching (CS). It reviews the definitions, types and functions of CS and also discussed the different frameworks proposed for the analysis of pragmatic functions of CS. Classroom CS is also described in this section as it is the main focus of this study. Bilingual education, translanguaging and classroom CS will be compared in section 3.5 and some conventionalised forms of action in the science classroom will be presented in section 3.6. Finally, section 3.7 provides a summary to this chapter.

3.2 Bilingualism and Bilingual Education

Bilingualism means having the ability to use two languages, prefix ‘bi’ means ‘two’, whereas ‘multilingualism’ is about the ability to use three or more languages. Nevertheless, to say a person who speaks two languages is a ‘bilingual’ is ambiguous because there may be different scenarios to this, e.g. the person is proficient in two languages but uses only one in practice, the person has higher competence in one language than the other even though he/she speaks both languages regularly, the person speaks one language at work and another language at home or even uses different language in speaking compared with writing and reading. Baker (2011, p. 3) therefore, uses ‘language ability’ and ‘language use’ to differ between the degree and function of a certain language to a bilingual.

As for ‘bilingual education’, Abello-Contesse defines it as ‘a generic concept that refers to various types of educational programs which provide systematic instruction in two (or more) languages for a prolonged period of time’ (2013, p. 4). Bilingual education is not a recent phenomenon in Malaysia. As Malaysia is a multi-ethnic and multilingual country, where Malay is the National language and English is the second language in the nation, most Malaysians are bilingual. Besides Malay and English, many also speak Mandarin or Tamil as

their mother tongue. Language has proved to be one of the controversial issues in Malaysia, as it is a multiracial country (Asmah Omar, 1979). To ensure peaceful co-existence among the various races, the Sedition Act of 1971 regards language as a 'sensitive' issue and discussion of it meant a jail sentence (Asmah Omar, 1979). Education, on the contrary, is seen as a means of 'upward social mobility, redressing economic imbalances and influencing young minds into target attitudes of the future' (Gaudart, 1987). Therefore, it is clear that language plays a major role in the Malaysian education system.

3.2.1 Varieties of Bilingual Education

Many researchers have tried to classify bilingual education. One of the most detailed classifications was by Mackey (1970). There were 90 different patterns of bilingual schooling under this categorisation which considers: the languages of the home, the curriculum, the community in which the school is located and the international and regional status of the languages. Fishman (1976) and Hornberger (1991) categorise the types of bilingual education by examining the aims of such education. A frequent distinction in aims is between transitional and maintenance of bilingual education. Transitional bilingual education aims to shift children from minority language to the dominant or majority language. Social and cultural assimilation is the underlying aim. On the contrary, maintenance bilingual education attempts to foster the minority language in the child, strengthening the child's sense of cultural identity and affirming their rights of ethnic minority group in the country (Baker, 2011). Otheguy and Otto (1980) distinguish the different aims of static maintenance and developmental maintenance. Static maintenance aims to maintain the language skills at the level when child enters school. This is to prevent home language loss and not increase skills in that first language. Developmental maintenance, however, aims to develop student's home language skill to full proficiency and full biliteracy or literacy. These studies show that the aims of different forms of bilingual education can be very different and Ferguson et al. (1977) even provided 10 examples of the varying aims of bilingual education:

- i. to assimilate individuals or groups into the mainstream of society; to integrate the minority group into the community
- ii. to unify the multilingual society; to bring unity to a multi-ethnic nation
- iii. to enable individuals or groups to communicate with outside world
- iv. to provide language skills, which are on demand in the market, increasing the employability and status

- v. to preserve ethnic and religious identity
- vi. to reunite and moderate between different linguistic and political communities
- vii. to extend the use of colonial language
- viii. to strengthen the elite groups and preserve their position in society
- ix. to give equal status in law to languages of unequal status in daily life
- x. to deepen the understanding of a language and its culture

The above list shows that varying philosophies and politics have influence on the aims of bilingual education. Based on this, Baker (2010) suggests that bilingual education has four major perspectives: i) as part of language planning, ii) politics, iii) economics and cost-efficiency and iv) pedagogy. He also suggests that there are 10 types of bilingual education, among which García (2009) and Skutnabb-Kangas (2000) have provided many international examples. These programmes are split into three forms: monolingual forms of education for bilinguals, weak forms of bilingual education for bilinguals and strong forms of bilingual education for bilinguals.

A) Monolingual Forms of Education for Bilinguals

1) Submersion education (structured immersion)

Submersion education is often used to describe the education for students who speak minority language and are placed in mainstream schools. It is very often described using the swimming pool metaphor where students are thrown into the deep end and expected to swim as quickly as possible without proper swimming lessons. The language of the pool will be the majority language (e.g. English in the United States) and not the home language of the child (e.g. Spanish). The minority students are taught all day in the majority language, alongside fluent speakers of majority language. Classroom communication will always be in the majority language. In such a situation, students will either sink, struggle or swim. One of the basic aims of submersion education is assimilation of minority language speakers. This is seen as a tool of integration. Hence, school becomes a melting pot for students to learn the majority language.

In the United States, such an experience is also found in structured immersion programme (Brisk, 1998). This programme contains only language minority students and no language

majority students. In such classes, the first language is not developed but replaced by majority language. This is different from the submersion education as teachers in structured immersion use a simplified form of the majority language and they may sometimes accept first language contribution at the beginning. There will be no native language support in these classrooms.

2) Submersion with pull-out classes

Submersion education may occur with or without pull-out classes, which also known as withdrawal classes. Such classes are provided as a way of keeping language minority students in mainstream schooling. Due to majority language inability, these students may fall behind on curriculum content delivered to others in majority language. Therefore, these students will be taken into consideration for extra help. However, such classes may be seen as ‘remedial’, ‘disabled’ or ‘limited in English’ and may cause the minority language students to be alienated.

One variation of this is the sheltered English or also known as sheltered content instruction. In this class, minority language students are taught in the curriculum with simplified vocabulary and purpose-made materials and methods. Although these materials are specifically catered for minority language students, the medium of instruction in such classes will still be in English. Only the content and the curriculum materials are developed and pitched at the students’ level of proficiency. This is different from the usual English as Second Language (ESL) classes as ESL teachers teach English as a language subject whereas in these pull-out classes, it will still be content focused.

3) Segregationist education

Segregationist education is a form of ‘minority language only’ education (Mangubhai, 2002; Skutnabb-Kangas, 1981, 2000). This occurs when minority language students are denied access to the mainstream schools, or schools which are attended by the majority language students. The main aim of such education is for apartheid (e.g. educating colonial subjects only in their native language). By doing this, the ruling elites are able to maintain subservience and segregation among themselves and the minority language speakers. When the minority language speakers do not know the majority language, they then will not be able

to ‘influence the society or, especially, to acquire a common language with the other subordinated groups, a shared medium of communication and analysis’ (Skutnabb-Kangas, 1981, p. 128). Segregationist education usually forces a monolingual language policy on the relatively powerless (i.e. minority language speakers).

Table 3.1 shows the summary of monolingual forms of education for bilinguals.

Table 3.1 Summary of monolingual forms of education for bilinguals [taken from Baker (2011, p. 209)]

Monolingual Forms of Education for Bilinguals				
Type of programme	Typical type of child	Language of the classroom	Societal and educational aim	Aim in language outcome
Mainstream/submersion (structured immersion)	Language minority	Majority language	Assimilation/ subtractive	Monolingualism
Mainstream/ submersion with withdrawal classes/ sheltered English / content-based ESL	Language minority	Majority language with ‘pull-out’ L2 lessons	Assimilation/ subtractive	Monolingualism
Segregationist	Language minority	Minority language (forced, no choice)	Apartheid	Monolingualism

B) Weak Forms of Bilingual Education for Bilinguals

4) *Transitional bilingual education*

This is the common type of education in the United States. The main aim of this kind of education is assimilationist. The way this is different from submersion education is that minority language students are allowed to use their home language during their earlier schooling, until they are proficient enough in the majority language in order to cope with mainstream education. This can be described as a brief swim in one pool until the students are deemed fit to be moved to the mainstream pool. The purpose is to increase the use of majority language while proportionately reducing the use of home language in classroom (Villarreal, 1999).

Transitional bilingual education is split into two types: early exit and late exit. In the early exit, students are provided up to 2 years of maximum help using their mother tongue in class whereas in the late exit, around 40% of classroom teaching is conducted in mother tongue till sixth grade. In such classes, a bilingual teacher is needed as he or she can then be more sympathetic to the language of the students.

5) Mainstream education (with foreign language teaching)

In the United States, Australia, Canada and parts of the Europe, students attending language majority schools take their education through their home language, i.e. parents who are English monolingual send their children to English-medium school. Very often there is some foreign language teaching. In Wales, it is sometimes informally called a ‘drip-feed’ programme. These second (foreign) language lessons normally take around half-an-hour a day and include languages like Arabic, French, German, Chinese Mandarin, Japanese or Spanish. These programmes focus on language learning instead of curriculum content. In other words, it makes the language a subject in the curriculum similar to Science and Mathematics. However, in countries like the United States and England, there are relatively few second language students who become competent in that second language. Although students receive a short second language lesson per day between 5 and 12 years, many are still not able to communicate after few years of drip-feeding. Therefore, mainstream education (with foreign language teaching) rarely produces functionally bilingual children.

6) Separatist education

The aims of separatist education are minority language monolingualism and monoculturalism. It is organised by language minority community for its own survival and self-protection. Schermerhorn (1970) called this a secessionist movement where a language minority aims to detach itself from the language majority to pursue an independent existence. It is very unlikely for separatist minority language school to formally state its aims in a linguistic separatist fashion. It can however, be implicitly found in schools like isolationist religious schools.

Table 3.2 shows the summary of the types of programme within the weak form of bilingual education for bilinguals.

Table 3.2 Summary of weak form of bilingual education for bilinguals [taken from Baker (2011, p. 210)]

Weak Forms of Bilingual Education for Bilinguals				
Type of programme	Typical type of child	Language of the classroom	Societal and educational aim	Aim in language outcome
Transitional	Language minority	Moves from minority to majority language	Assimilation/ subtractive	Relative monolingualism
Mainstream with Foreign language teaching	Language majority	Majority language with L2/FL lessons	Limited enrichment	Limited bilingualism
Separatist	Language minority	Minority language (out of choice)	Detachment/ autonomy	Limited bilingualism

C) Strong Forms of Bilingual Education for Bilinguals

7) *Immersion bilingual education*

The immersion bilingual education derives from a Canadian educational experiment in the 1960s. Its main aim was for children to become bilingual and bicultural without the loss of achievement. The types of immersion bilingual education differ in terms of the following aspects:

- Age at which a child commences the experience: Early immersion is when a child starts at the kindergarten or infant stage. Delayed or middle immersion happens when a child starts at 9–10 years old or late immersion, at secondary level.
- Amount of time spent in immersion: Total immersion usually starts with 100% immersion in the second language and then reduces to 80% after 2–3 years, 3–4 years later, students will be finishing junior schooling with around 50% immersion in the second language per week. Partial immersion provides approximately 50% immersion in the second language throughout infant and junior schooling.

Of all this, early total immersion has always been a popular entry level programme in Canada. From one school, started in 1965, immersion education spread rapidly in Canada and there are a few essential features which create such speedy educational growth. Firstly, immersion education in Canada aims at bilingualism in two prestigious, majority languages, i.e. French

and English as compared with those which aim at one majority and one minority language (e.g. English and Spanish). Secondly, immersion bilingual education has been optional and not compulsory. Parents are able to make the choice whether or not to send their children to such a school and if they do, the cultural and economic convictions of these parents with the commitment of the teachers will be a motivation to the children. Third, children's home language is appreciated and not belittled in these schools. They are allowed to use home language for up to one and a half years for classroom communication. Fourth, the teachers in immersion bilingual education are competent bilinguals. During the early stages, teachers may appear to the children as able to speak French but only understand (not speak) English. Fifth, classroom language always aims to be meaningful, authentic and relevant to the child's need instead of being tightly controlled and repetitive. With this, the content of curriculum becomes the focus for the language and children in early immersion will then be able to learn the second language incidentally and unconsciously. Sixth, students start immersion with similar lack of experience in the second language as most of them are monolinguals. This not only simplifies the teacher's task but also means that student's self-esteem and motivation will not be at risk because of others who have better level of proficiency. Seventh, students in immersion education experience the same curriculum as those who are in mainstream schooling. Eighth, immersion is not just educational initiative but also societal, political and sometimes economically rational that is different from country to country.

Immersion schooling now occurs internationally with many successful examples in countries like Catalans and Basques, Finnish, Australian, Japanese, Scotland, South African, Swiss, Welsh and Irish.

8) Heritage language bilingual education

Another 'strong form' of bilingual education happens when school uses the native, ethnic, home or heritage language of the minority children as the medium of instruction and has the goal of full bilingualism. There are many examples of such education in the world: Australia, Canada, China, Japan and New Zealand.

In the United States, this form of bilingual education is sometimes called maintenance bilingual education or developmental maintenance bilingual education and has the following features:

- Most students come from language minority homes where their language may be the majority language of their community. These children are very often joined in class with smaller number of majority language children.
- The parents have the choice of sending their children to heritage language bilingual school or mainstream schooling.
- The language minority student's home language will often be used for almost half or more of the curriculum time. Some models tend to use the majority language as the medium of instruction for technological or scientific studies and minority language for music, art and social studies. Others will use the student's home language for between 50% and almost 100% of the curriculum time.
- The justification for using the minority language for most of the classroom time (80–100%) is that children can easily transfer ideas, concepts, skills and knowledge into the majority language, i.e. having learnt multiplication in Spanish, students will not need to be taught the same mathematical concept again in the majority language as the transfers will happen easily if such languages are sufficiently developed.
- The rationale for heritage language programmes is that minority language is easily lost while the majority language is easily gained. In a community, children tend to have higher possibility of being exposed to majority language through television, shops, signs, videos and all these will be able to contribute to or induce bilingual proficiency. Therefore, bilingualism is believed to be achievable when initial concentration on minority language is given at school. It is during later stages of elementary schooling that students may receive more training for majority language development.
- Although most heritage language schools are elementary schools, this is not the case for Wales and Hawai'ian heritage programmes.

9) Dual language bilingual education

In the United States, dual language (or two-way) bilingual education normally occurs when there are approximately equal numbers of language minority students and language majority students in the same classroom and both languages are used for classroom communication. Since both languages are used for learning in the classroom, the aim of this education is to produce relatively balanced bilinguals (Lindholm-Leary, 2001) and biliteracy is also being acquired sequentially in both languages (Baker, 2011). The United States dual language

programmes tend to share the following features (Genesee & Gándara, 1999; Lindholm-Leary, 2001):

- The minority language is used for at least 50% of classroom instruction for up to 6 years.
- Language is primarily learnt through content and in each lesson, only one language is normally used. Instructions can be graded to the student's level but it should also be challenging and empowering.
- The majority language (i.e. English) speakers are integrated with the minority language (e.g. Spanish) speakers during all lessons and these students are present approximately in balanced numbers for most content instruction.

Howard and Christian (2002) indicate a few major goals of dual language programmes which are for i) students to have high level of proficiency in their first and second language; ii) students to master reading and writing at grade level in both languages; iii) they should have academic achievement (e.g. Mathematics, Science and social studies) at least at grade level; iv) students should have positive and intercultural attitudes and behaviours; v) local communities and society to benefit from having citizens who are bilingual and biliterate. Based on these goals, the aim of dual language bilingual schools is no longer just to produce bilingual and biliterate children but also to enhance inter-group communication competence and cultural awareness (Genesee and Gándara, 1999).

In order to produce children who are bilingual, biliterate and multicultural, a variety of practices are implemented in dual language schools (Lindholm-Leary, 2001):

- The two languages in school (e.g. Spanish and English, Japanese and English) are given equal status in school. Both languages are used as a medium of instruction and are integrated into language and content learning. However, it should be taken into account that the same content should not be taught in both languages to avoid being repetitive.
- The school ethos are in both languages. Any announcements made or notices displayed in schools are bilingual. Letters to parents are written in two languages as well.
- Sometimes, in dual language bilingual schools, both minority and majority languages are taught as languages. In these lessons, aspects of spelling, grammar, communicative skills are taught directly. In other schools, using both languages as

media of instruction is regarded as sufficient to ensure bilingual development. In these schools, students are expected to master the languages through content curriculum as well as learning from peers who are effective first language role models.

- Staff in dual language bilingual schools are generally bilingual. If this is difficult due to teacher supply or any other reason, teachers are paired and work as a team. This underlines the importance of the culture of language minorities being shared in the classroom.
- The length of the dual language bilingual programme needs to be relatively longer to ensure a fuller and deeper development of language skills and biliteracy in particular. A minimum of 4 or 5 years is said to be more effective than having it for only 2 or 3 grades.

In order to meet the central idea of language separation and compartmentalisation, some language boundaries are established in dual language bilingual schools. First, a decision is made about when to teach through each language. There are a few frequent preferences i) each language is to be used on alternate days in a strict sequence ii) different lessons may use different languages with a regular changeover to ensure both languages are used in all curriculum content iii) the division of time may be in half days, alternate weeks or alternate half semesters as long as distribution of time is carefully planned. Second, bilingual teachers need to ensure they do not switch languages within a lesson. If language mixing by the teachers occurs, student might become uninvolved when the lesson is delivered in their weaker language. Third, language boundaries may be established in the content curriculum. In some schools, different parts of the curriculum are taught in different languages. For example, music, arts and social studies are taught in Spanish while Science and Mathematics in English. However, when the allocation of languages is by content, this may affect the status of language in the eyes of the child, parents and society.

10) Bilingual education in majority language

Bilingual education in majority language comprises the joint use of two (or more) majority languages in the school. According to Mejía (2002), the aims of these schools usually include bilingualism or multilingualism, biliteracy and cultural pluralism. These schools normally exist in societies where most of the citizens are already bilingual or multilingual (e.g.

Malaysia and Luxembourg). In the Asian examples, a country, e.g. Brunei and Singapore may have one dominant native language with a desire to introduce a second National language into the school. Since the international language, i.e. English is used as the medium of instruction alongside the native language, the aim of this bilingual education is then to help students achieve full bilingualism and biliteracy through an enrichment bilingual education programme. Bilingual education in majority languages also means that some curriculum content is learned through the student's second language. In Europe, this is increasingly called Content and Language Integrated Learning (CLIL).

The following Table 3.3 gives a summary of the types of programme found within the strong form of bilingual education for bilinguals.

Table 3.3 Summary of strong forms of bilingual education for bilinguals [taken from Baker (2011, p. 210)]

Strong Forms of Bilingual Education for Bilingualism and Biliteracy				
Type of programme	Typical type of child	Language of the classroom	Societal and educational aim	Aim in language outcome
Immersion	Language majority	Bilingual with initial emphasis on L2	Pluralism and Addictive	Bilingualism and biliteracy
Maintenance /Heritage language	Language minority	Bilingual with emphasis on L1	Maintenance, pluralism and enrichment. Additive	Bilingualism and biliteracy
Two way/ Dual language	Mixed language minority and majority	Minority and majority	Maintenance, pluralism and enrichment. Additive	Bilingualism and biliteracy
Mainstream bilingual	Language majority	Two majority languages pluralism	Maintenance, biliteracy & enrichment. Additive	Bilingualism

Although typologies have value for concept clarity, and for comparisons across countries and context, they are not without limitations (Baker, 2011:209):

1. these models usually suggest static system but bilingual schools are constantly developing and evolving
2. there are too many variations within a model which might or might not be discussed

3. models only address the ‘input’ and ‘output’ of the education system but not the classroom processes
4. models do not explain the effectiveness of bilingual education
5. models are non-theoretical
6. models are usually relevant to one context and cannot be exported or imported without considering the traditions of new context
7. countries in the southern hemisphere are weakly represented
8. policymakers and particularly teachers do not use models to talk about bilingual education

3.2.2 Bilingual Education in Malaysia

Bilingual education is not a recent phenomenon in Malaysia. In fact, it is believed that it started in the sixteenth century (Gaudart, 1987). An example of the early form of bilingual education was that students in Quranic schools were taught in Arabic and not their mother-tongue dialects (Gaudart, 1987) because 16th century Malaysia preferred its people to learn a foreign language like Arabic along with learning Malay (Asmah, 1976).

Based on the education system in the 1980s, Gaudart (1987) proposed that there are four types of bilingual education in Malaysia:

- i. Initial transfer
- ii. Re-transfer
- iii. Circular transfer
- iv. Gradual transfer

The **initial transfer** is through Malay medium primary schools. Students entering this school are immersed from the start in standard Malay and then introduced to English as a subject, 6 months after entering school. They then have a choice to learn Mandarin, Tamil or Arabic in their 4th year of primary education and/or later in secondary school. There are three types of initial transfer. The first type falls on the group of Malay students who speak other dialects of Malay instead of the standard Malay used as medium of instruction (MOI) in school. The second type of initial transfer falls on students whose mother tongue, either English, Mandarin or Tamil, is maintained in school as a subject but not as a MOI whereas the third

type falls on students whose mother tongue is neither the MOI nor being taught as a subject in the school. Examples of these are Kadazan, various dialects of Mandarin and Filipino.

The second type of bilingual education, i.e. **re-transfer** is found in Mandarin and Tamil medium schools. In this pattern, the first transfer happens when students begin their education in Mandarin or Tamil, which is not their mother tongue as they speak other dialects of Mandarin or Tamil. Chinese and Indian parents choose to send their children to these schools mainly because of their wish to maintain the ethnic culture. The second transfer happens when these students enter secondary schools which are all in the medium of Malay, also not their mother tongue.

In **circular transfer**, we find students of Malay dialects begin their education in Mandarin or Tamil medium. As a remedy to improve students who have limited proficiency in Malay, i.e. who do not score at least a grade C in the *Ujian Penilaian Sekolah Rendah, UPSR* (Primary School Evaluation Test), these students have to attend 1 year 'Remove Class' where they receive intensive instructions in standard Malay, prior to proceeding their education in year 1 of secondary school.

Lastly, in the pattern of **gradual transfer**, students begin their primary education in the medium of their mother tongue, e.g. Tamil or Mandarin and then change to Malay MOI in secondary school after an intensive course in Malay during 'Remove Class'.

3.3 Issues in the Choice of Medium of Instruction in Multilingual Societies

One of the main issues regarding language in education policy in many post-colonial countries, especially in Africa and Asia, is the choice of medium of instruction at the different levels of education. Tollefson and Tsui (2004, p. 17) point out that "Choices made in medium of instruction are not purely about educational efficacy but also about social, political, and economic participation, social equality and human rights." The importance of medium of instruction is seen in the role it plays in maintaining and revitalising a language and a culture, being the form of intergenerational transmission and determining, which social and linguistic groups have access to political and economic opportunities, and which groups are disenfranchised (Fishman & Fishman, 2000; Tollefson & Tsui, 2004).

The choice of medium of instruction in post-colonial countries is a controversial topic as many researchers have expressed their views on favouring local languages as medium of instruction and restricting the use of English (or other former colonial languages). Ferguson (2006, p. 179) comments that such moves may be necessary for i) promoting the development of indigenous languages ii) improving the educational performance of pupils, particularly of the less able and iii) mitigating the inequalities which are aggravated by the use of official languages of foreign origin over which large sectors of the population have little or no control. However, there are also arguments for English-medium education and/or the early introduction of English as a curricular subject (Trudell, 2007; Probyn, 2001, 2005; Nunan, 2003). In this sub-chapter, we will first look briefly at the present language policy in different countries. Then, we will investigate the educational issues of choosing MOI for different levels of education. We will also be looking at the socio-political and economic issues later in this chapter before concluding with the implications for language policy in Malaysia.

3.3.1 Present Language Policies in South Africa, Hong Kong, Singapore and Brunei

Before discussing the principal issues involved in the choice of medium, we will first briefly survey the existing policies found in different countries. The main reason for choosing South Africa, Hong Kong, Singapore and Brunei for discussion is that these countries were once colonised by the British. Therefore, the influence of English language within the country and even within the education system is still rather apparent. Besides, within these countries, there are many other dialects and languages being used in the society, hence making the nation a multilingual nation just like Malaysia.

In Sub-Saharan Africa, the role of English as the MOI for subject learning has been the focus of increasing controversy and much research has focused on the impact of English as MOI on the quality of classroom interaction and subject learning (e.g. Brock-Utne, 2005; Williams, 2006). Different countries in Southern Africa have different language policies. For example, in public (state) schools in Kenya, Swahili, a language spoken in eastern and central Africa, is used as MOI for first 3 years of primary education before switching to English later on. For Tanzania though, the abrupt change from local language as MOI to English happens between the transition of primary school and secondary school. Generally speaking, the common practice in Africa is education to be conducted through a local language medium for the first

few years of primary school before transitioning to a metropolitan language medium (i.e. English, French or Portuguese) for the remainder of formal education.

Moving to Asia, under the education policy implemented in 1978, the Hong Kong government provides 9 years of free education for students aged 6–15 years old (Cheng, 2004). With the implementation of this policy, Cantonese, a dialect of Chinese, was the medium of instruction where English and Chinese were compulsory subjects. During Chinese lessons, students have to learn Cantonese for spoken language and Modern Standard Chinese for written language. Then, under the Secondary School Placement Allocation Scheme, primary six students are allocated a place in junior secondary schools. If students perform well, they can then proceed to senior secondary schools. There are three types of senior secondary schools: Anglo-Chinese secondary school, Chinese middle schools and technical schools. In these schools, only Anglo-Chinese secondary schools use English as medium of instruction. Up till 1973, students in Anglo-Chinese secondary schools and Chinese middle schools had to take the Hong Kong Certificate of Education Examination (English) and Hong Kong Certificate of Education Examination (Chinese), respectively. It was from 1974 that students from both types of schools take the same exam but they could choose to answer either in English or Chinese. Students who have good academic results in the Hong Kong Certificate of Education Examination may proceed with the 2-year course in secondary school, which prepares them for the Hong Kong Advanced Level Examination. These students would then apply for admission to eight universities/college funded by the government.

In Singapore, the education system is based on five pillars of literacy, numeracy, bilingualism, physical education and moral education. Since 2003, primary education is now compulsory for children in Singapore (Ministry of Education Singapore, 2012a). Therefore, children are sent to primary schools at the age of 6–7. Under primary education, students are taught to have a good grasp in English, mother tongue and Mathematics. They will then take the Primary School Leaving Examination (PSLE) after 6 years of study. When it comes to secondary education, students are placed in Special, Express, Normal (Academic) or Normal (Technical) course according to their performance at the PSLE. Prior to 2006, the top 10% of students in PSLE went into the ‘Special stream’, which allowed them to study their mother tongue at a more advanced level. About 50% went into the ‘Express stream’ and studied mother tongue as a ‘second language’ level. The rest of the 40% who went into ‘Normal

streams' were learning mother tongue at an even lower level. This was gradually changed to allow more students to study their mother tongue at the advanced level and currently, if students are able to show that they can cope with Higher Mother Tongue Language without affecting their other subjects, then they will be allowed to do so (Dixon, 2009). Students will then take the General Certificate of Education Ordinary Level (GCE 'O' Levels) and General Certificate of Education Normal Level (GCE 'N' Levels) for Special, Express and Normal streams, respectively. Based on their results and their participation in co-curricular activities, they will then be considered for Junior Colleges/Centralised Institute (post-secondary education), polytechnic and Institute of Technical Education for further studies. Upon getting good results in post-secondary education, students can then proceed to university education.

For Brunei, the Ministry of Education policy is to provide minimum of 12 years of education to children in the country. This includes 7 years in primary education (inclusive of a year in pre-school) and 5 years of secondary education. Students will then be placed in mainstream secondary schools or Level II programme base on their performance in PSR (*Penilaian Sekolah Rendah*, Primary School Assessment). Those who are in Level II programme, follow vocationally oriented curriculum, whereas the majority of students in mainstream schools attend the PMB (*Penilaian Menengah Bawah*, Lower Secondary Assessment) after 3 years of lower secondary education. Upon passing the examination, they will be channelled into either Science or Arts stream for upper secondary where they are prepared for the Brunei–Cambridge GCE Ordinary level (GCE 'O' Levels) examination. Students who perform well in their 'O' Levels may proceed to do a further 2-year pre-university course leading to the Brunei–Cambridge Advance Level Certificate of Education examination (GCE 'A' Levels). After this, they may then decide to opt for employment or further their studies at either University of Brunei Darussalam or abroad.

3.3.2 Issues of Choice of Medium of Instruction at Tertiary Level

We should note that it is not plausible to consider the choice of MOI required at each level of education i.e. primary, secondary and tertiary in isolation. This is because an education system is an interlocking whole and the end-result of one level will affect the next. In other words, parents and students would usually view primary and secondary education as a preparation for the next level. Hence, it would be appropriate for us to first consider the choice of MOI at tertiary level.

One of the main reasons for English to be more preferred over local language in the choice of MOI for universities is the fact that published academic writings and international conferences are dominated by the use of English. As cited by Lillis and Curry (2013, p. 229), English is the dominant language for academic publishing in almost every academic and more than 95% of indexed natural Science journals and 90% of social science journals use all or some English. Because of this, it is very important for universities to equip their students with the knowledge of English so that they are able to ‘connect’ with the international research field. It is also for this reason that courses like English for Academic Purposes (EAP) and English for Scientific Purposes (ESP) are growing in countries like Malaysia, Thailand and China.

According to Kamsiah Abdullah (2004), there are four reasons on the acceptance of English as the medium of instruction by Bruneians.

- 1) They understand the need of being conversant with new technologies that come from the English-speaking world.
- 2) As Brunei is a small country, there is no ready market for books published locally and so, Brunei textbooks have been imported from abroad. It will then seem more practical to teach subjects like Science, Mathematics, English Literature Geography and History in English rather than waiting for the Malay-translated version.
- 3) There is only one local university in Brunei and the programmes offered are limited to humanities and education. Therefore, students who would like to further their tertiary education will mostly be going overseas and thus, primary and secondary education in Brunei will need to prepare the students to be taught in English.
- 4) The Malays in Brunei had never felt threatened by English due to their clear majority, unlike Malaysia, where there is strong competition from the Chinese who dominates in business and other non-religious aspects of life. Therefore, introducing English as the medium of instruction was certainly a much easier task in Brunei.

There are, however, some disadvantages for adopting English as MOI at tertiary level. Firstly, the use of an international language as the MOI may hold back the development of the local languages. If a National language is not used for academic purposes, then its linguistics resources may never be expanded. However, as English terminologies and scientific registers have evolved over centuries, it will be unrealistic and expensive to duplicate such resources

in local language within a short period of time.

Besides, choosing English as MOI at tertiary level will certainly have backwash effects on secondary school curricula. If English is the MOI at universities, it will create pressure for secondary schools to adopt it as MOI in order to prepare the students for higher education. It was because of this reason that the English for Mathematics and Science policy was implemented in Malaysia in 2003. It had been found that learning English as a subject itself had not developed sufficient proficiency for students to cope with the demands of English-medium courses at universities.

With the mention of the effects which English medium at tertiary level may have on primary and secondary education, we should now take a look at the issues involving the choice of MOI for these levels.

3.3.3 Issues of Choice of Medium of Instruction at Primary and Secondary Education

One of the main reasons why Hong Kong and Malaysia have chosen vernacular languages over English as media of instruction in primary and secondary education is based on the arguments put forward by UNESCO (1953) supporting the use of mother tongue (or a language well-known to a child) as the language of initial education and literacy. Besides, it is also believed that mother tongue as a medium enhances the importance of local languages and helps students to understand better if they are taught in a language that they are familiar with. In 1999 and 2002, Chinese as Medium of Instruction Centre at the University of Hong Kong found that students' academic performance, motivation and self-confidence have improved when learning through mother tongue (Tsui, 2004). Marsh, Hau and Kong (2000) have also found out that students who were taught using English only showed slight improvement on their English proficiency and slightly negative effect on their performance in Mathematics. However, there were great negative effects on other subjects like geography, History and Science. On top of it, these negative effects were consistent throughout 3 years and affecting all level of students. Despite this, as English is still regarded as a language of "superiority, power and success" (Tse, Shum, Ki, & Chan, 2007), some parents are still eager to enrol their children into the few English-medium schools left in Hong Kong.

Another argument for the support of using local language as MOI is that in some developing countries, especially those rural areas in Africa, primary education may be all what a pupil will get. In cases like these, primary education is no longer preparatory for secondary education but the only education a child may have. If this is the case, learning in a medium other than their local language will make no point as it will not only hinder their progress in the subjects but also be useless as most of them will likely to remain in rural areas (Ferguson, 2013).

Opting for English medium instead of local language medium may also cause social inequality. If English medium is in policy, the segregation between urban elite and rural pupils will be even greater. This is because students in urban area will have more exposure to English and greater opportunity to master the language through private tuitions, mass communication and so on. These students will have fewer problems in their studies compared with the students in rural area. It is because of this that the English for Mathematics and Science policy in Malaysia was abolished in 2011.

3.3.4 Socio-political and Economic Issues of Choice of Medium of Instruction

The sections above have mostly discussed the issues of choice of MOI from the educational perspective. However, implementing and abolishing a language policy does not look solely on the educational effects it brings. This involves other political and economic issues that we will consider now.

Ferguson (2006) divides these issues into two major constraints: socio-political constraints and economic and practical constraints. Under socio-political constraints, one of the more frequent justifications for colonial languages to be the media of instruction is that they are ethnically neutral (Ferguson, 2006, p. 183). This is definitely one of the main reasons Singapore promoted English as the ‘working language’ (Dixon, 2009) for interethnic communication. It is argued that by choosing any one (or more) language(s) from the vernacular languages as the medium of instruction, it may give advantage to one ethnic group over another and that could cause serious political conflicts. This move may still divide the society if not properly implemented. While colonial languages may be ethnically neutral, they are after all not neutral in the socioeconomic sense. During the implementation of English for the Teaching of Mathematics and Science policy (ETeMS) in Malaysia, students in the urban

schools have more opportunities to be exposed to English. They have easier access to English books, movies and private tuition classes to help cope with the transition. However, for those who are in the rural area, they have none of these and so, most of these students perform badly in the National examinations, which leads to a review of policy. If appropriate measures are not taken, we might see a greater segregation between the rich and the poor.

The second constraint comes from the economic power and attractiveness of English. As Ferguson (2006, p.185) puts it, “English is a language that is perceived to be...a gatekeeper to educational and employment opportunities, to social advancement.” It is no wonder when PPSMI was first introduced in Malaysia, most parents welcomed the move. Hong Kong parents were seen carrying banners and writing letters to the Education Department to express their dissatisfaction when they learned that the school at which their children were studying had to adopt Chinese medium of instruction (Tse S. K., Shum, Ki, & Wong, 2001). Similarly, the attractiveness of English is also partly fuelled by the unattractiveness of vernacular language being the medium of instruction. Bruneian and most Malaysian parents think that there will be no value teaching children in Malay because they will most likely be learning the subjects in English if they are furthering their studies in tertiary education. Therefore, many think that it is redundant to have vernacular languages as the media of instruction.

Furthermore, moving on to the economic and practical constraint, nobody can ignore the influence of globalisation in the current economic world. Ferguson (2006) uses Tanzania as an example of a country which was in favour of maintaining the English medium in hope that this move can protect the country from being isolated from international links beyond the African continent. When Singapore first achieved its independence, the nation was in an economic crisis and on top of that, it was in conflict with its neighbouring countries, Malaysia and Indonesia. Therefore, the only wise thing to do at that time was to encourage the use of English medium in order to equip the country for international trade and investment.

Most vernacular languages lack the requisite level of linguistics resources as they are not fully standardised and elaborated (Ferguson, 2006). However, for the case of Malaysia, there is *Dewan Bahasa dan Pustaka* (The Institute of Language and Literature) which plays an important role in corpus planning for Malay language. This institute had successfully

incorporated the facility to switch from English to Malay medium of instruction in 1983 for all subjects in local universities (Gill, 2004). It had a great responsibility during the Malay to English medium transition and now, it ensures that the transition from English to Malay happens smoothly, after the implementation of English for Mathematics and Science policy and will continue again in the coming decades. Moreover, adopting vernacular languages as media of instruction requires the translation and production of a large number of textbooks. This requires large expenditure and can be problematic when choosing qualified authors and translators for the job. *Dewan Bahasa dan Pustaka* (The Institute of Language and Literature) has certainly helped Malaysia to overcome this issue but again, the question whether or not translators can cope up with the speed that new information is being published everyday is problematic.

3.3.5 Implications for Malaysia

At various points in the preceding discussion, we have explored the advantages and disadvantages of having English or local languages as the MOI. It is undeniable that they are both valuable for different purposes: English, for its socioeconomic mobility and its obvious status as an international language; local languages because they contribute more effectively to early learning and local engagement. After reviewing the different language policies in various countries and the different constraint on changing of media of instruction, I believe that there is no one particular formula or equation which works best in all countries. The more plausible measure would be to promote bilingual education, whereby the local language will be given the priority as MOI in primary education with English introduced during upper primary as a subject; from year 6 onward English could gradually be adopted as MOI for certain subjects and slowly shift to more subjects in English in secondary school (Ferguson, 2013).

Nonetheless, as it stands now, the language policy in Malaysia will no longer be adopting English as MOI whether in primary or secondary school (with the exception for schools wishing to continue the English for Maths and Science policy during the soft-landing period). It will be a fruitless call to advocate for a change of MOI in Malaysia as constant change of language policy will affect the smooth teaching and learning process.

It is perhaps useful to recall here that bilingual education already has a de facto existence in many classrooms in Malaysia, taking the form of classroom code-switching (CS). By promoting effective teaching of English as second language during primary and secondary education together with systematic classroom CS during sixth form, it is hoped that this will be sufficient to equip students with the necessary proficiency to study through the language at university.

3.4 Code-switching (CS)

Code-switching (CS) is the core focus of this research. Therefore, in this section, I will study in detail the different aspects of CS for a better understanding of its background and uses.

3.4.1 Classroom Discourse and Code-switching

Apart from their families and neighbourhoods, schools are most likely the main communities in which a child communicates mostly through spoken language. Within the school context, spoken language is often used as a means for teaching and for students to demonstrate to teachers what they have learned in the classroom. As Cazden (1986, p. 432) points out, classroom communication is a 'problematic medium' that cannot be ignored by anyone interested in teaching or learning. Johnson (1995) also notes the importance of understanding the dynamics of classroom discourse by teachers in order to establish and maintain good communication practices. Therefore, it is hoped that by studying classroom discourse, we will be able to expand our understanding in the medium used for the teaching of Science within the Malaysian context.

There are many classroom discourses. Cazden (1986) categorises these classroom discourses into a few broad categories: lesson structures, participation structures, lesson components and students initiatives (asking for help). Some of these could be elaborated further by looking into the subcategories. For example, participation structures can be divided into the importance of nonverbal (and verbal) cues, demands on children's interactional competence, participation structure and academic content and joint construction of discourse. Some features of lesson components include teacher questions, student responses and teacher evaluations (the Initiation, Response and Evaluation sequence). Furthermore, Cazden (1986) also discusses the features of teacher-talk register, which includes control talk, special lexicon,

prosodic features, tentativeness indicators, humour and expressions of affect. Although focusing more on second language classrooms, Walsh (2006) also presents a description of the principal characteristics of classroom discourse which are control of patterns of communication, elicitation techniques, repair strategies and modifying speech to learners.

Of the many different classroom discourses, CS has been chosen as the main focus of this research due to its pedagogic functions in multilingual classrooms. CS is increasingly evident in the social life of Malaysians (Maya Khemlani David et. al., 2009). With Malay as the National language and English as the second language, most Malaysians can speak at least two languages. Because of this, CS is a common phenomenon in Malaysia and according to a senior assistant at the Education Policy Research Division (personal communication), there is no official document discouraging teachers from CS in their lessons. Therefore, it will be interesting to study the feature of classroom CS in the multilingual Science classrooms in Malaysia and whether it can be used as a tool to help teachers and students in the teaching and learning of Science within the multilingual context.

3.4.2 Definitions, Types and Functions of Code-switching

A) Definitions and Types of CS

There are many definitions of CS. For example, CS has generally been used to describe alternation between languages within the course of a single conversation, whether it is at a word or sentence level, or even blocks or chunks of speech (Baker, 2011, p.107). As cited in Dabène and Billiez (1986:311), Hamers and Blanc (1983) defined CS as “the communicative strategy used by interacting bilingual speakers; this strategy consists of alternating units of variable length belonging to two or more codes inside one single language interaction.” De Klerk (2006:602) defines CS as “the use of more than one variety or language in the same conversation”. The problem with having many different definitions of CS was noted in Milroy and Muysken (1995), saying that “the field of CS research is replete with a confusing range of terms descriptive of various aspects of the phenomenon. Sometimes the referential scope of a set of these terms overlaps and sometimes particular terms are used in different ways by different writers” (1995, p. 12).

To complicate the definition of CS further, various terms have also been used to describe switches between languages in conversation such as *borrowing* (Poplack, 1988), *alternation* (Muysken, 2000) and *code-mixing* (Gardner-Chloros, 2009). Some have also argued that there is no clear line between CS and borrowing (Myers-Scotton, 1992) and Gardner-Chloros (2009, p. 12) view both as being on a *diachronic* continuum where “loans start off as code-switches and then gradually become established as loans.” Although various terms had been used to describe switches between languages in conversation, the two most commonly used terms are code-switching and code-mixing (Gardner-Chloros, 2009). Code-mixing usually describes changes at the intra-sentential (word) level i.e. when one or a few words in a sentence is/are changed. For example, ‘I *suka makan* spaghetti’ (I like to eat spaghetti). In contrast, code-switching is used to describe changes between sentences in a conversation e.g. ‘The food is served. *Marilah makan.*’ (Come and eat).

Muysken (2000) proposes three categories of CS: insertion, alternation and congruent lexicalisation. Insertion in CS is similar to borrowing. It happens when the lexical items or entire constituents are inserted into a structure from the other language. It is different from borrowing in the sense that the size and type of element inserted is smaller, e.g. noun versus noun phrase. In the next process, alternation happens when there is a true switch from one language to the other, involving both grammar and lexicon. Thus, it usually occurs between turns or utterances. Lastly, when two languages share a grammatical structure which can be filled lexically with elements from either language that is congruent lexicalisation. Below are some examples which can differentiate these three categories.

1. Insertion: Do you want to eat spaghetti or *nasi lemak*?
(Do you want to eat spaghetti or coconut rice?)
2. Alternation: *Saya nak pergi ke pasar*, do you want to come along?
(I want to go to the market, do you want to come along?)
3. Congruent lexicalisation: *Bila* you *nak hantar* homework?
(When (do) you want to submit homework?)

Besides Muysken, Poplack (1982) distinguishes CS occurrence within the same turn into three types: (i) tag-switching, (ii) inter-sentential switching and (iii) intra-sentential switching. Tag-switching is a minimal kind of switching which involves the insertion of a tag or marker from one language into a stretch of speech in another language.

E.g. You were supposed to finish page 3 yesterday, *betul?*
(You were supposed to finish page 3 yesterday, right?)

Some discourse markers prototypically precede clauses and are independent of sentence structure. In this case, although it is still tag-switching, discourse marker switching may be used as well.

E.g. *Now*, tengok muka surat 23. (Now, look at page 23.)

Inter-sentential switching involves switching languages at the clause boundary or between speaker turns.

E.g. i) *Saya kena hantar ayah* to the airport.

(I need to send my father to the airport).

ii) I was wondering *kenapa semua orang tengok kat saya* and when I turned around, Shaun was on his knee *melamar kepada saya!*

(I was wondering why everyone was looking at me and when I turned around, Shaun was on his knee proposing to me!)

Lastly, the intra-sentential switching differs from inter-sentential switching by involving switches *within* the clause or phrase.

E.g. You should bribe him with a piece of his favourite cheesecake *dengan teh tarik kesayangannya*.

(You should bribe him with a piece of his favourite cheesecake and his favourite tea.)

For the purpose of this research, following Canagarajah's views (1995), I will not distinguish formal types of CS as this will limit the discussion of its sociolinguistics and discourse functions. Therefore, all instances of CS will be included in this study and the term 'code-switching' will be used overall to refer to instances when a speaker switches from one language to another during a stretch of talk.

B) Functions of Code-switching

CS has been studied from different perspectives: grammatical, sociolinguistic pragmatic and educational. The general pragmatic functions of CS will be discussed in this section and the pedagogic functions later in this section.

In order to understand the different discourse and pragmatic functions of CS, we need to acknowledge that very often, switches are multifunctional (Ferguson, 2009) and therefore, it is difficult to give an explanation for the move in every instance of switching. A taxonomy of general purposes of CS is provided by Baker (2011, pp. 108-110) as below:

- To emphasise a point made.
- To substitute words which have no direct translation in the other language.
- To express a concept which has no equivalent in the culture of the other language.
- To reinforce a request and very often, to underline authority as well.
- To clarify a point or to explain a concept in another language.
- To express identity by shortening the social distance or to show the friendship and family bonding that the speakers share.
- To report a direct speech.
- To use it as an interjection.
- To ease tension and inject humour into a conversation.
- To show a change of attitude or relationship. This is very often seen in two speakers who meet for the first time and later on in the conversation, find that they are both from a same country or share the same cultural background.
- To exclude others from a conversation.
- To introduce a certain topic, which is typically discussed in a preferred language. For example, English is the language of commerce and so Spanish-English bilinguals in the South West of United States always switch to English when discussing about money.
- To imitate friends or adults, especially for children to identify with higher status and more powerful people in their lives.

3.4.3 Different Frameworks Analysing the Pragmatic Motivations of Code-switching

In this section, three theoretical approaches used to analyse the motivations of CS will be discussed. These are:

- a) situational and metaphorical CS (Gumperz, 1982)
- b) the Markedness Model (Myers-Scotton, 1993)
- c) conversational analysis approach (Drew & Heritage, 1992)

A) Situational and Metaphorical CS

The work of Gumperz has been seminal and influential in the study of CS. In their study of the local dialect in the Norwegian village of Hemnesberget, Blom and Gumperz (1972) proposed a functional distinction between *situational* and *metaphorical* CS which is still popular amongst researchers in this area.

In situational CS, a switch from one language to another language redefines the event taking place, involving “clear changes in the participants’ definition of each other’s rights and obligation” (Blom and Gumperz, 2007, p. 87). For example, when a teacher giving a formal lecture in English switches to Malay to encourage classroom discussion, this switch has a situational function as both teacher and students understand that the switch marks a shift from the formal lecture to classroom discussion. A change of context may not trigger a situational switch but such a switch may actually contribute to creating that changed context. Situational CS is also more likely to be intersentential than intrasentential, which some researchers are likely to see as *language choice* rather than a switch.

On the contrary, metaphorical switching which was labelled as *conversational CS* in Gumperz (1982, p. 61), does not signal a change of social events during an interaction. Such switching shows the different relationships that the speakers of a conversation have. For example, a student may converse in English with the teacher during a formal meeting but may switch into Mandarin when talking about more personal issues or family affairs to show a more personal and local relationship. Under Gumperz’s model, there are six conversational functions of CS:

- a. Quotation: a direct quotation or reported speech.

I invited her to come to the party but she said ‘*Taknak-lah, masih ada banyak kerja.*’ [Can’t make it, (I) still have a lot of work.]

- b. Addressee specification: directing the message to one of several possible addressees in a conversation.

Husband: What would you like to have, coffee, tea or juice?

Visitor: I'm fine with anything.

Husband: Right, I'm going to let you try our new coffee. (Turns to the wife) *Bancuhkan kopi yang baru beli itu.* [Brew the newly bought coffee]

- c. Interjection: code-switch may serve as a sentence filler.

A: Where shall we go for dinner?

B: *Jom* [an expression of invitation], let's try the new café down the road.

- d. Reiteration: sometimes a message may be repeated in another language literally or in somewhat modified form. Very often, such repetition is to clarify or emphasise the point made.

Wife giving direction to the husband who is driving.

Turn right here. *Kanan!* [Right! (with louder voice)]

- e. Message qualification: this serves to qualify constructions such as sentence and verb complements or predicates following a copula.

Ini dua anak saya [These two are my children], the older one is 11 years old and the younger one, *anak angkat saya* [my adopted child] is 8 years old.

- f. Personalisation vs. objectivisation: to distinguish between the talk about action and talk as action, the degree of speaker involvement, whether a message reflects personal opinion of general knowledge.

A: *Mana Siti?* [Where is Siti?]

B: She's supposed to pick me up from home at ten.

A: At ten?

B: *Ya, dan saya tunggu sampai pukul sebelas.* [Yes, and I waited till eleven o'clock.]

Here, B's response to A's Malay question treats the appointment as an objective fact and B switch back to Malay to explain his own actions.

B) The Markedness Model

The Markedness Model (Myers-Scotton, 1993) argues that CS involves negotiating what Myers-Scotton refers to as a particular set of rights and obligations (a RO set).

“Choose the *form* of your conversational contribution such that it indexes the set of rights and obligations which you wish to be in force between speaker and addressee for the current exchange” (Myers-Scotton, 1993, p. 113).

The RO set is derived from the social features which speaker and addressee mutually accept as relevant to the current conversation (Myers-Scotton, 1983). Its content will vary as the selection of features differs from one conversation to another, even for the same speaker and addressee. This model has three categories: (i) the ‘unmarked-choice’ maxim, (ii) the ‘marked-choice’ maxim and (iii) the ‘exploratory-choice maxim’.

The unmarked-choice maxim directs speakers to “make your code choice the unmarked index of the unmarked RO set in talk exchanges when you wish to establish or affirm that RO set” (Myers-Scotton, 1993, p. 114). In other words, the unmarked choice is the expected normal language for a particular interaction involving particular speakers. A speaker who belongs to a multilingual speech community is aware of an underlying set of rules that determines the reasons behind his choice of one code over another. When he chooses one language over another, he is seen complying with the RO set that he wishes to be in force between him and his addressee(s). When he makes such choices, he is motivated by the social consequences that he knows may take place as a result of making those decisions. Thus, Myers-Scotton defines the unmarked code as the “expected medium” in a particular type of conversationalised exchange (1993, p. 89-90)

A marked choice involves a departure from the normal, expected language for a particular interaction. It is employed to “negotiate a change in the expected social distance holding between participants, either increasing or decreasing it” (Myers-Scotton, 1993, p. 132). When the speaker ‘deviates’ from the expected RO set, the CSs made are not predictable from the setting, topics and participant; such marked-choice is made by the speaker who attempts to renegotiate the relationship holding between him and the addressee. An example given by Scotton and Ury (1977, as cited in Myers-Scotton, 2007) shows that a passenger has initially

conversed in Swahili (unmarked code) with the bus conductor when paying the bus fare. However, when the bus conductor delays in giving change to the passenger, the passenger switches to English (marked choice) to index his authority and educational status. The conductor then replies in English to show that he too, can compete in the power game by matching the passenger's marked choice.

The difference between unmarked-choice and marked-choice could be made clear in this example (Myers-Scotton, 1993): in East Africa, the local vernacular language used for talking about family is "unmarked choice"; however, if the local vernacular language is used in a public speech, then it is a "marked choice" because it is unexpected and the speaker is seen decreasing his distance with the addressees in a more formal occasion. Finally, when speakers are unsure about the expected communicative intent, they make exploratory code choices for an unmarked choice and choose the RO set that they favour. Such exploratory CS is rather uncommon because usually, the unmarked choice is clear. This may sometimes happen when there is a clash of norms, for example, someone who was a classmate is now your subordinate.

Li Wei (1998) comments that although Myers-Scotton's Markedness Model may be the most influential model, it still does not explain how participants create meaning within an interaction. It places emphasis on the analyst's interpretation of participants' intentions. Myers-Scotton and Bolonyai (2001), on realising the limitations of the Markedness Model as the notion of how linguistic choices are translated into social meaning later expanded the model and proposed a Rational Choice (RC) model.

According to Myers-Scotton (1999, p. 261), "rationality tells us why choices are made: Rationality directs actors to make choices that optimise their rewards". Thus, the RC model is based on "assumptions of preferences and intentions, operating on perceived opportunities" (Myers-Scotton & Bolonyai, 2001, p. 5). They argue that code choices are made because of the speakers' intentions and calculations and propose that as speakers are rational, they make their choices after assessing the possible options in terms of a cost-benefit calculation.

Li Wei (2005, p. 377) however, argues that there are two main limitations to the RC model:

- i) The assumption of rationality tells us little about what social actors will do. Besides showing that there is a certain kind of consistency in

the interactants' behaviour, it is not sufficient to explain why speakers choose to switch language at one particular time.

- ii) RC models do not explain the processes of deliberation that play an important part in speakers' choice of code. In other word, RC models treat deliberation as if it were transparent. It neglects the fact that speakers sometimes do deliberately switch language for other reasons, other than their rationality.

Li Wei (2005) argues that analysts should not take rationality for granted and should instead focus on how the meaning of code-switches derive from their interlocutors in a sequence of talk. In other words, evidence of the social reality should be analysed from the on-going conversation.

C) Conversational Analysis Approach

Another approach to CS is Conversational Analysis (CA) (Drew & Heritage, 1992; Li Wei, 1998; Seedhouse, 2004). In the explanation of linguistic choices, CA suggests that speakers follow systematic properties of structural organisation (e.g. turn-taking, adjacency pairs) when contributing to a conversation. The main focus of this approach is on the sequence of talk. It gives importance to the role of speakers and the immediate addressee's response in shaping the conversation and downplays the role of societal norms, arguing that meanings can be locally produced in the sequencing of the code alternation. To quote Drew and Heritage, "CA perspective embodies a dynamic approach in which 'context' is treated as both the project and product of the participants' own actions and therefore as inherently locally produced and transformable at any moment" (1992, p. 19).

Although CA was originally developed to analyse monolingual conversation, it has been employed to interpret the structure of bilingual interactions (Auer, 1998). It emphasises fine-grained transcription and analysis of conversational data in order to uncover the meanings of switches from the sequence of talk. Auer (1984) states two advantages of adopting the CA approach to study the meaning of CS. First, the CA approach gives priority to

the sequential implicativeness of language choice in conversation, i.e. the fact that whatever language a participant chooses for the organisation of his or her turn, or for an utterance which is part of the

turn, the choice exerts an influence on subsequent language choices by the same or other speakers.

(Auer, 1984, p. 5)

Secondly, it “limits the external analyst’s interpretational leeway because it relates his or her interpretations back to the members’ mutual understanding of their utterances as manifested in their behaviour” (Auer, 1984, p. 6).

Li Wei (2005, p. 382) also suggests that the CA approach to bilingual CS addresses three fundamental points: i) relevance, ii) procedural consequentiality and iii) the balance between social structure and conversational structure. CA analysts should try to show how their analyses are *demonstratively relevant* (Li Wei, 2005) to the participants. The point of procedural consequentiality involves showing whether or how the extra-linguistic context can determine the conversational consequences. Researchers should not rely on their intuitions but on the evidence of the conversational data. Last but not least, those who adopt the CA approach are required to pay attention to the balance of social and conversational structures. CA analysts are encouraged not to assume that speakers’ decision in a certain code choice is to ‘index’ his identity, attitudes, power relations and formality; rather, the analyst should show how these identity, attitudes, power relations and formality are reflected or enacted in the sequence of talk.

These three points imply an important shift of analytic interest, i.e. in order to answer the *why* questions, analysts should fully examine the ways in which the participants co-construct the interactional context, by investigating the *how* questions. In short, the purpose of CA is to analyse “members’ procedures for arriving at local interpretations of language alternation.” (Auer, 1984, p. 3)

Nonetheless, the CA approach has also been criticised for not explaining the speakers’ motivations for certain code choices despite its emphasis on transcription techniques and the minute details of conversational turn taking (Myers-Scotton, 1999; Myers-Scotton and Bolonyai, 2001). Also, the fact that some researchers adopt CA as a transcription method, apply the transcription conventions but do not explain their rationale systematically and explicitly, has led to claims that CA is atheoretical and unduly empiricist (ten Have, 1990).

In conclusion, RC models of CS provide the platform for researchers to investigate the social motivation of CS whereas CA provides the evidence that RC model would need to support its claims. Such a dual-level approach, labelled as *evidence-based explanation* (Li Wei, 2005, p. 387), is said to be able to “deepen our understanding of the way bilingual speakers use their linguistic and interactional resources and achieve a richer, more interesting, but still relevant explanation” (Li Wei, 2005, p. 388).

3.4.4 Classroom Code-switching

In order to address the educational focus of this study, this chapter now turns towards a review of CS research in educational contexts. This section will first present the history of classroom CS as a background for this section. The functions of classroom CS will then be discussed by drawing on different studies done previously, around the world. Finally, it will discuss different attitudes towards classroom CS.

3.4.4.1 Development of Classroom Code-switching Research

Martin-Jones (1995, 2000) describes the development of research in bilingual classrooms. Since the mid-1970s, early studies of classroom discourse have focused mainly on the communicative functions of teacher’s CS. Classroom observations were combined with quantitative analyses of test scores (Legarreta, 1979) and comparisons were then made between different types of bilingual education programmes. However, the quantitative evidence generated by such means was of a very limited nature to provide inferences about CS as it was thought it lacked the communicative elements of classroom talk. Hence, researchers began to adopt coding schemes that had been devised for studies of classroom behaviour. One of the most frequently used systems was proposed by Flanders (1970).

Studies in the 1980s–1990s focused more on the sequential flow of classroom discourse and the way CS contributes to the interaction between teachers and learners in bilingual classrooms. As both Milk (1981) and Guthrie (1984) worked with audio-recorded data and drew on descriptive frameworks developed by linguists who were working on monolingual classroom discourse, they were able to provide direct evidence of linguistic behaviour. This gave particular foreground to the analysis of classroom discourse functions where the attention shifted from what roles different languages play in a bilingual classroom to how

language values are imparted through language choices. Milk (1981) adapted a model proposed by Sinclair and Coulthard (1975) which focuses on the patterns of CS in the data while Guthrie (1984) compares how two teachers (one bilingual and one monolingual) work with Chinese learners in a California school. He adapted a system of conversational acts developed by Dore (1977) to code all the teacher talk in his audio-recorded corpus. Through this, Guthrie was able to identify five communicative functions¹ of teacher's CS in his study. It also allows us to have insight into teacher's attitudes towards classroom CS. However, Martin-Jones (1995) commented that the approach was still "a relatively static, taxonomic and quantitative one" (p. 94) and was oriented more towards cataloguing and quantifying (2000) because the focus was still on individual speech acts instead of on the sequential flow of classroom discourse.

Such a quantitative approach to classroom CS has received much criticism from researchers like Mehan (1979) and Payne and Cuff (1982). According to Mehan (1979, p. 14), quantitative approach to classroom CS:

"minimises the contribution of students, neglects the interrelationship of verbal to non-verbal behaviour, obscures the contingent nature of interaction and ignores the often multiple functions of language."

To the opponents of quantitative approach, classroom discourse should be analysed in its totality and such research explores the participants' own interpretation of the verbal or non-verbal behaviour. Some of the research tools adopted in this interpretative approach include observation and note taking, interviews, case studies and analysis of other relevant teaching materials or official documents.

Gardner-Chloros (2009, p. 10) summarises three main approaches which have gained popularity in recent years in the study of CS:

1. Sociolinguistic/ethnographic descriptions of CS situations
2. Pragmatic/conversation analytic approaches
3. Grammatical analyses of samples of CS and the search for underlying rules, models and explanations to explain the patterns found

¹ His study shows that teachers switched into Chinese (i) for translation (ii) as a 'we code' (iii) for procedures and directions (iv) for clarification (v) to check understanding (Guthrie, 1984, p. 45).

However, none of these methods on its own can provide a complete picture of behaviour as complex as CS. When deciding a methodological strategy for a study, Romaine (1984, as cited in Edwards & Westgate, 1994, p. 60) proposes that “there can be no question of choosing one method which will be universally the ‘right’ one. Methodology can be evaluated only within the context of some question which one wants to answer.” As the bilingual system is usually not as neatly defined as the monolingual system, Moyer (2008) also suggests that in the field of bilingualism, a combination of methods may be most appropriate.

3.4.4.2 Functions of Classroom Code-switching

Classrooms are often described as places where the tensions around language policy and practice are most acutely experienced and teachers are faced with complex dilemmas that are both pedagogical and political. For example, teachers are usually unsure if they should still use the mother tongue in their classroom discourse given that the government has decided to implement English as the language of instruction in certain subjects in Malaysia. Martin (2005, p. 89) further illustrates the reason behind such dilemmas as “the lack of official recognition of or support for these practices might be the concern about the efficiency of a pedagogy that supports the switching between languages.” In other words, the government may not support the act of classroom CS because they are afraid that such practice may jeopardise the effectiveness of classroom teaching. Nonetheless, many classroom-based studies have been carried out and found that classroom CS does have many advantages and useful functions. Many of these studies were carried out in post-colonial settings, where English remained the official medium of instruction even after the British colonisation. Such places include Brunei (Martin, 1996), Zulu (Adendorff, 1993), Sub-Saharan Africa (Clegg & Afitska, 2010), South Africa (Setati et al, 2002), Turkey (Eldridge, 1996), Hong Kong (Lin, 1996, 2005), Malta (Gauci & Camilleri Grima, 2012), Sri Lanka (Canagarajah, 1995) and Malaysia (Kow, 2003; Then & Ting, 2009, 2011).

The abovementioned studies show that the multiple functions of classroom CS have been documented in a range of educational contexts across the world. In an attempt to show that classroom CS is not all inexplicable, dysfunctional or useless; in fact, it provides opportunities for students to prepare themselves for their sociolinguistic life outside classroom in Jaffna. Canagarajah (1995) listed the micro-functions of classroom CS found in

his study of ESL classes in Jaffna. The following table shows the useful functions CS serves for classroom management and transmission of knowledge.

Table 3.4 Micro-functions of classroom code-switching proposed by Canagarajah (1995)

Categories	Micro-functions of classroom CS
Classroom management	Opening the class Negotiating directions Requesting help Managing discipline Teacher encouragement Teacher compliments Teacher's commands Teacher admonitions Mitigation Pleading Unofficial interactions
Content transmission	Review Definition Explanation Negotiating cultural relevance Parallel translation Unofficial student collaboration

Apart from Canagarajah, Adendorff's study (1993), for example, also views CS as a way of guiding the students to understand the academic goals as well as their interpretation of social relationship in the classroom. Martin (1996) further develops this point in his study, where the overall effect of CS plays an important role in socialising the students into the language norms of the country, Brunei. The teachers involved in this study also show the conviction that CS is an essential strategy to help cope with the curriculum.

Rollnick and Rutherford (1996) analysed the audio recordings of group work in different Science classes for the use of English and SiSwati and its effect on learning and expressing Science concepts. They detailed a few reasons for the use of CS. For example, switches from SiSwati to English occurred when:

- a. a quote is taken from the English textbook
- b. it is more straightforward to explain a scientific concept in English
- c. students are required to take notes in English

Switches from English to SiSwati were also recorded and these happened when:

- a. Repetition is needed to explain something that had been explained in English earlier
- b. Alternative conception is needed as a correct answer
- c. Groups are communicating procedural matters

Nonetheless, there are also many occasions where the switches occur for no obvious reason. The conclusion drawn from Rollnick and Rutherford's (1996) study favours the use of CS in classroom as it not only serves many important functions, such as "voicing of alternative conceptions, clarifying concepts, eliminating misconceptions and formulating ideas" (p. 101) but is also "a naturally evolved strategy which makes sense in the pragmatic terms" (p. 102). With much research carried out on naming the pedagogic functions of CS, Eldridge (1996) notes that the main problem with such analyses is that "many switches may be either multi-functional, or open to different functional interpretations" (Eldridge, 1996, p. 305). Ferguson (2003) argues further that a considerable overlap has been found between the functions of classroom code switching, which is why there is no single taxonomy of pedagogic functions of CS. Thus, he proposes three broad categories of functions. Firstly, CS is for constructing and transmitting knowledge. When a lesson is being taught in a language in which students have limited proficiency, they will face great difficulty in understanding the texts or even whatever the teacher says in the class. This includes scaffolding, explaining key L2 technical terms and mediating the meaning of L2 textbooks. Therefore, CS is an important means by which teachers can explain the written texts and instructions in a language that students are familiar with. Martin's study (1999) supports this point as his data collected in two primary classrooms in Brunei shows that a teacher switches from English to Malay in order to: (i) encourage and elicit pupil participation (ii) to clarify the meaning of a text and (iii) to differentiate when the teacher is reading the text or commenting on it. In Hong Kong, Lin (1996) found that CS is used to annotate and explain key textbook terms, which are first introduced in English and then explained in Cantonese.

The second pedagogic function of CS is for the management of classroom discourse (Ferguson, 2003). This includes a change of footing² (Goffman, 1974, 1981) during lessons

² Footing refers to how interlocutors align themselves in relation to each other and to the interactions in which they are engaged. A change in footing is another way of talking about a change in our frame for events. That is, framing describes an overall view of an interaction, while footing is from the point of view of the participants.

to managing students' behaviour in class. Lin (1996) and Canagarajah (1995) both find that teachers use CS while disciplining students and giving task instructions. Switches into the shared L1 of teacher and pupil seem to convey meaning to the students easier as both parties have better proficiency in their first language. Lin (1996) also finds that an increase in personal interaction as opposed to instruction triggers a switch to Cantonese. Similarly, Canagarajah (1995) illustrates how teacher switches from English to Tamil while negotiating the task instructions as opposed to performance of the task itself.

Finally, according to Ferguson (2003), the classroom is not only a place of formal learning but also a social and affective environment where teachers and students negotiate relationships and identities. Therefore, CS is used for interpersonal relations and to humanise the classroom climate. Very often, English indexes a more distanced, formal teacher–student relationship. In order to build rapport with students and allow teacher to negotiate different identities as a didact, an authority figure or community member, the teacher may need to code-switch so that students feel that their relationship with the teacher is a more personal one.

3.4.4.3 Code-switching in Content Classroom vs. Language Classroom

Besides looking into the effectiveness of classroom CS in stand-alone cases, there is also research which investigates the functions and differences of CS across subjects (Adendorff: 1993; Setati et al, 2002). Adendorff (1993) compared the motivations and functions of CS in English, Biology, Geography classes and during the school assembly. In the English lessons, the teacher switches into Zulu for five main reasons:

- i) to provide direct translation and paraphrase as he feels that his students do not understand him
- ii) to clarify his interpretation of the poem
- iii) to encourage his students
- iv) to provoke his students which is seen as an attempt to engage the passive pupils
- v) to reach everyone in the classroom

When compared with the English lesson, switches into Zulu during the Biology lesson appear to have rather different functions. One of these functions is usually signalled by the following formula (p. 148):

[‘khona’ suitably inflected for concordial agreement + noun class 2 prefix
(typically plural)]

This provides a cue for the students to pay attention to what is coming up. In other words, this usually happens when a key technical term is being introduced to the class for the very first time. Another phrase often used by the Biology teacher is ‘Kuyezwakala angithi?’ Interestingly, this is never translated or paraphrased into English by the teacher as it is used to check if students are following, and as an implicit encouragement to students. However, unlike the English and Biology lessons which use Zulu CS for academic and social functions equally, the geography teacher is seen to rely on CS for classroom management. The data shows that the teacher’s choice of Zulu was mainly coupled with students’ laughter and this undercut the implied authoritarianism (as Zulu is the language of extra loudness). It also signalled his desire to be closer to the students and that they would co-operate with him. Meanwhile, the frequency of CS by the school principal is greater than in any of the lessons discussed earlier. The principal switches to Zulu i) to paraphrase his message, ii) as a vehicle for listing, iii) for reiterating important information and iv) as a focusing device. Adendorff’s (1993) study therefore shows a different pattern of CS in different subjects and with different teachers.

In another study, Setati et al (2002) found that the Mathematics and Science teachers observed switch more during whole class than English language teachers did, which shows a clear difference between their primary goals, especially in an environment where English language exposure is limited. This was because it was more important for the English language teacher to play the role of modelling and scaffolding the use of English than it was for Mathematics and Science teachers. This was confirmed when an English teacher commented that she would switch more when she taught other subjects such as the health lessons, compared with when she taught English. She even said that she would only switch to TshiVenda during English language lesson ‘as a last resort’.

Although classroom CS is not legitimised in Malaysia, various research work expresses support for classroom CS (Then & Ting, 2009, 2011; Badrul & Kamaruzaman, 2009;

Kamisah & Misyana, 2011). Then and Ting (2009) argue that CS is necessary for imparting content knowledge in Science and English lessons. This is especially the case for teacher-fronted content lessons. In order to ensure students' comprehension of the lesson, reiteration of key points and message qualification in *Bahasa Malaysia* has to be encouraged. Their study also suggests that teachers should accept CS as a tool to explain concepts, especially when students lack proficiency in the language of instruction.

3.4.4.4 Arguments and Attitudes towards Code-switching in the Classroom

Although classroom CS has been widely researched in the past 3 decades, studies have shown that there are varying attitudes towards it (Kachru, 1978; Grosjean, 1982). For example, some educational authorities believe that languages should not be mixed and that students will not be able to learn a language well if we keep mixing them. They even see CS as a dysfunctional form of speech behaviour. In Hong Kong, there have been repeated official calls for teachers to refrain from what is called 'mixed code' teaching (Lin, 1996). On the contrary, Adendorff (1993, p. 142) comments that "CS is...highly functional, though mostly subconscious. It is a communicative resource which enables teachers and pupils to accomplish a considerable number and range of social and educational objectives".

A) Negative Attitudes to CS

As seen in previous sections, much research has been done in an attempt to detail the advantages of classroom CS. Nonetheless, not many researchers see it as a classroom practice which should be encouraged. Martin (2005, p. 88) reports that:

“the use of a local language alongside the ‘official’ language of the lesson is a well-known phenomenon (in Malaysia) and yet, for a variety of reasons, it is often lambasted as ‘bad practice’, blamed on teachers’ lack of English-language competence...or put to one side and/or swept under the carpet”.

Clegg and Afitska (2010) noted that the occurrence of CS is very much affected by the attitudes of stakeholders in education. Although multilingual communities may accept CS as a normal strategy for negotiating meaning among speakers who speak more than one language, it may be a different story if it is being used in schools. In many countries,

classroom CS may be considered “inappropriate, officially frowned upon or banned outright” (Clegg & Afitska, 2010, p. 15). The reasons for negative attitudes to classroom CS include the differential status of languages in a particular society and their allocation to different purposes. In other words, in many multilingual societies, L1s or native languages are considered as an unsuitable choice of medium of instruction (Ferguson, 2003). In a Tamil speaking community in Sri Lanka, classroom CS into Tamil may signal interactions which are unofficial and personal, whereas English remains the language of textbooks and the curriculum (Canagarajah, 1995). Secondly, teachers are reported to have a dilemma between “access to meaning and access to English” (Setati et al, 2002, p. 140) because, although teachers are allowed to explain the concept in students’ mother tongue, students are still required to produce the content in English when it comes to formal examinations. Therefore, the practice of CS may affect students’ ability to answer questions in English. In addition, the practice of CS may have negative effects on learning. For example, Payawal-Gabriel and Reyes-Otero’s (2006) study in Philippine suggests that teachers’ CS may confuse students and affect their comprehension.

B) Positive Attitudes to Classroom CS

Despite negative views on classroom CS, there are also positive arguments for the use of classroom CS as bilingual pedagogy. Many commented that CS can be a useful tool in teaching. Macaro (1997) argues that discouraging the use of L1 in classroom is not only impractical but also likely to deprive learners of an important tool for language learning. Rollnick and Rutherford (1996, p. 101) report that the use of CS in Science classroom communication serves some important functions, such as presenting alternative conceptions, clarifying concepts, eliminating misconceptions and formulating ideas. Besides, Lin (2005, p. 46) also describes the practice of classroom CS as “local, pragmatic coping tactics and responses to the socioeconomic dominance of English in Hong Kong, where many students from socioeconomically disadvantaged backgrounds with limited access to English resources struggled to acquire an English-medium education for its socioeconomic value”. Arthur and Martin’s (2006) study of interactional patterns in Brunei also supports this view as teachers in the study employ classroom CS to help students’ understanding and to provide bilingual support.

Students' views on classroom CS should also be taken into account as well. Kamisah & Misyana's (2011) study in Malaysia argues that students who are less proficient in the target language (English) are more tolerant of the teacher's CS compared with the more proficient group. This group of students feel that their low level of English has hindered comprehension and thus, it is necessary for the teacher to code-switch to Malay in order to aid understanding. Classroom CS not only brings advantages to the students but also for teachers who are less proficient in the target language. These teachers say that classroom CS is a useful coping strategy (Kamisah & Misyana, 2011). If they are not allowed to code-switch, their students will not be able to acquire content knowledge taught in class. Therefore, students should not expect their subject teacher to be a language model in the content classroom. Although teachers who have a higher proficiency in English strongly believe that classroom CS should be minimised or even eliminated, they admit that it is impossible to avoid because of the differences in English proficiency among the students. Thus, classroom CS is said to be "a strategy to promote fast and easy understanding among the students" (Kamisah & Misyana, 2011, p. 240). If the main aim of classroom CS is for students to understand the content taught in a language that they are not familiar with and help students to grasp the idea better, then it may be beneficial.

In order to sum up the general learner's perceptions of teacher's CS, Badrul & Kamaruzaman's (2009) study suggests that i) there are many functions of teacher CS in classrooms, ii) teachers' CS is significantly associated with learners' affective support, iii) teachers' CS is also associated to learners' learning success and iv) learners support the CS in ELT classrooms.

3.4.4.5 Possibility of Regulating Classroom Code-switching in Malaysia

Classroom CS is like a double-edged sword. It is undeniable that CS is indeed necessary for constructing and transmitting knowledge, managing classroom discourse and humanising the classroom climate (Ferguson, 2003), especially in a bilingual/multilingual classroom. It is also vital in providing students plenty of opportunities to be familiarised with the sociolinguistic life in their larger community outside the classrooms (Canagarajah, 1995). Nonetheless, this tool should be used wisely and not be overly depended. If teachers and students abuse the use of CS, it might decrease the time spent on exchanging real

communicative acts in the target language (Gauci and Camilleri Grima, 2012) and thus, would counter the productive effects CS has on the lessons.

While promoting bilingual education in Africa, Clegg (2001, p. 210-211) made four points to encourage relevant parties to embrace such an approach to education. These points are:

1. Bilingual education is ideologically a proper goal for bilingual communities.
2. When a language-sensitive pedagogy is introduced to subject teachers during their pre- or in-service training, it can considerably improve students' performance.
3. Subject teachers will be given main focus if there is a desire to improve the way teachers and students use English for teaching and learning.
4. As bilingualism goes hand-in-hand with L2-medium teaching, L2 needs to be allowed in classroom for bilingual education to work well.

Although the above points are for advocating bilingual education, they are very relevant to promoting CS in Malaysian classroom. As CS is part of bilingualism, the points mentioned are applicable to this study. So, being a multilingual nation, it is only rational that CS is incorporated into Malaysian classrooms to represent the multilingual community we have and if we have a way to regulate classroom CS, we do not have to worry about such a tool being used wrongly. According to Clegg's language-sensitive pedagogy (2001, p. 222-223), below are the key features for developing language ability and content knowledge in bilingual classroom:

1. Be aware of the language and learning demands that lessons can make on students.
2. Plan lessons to support students' language and learning needs.
3. Use tasks that provide language and learning support, as well as those that develop subject matter knowledge.
4. Use as much visual material as possible to illustrate the subject matter (pictures, diagrams, graphs, etc.).
5. Help students with key vocabulary.
6. Use the board to underline the main contents of the lesson.
7. State concepts clearly orally and in writing (elicit, repeat, exemplify, summarise, etc.).
8. Talk in a natural, interactive, comprehensible way.
9. Vary the form of interaction (e.g. whole-class activities, small-group activities, one-on-one sessions between teacher and student, individual work) to suit the purpose of the lesson.

10. Teach key learning strategies.
11. Agree on ground rules for the use of students' L1.
12. Ensure the purpose of tasks is clear and the sequence of tasks is in order.
13. Work within the framework of a school language policy.

Besides Clegg's language-sensitive pedagogy (2011) which could be used to develop language ability and content knowledge in bilingual classroom, Jacobson's New Concurrent Approach (NCA) (Faltis, 1989) looks specifically at how inter-sentential CS can be systematically incorporated in classroom teaching. In order for NCA to be successful, CS is structured in terms of the following four criteria (Faltis, 1989: 118):

1. Both languages are to be used for equal amounts of time
2. The teaching of content is not to be interrupted
3. The decision to switch between the two languages is in response to a consciously identified cue
4. The switch must relate to a specific learning objective

With regards to point number 3, teachers who undergo the NCA cue-response training programme would gain fluency in responding to cues and would know which language to switch to when responding to these cues. The following table (taken from Faltis, 1989, p. 122) details the 16 cues indicating the purpose for switching, which spread across four major areas.

Table 3.5: The New Concurrent Approach cue system [taken from (Faltis, 1989, p. 122)]

<ol style="list-style-type: none"> 1. Classroom strategies <ol style="list-style-type: none"> a. Conceptual reinforcement b. Review c. Capturing of attention d. Praise/reprimand 	<ol style="list-style-type: none"> 2. Curriculum <ol style="list-style-type: none"> a. Language appropriateness b. Topic c. Text
<ol style="list-style-type: none"> 3. Language development <ol style="list-style-type: none"> a. Variable language dominance b. Lexical enrichment c. Translatability 	<ol style="list-style-type: none"> 4. Interpersonal relationships <ol style="list-style-type: none"> a. Intimacy/formality b. Courtesy c. Free choice d. Fatigue e. Self-awareness f. Rapport

Looking both at the language-sensitive pedagogy and new concurrent approach, it does show the possibility of regulating the use of CS in classroom. Building on Jacobson's NCA, this study will aim to do similar, listing a cue system suitable for Malaysian teachers, especially those who will be teaching Science to students who have learnt the subject in Malay throughout their primary and secondary education. By this, we hope to be able to maximise the benefits of classroom CS in the teaching of Science in multilingual classrooms.

3.5 Bilingual Education, Translanguaging and Classroom Code-switching

At the beginning of this chapter, I talked about bilingualism and the typology of bilingual education. It can be said that bilingual education distinguishes itself from other forms of language education in that content and language learning are integrated; usually, at least two languages are used as MOI in the class (Baker, 2011; Garcia, 2009).

Nonetheless, despite various researches being done in bilingual classrooms, Lewis, Jones and Baker (2013) point out that we still know very little about "the actual use of two languages, their distribution, balance and explicit or implicit purpose in lessons" (p.107). The interest in the allocation of two languages has stemmed from Jacobson's (1990, as cited in Lewis, Jones and Baker, 2013) discussion about four concurrent uses of two languages in a bilingual classroom:

- Switching languages
- Translating/interpreting
- Previewing, viewing and reviewing
- Purposeful concurrent usage

Jacobson's concept of purposeful concurrent use developed into 'translanguaging' in Welsh classrooms (Baker, 2011) and New York communities (Garcia, 2009). As cited in Baker (2011, p. 288), Cen Williams created the term 'translanguaging' for the planned and systematic use of two languages inside the same lesson, where the input (reading and/or listening) tends to be in one language and the output (speaking and/or writing) in the other language, and this is systematically varied.

Baker (2011) discusses four potential advantages of translanguaging:

1. It helps students to gain deeper and fuller understanding of the subject matter. Students who are required to read and discuss a topic in one language, and then to write about it in another language means that the subject matter has to be processed and 'digested'.
2. It helps to develop oral communication and literacy in the students' weaker language. As 'translanguaging' attempts to develop academic skills in both languages leading to a fuller bilingualism and literacy, it gives students the opportunities to improve and practise their skills in the weaker language.
3. It facilitates home-school cooperation. With translanguaging, students are able to expand, extend and intensify what they have learnt in the school through discussion with their minority language parents.
4. It helps the integration of fluent L1 speakers and L2 learners of various levels of attainment. When both languages are sensitively and strategically used in class, the students can develop their second language ability concurrently with content learning (Maillat and Serra, 2009).

In order to study the difference between code-switching and translanguaging, we look at code-switching once again by citing Ferguson's (2003) view on code-switching. He suggests that code-switching:

is not only prevalent across a wide range of educational settings but also seems to arise naturally, perhaps inevitably, as a pragmatic response to the difficulties of teaching content in a language medium over which pupils have imperfect control. Moreover, because teaching is an adrenalin-fuelled activity, making numerous competing demands on one's attentional resources, much switching takes place below the level of consciousness. Teachers are often simply not aware of when they switch languages, or indeed if they switch at all. (Ferguson, 2003, p. 46)

Some of the differences between CS and translanguaging I noticed are shown on next page:

Table 3.6: Comparison between code-switching and translanguaging

	Code-switching	Translanguaging
Situation when it happens	‘Arise naturally, perhaps inevitably’	‘Planned and systematic use of two languages’
Main purpose	As a response to the difficulties met during content teaching in a medium where students have imperfect control	As a tool to promote deeper understanding of content while developing the weaker language

In brief, according to Garcia (2009), it is typical for bilinguals to engage their bilingual worlds through translanguaging. Translanguaging is not about code-switching but more about hybrid language that is used in systematic and strategic ways to make sense for both speaker and listener.

3.6 Conventionalised Forms of Action in the Science Classroom

According to Kress et al. (2014), there are six conventionalised forms of action in the Science classroom.

1) Imaginary demonstration:

Such action is adopted to make clear particular entities which are usually unseen, e.g. microbes, blood circulation, the universe, theoretical entities such as orbits and historical aspects of entities, e.g. the life history of a star. During an imaginary demonstration, teacher would draw on the students’ everyday life experience or reconceptualise what is being taught.

2) Demonstration:

During a demonstration, teacher interacts with scientific equipment and stands in front of the class. This puts the teacher in an authoritative position and allows teacher to build scientific fact and authority as distinct from the everyday.

3) Experiment:

Conducting an experiment allows the construction of Science as collaborative exploration and constructing the students as ‘scientist’ through being brought into the

habitus of Science via the handling of the equipment. It also transforms everyday into the realm of the scientific.

4) Analogy:

Through this process the sociocultural and sociohistorical meanings of the everyday object are brought into the Science classroom as another resource for meaning making. The analogical connections allow the everyday world to appear as a way of asserting the realism of scientific truth.

5) Visual display through action:

This refers to the interconnectedness of the vision and the action in the production of an image. This process allows students to ‘rub out differences’ between everyday entities in order to reconceptualise the world.

6) Objects which mediate action in the Science classroom:

Everyday objects are brought into the classroom and through the handling of these objects in a scientific procedure, students are able to see the new qualities and functions of these objects and to see the scientific potential within the everyday.

3.7 Summary

This chapter has detailed the core context for this study. It has reviewed the bilingualism and bilingual education in other parts of the world, discussed the various issues surrounding choices of MOI in different levels of education. It has explained the different theoretical frameworks which help to build the framework for this current study. Besides reviewing in detail the previous study on CS, it has also shed light on the differences between bilingual education, translanguaging and CS.

In the next chapter, I will describe the research design and methodology adopted for this study.

Chapter 4 Research Design and Methodology

4.1 Introduction

This study is designed as a predominantly qualitative study of naturalistic classroom interaction in different medium of instruction (MOI) settings (Malay, English or both) for science. It aims at uncovering practices of language use in these classrooms with particular focus given to code-switching (CS). In this chapter, research objectives and research questions are reviewed in section 4.2. Section 4.3 presents the data sources for this study and then the description of the data collection procedure is provided in section 4.4. Framework for the data analysis is presented in section 4.5. Before the end of this chapter, sections 4.6, 4.7 and 4.8 detail the preparation done for data analysis, ethical considerations and context for analysis respectively. This chapter ends with a summary in section 4.9.

4.2 Reviewing the Research Objectives and Research Questions

In year 2003, the policy of English for the teaching of Mathematics and Science (ETeMS) was implemented in Malaysia. The Malaysian government wanted the implementation of this policy to help increase students' proficiency in English and to better equip them for the outside world due to globalisation (see section 2.4 for detailed discussion). However, this policy was abolished partially in 2009. Only primary and secondary schools are required to revert back to Malay for the teaching of Mathematics and Science but Form 6 (sixth year of secondary education, also known as pre-university level) and local universities would continue with English medium. One of the main reasons cited was the huge gap between the performance of urban and rural students, especially in the subjects of Science and Mathematics. Not only did students in rural areas not fare as well as students in urban areas, their results showed a declining pattern in these subjects (see section 2.5).

With the policy only being abolished partially, i.e. allowing Form 6 and local universities to continue with ETeMS, this meant that in years to come, students attending Form 6 will have learnt Mathematics and Science in Malay throughout their

primary and secondary education before being introduced to English syllabus in their Form 6. It is foreseen that this would be a problem for both the students and the teachers during the transition period because of a change of MOI. Therefore, there is a need for measures to address this problem – to manage the transition from teaching and learning Maths and Science in Malay to teaching and learning these subjects in English.

During such a transition period, there is a challenge for teachers to give instructions using the technical vocabulary of a core subject. One way to manage is for teachers to use the linguistics resources represented by the technical vocabulary in the two languages. Due to this, it is thought that the study of CS within a Science classroom can help us investigate the possibilities of treating it as a pedagogic strategy for the transition period. This research was designed with the abovementioned context in mind and hence, the aims of this study are as follows:

- To investigate and describe CS practice in Science classrooms
- To examine in what context and for what purposes CS takes place
- To study teachers' and students' beliefs, opinions and attitudes towards CS

Arising from these general aims, four research questions were formulated as below:

1. Do Science teachers CS in class?
2. How often do Science teachers CS in class?
3. In what context and for what purpose do science teachers CS in class?
4. What are the students' views towards teachers' CS?

4.3 Data Sources

This section explores the subjects and instruments used for this research. The sampling will first be described in 4.3.1 followed by the various research instruments in 4.3.2.

4.3.1 Sampling of Subjects

In order to ensure the availability of CS data, the choice of schools had to be narrowed down to schools which have English or bilingual Science syllabus. This,

according to Cohen and Holliday (1996), is non-probability sampling. I chose this sampling method because it ensured that only certain members of the population were chosen deliberately for the study as opposed to probability sampling where all members of the wider population have equal chances of being chosen as the subjects for the study. Furthermore, because it was important to have a balanced number of different types of school, I had to choose schools which met a specific purpose, i.e. at least one school which teaches Science in English and another school which teaches the subject in both Malay and English. This is the purposive sampling method. I understand that due to the selective nature of purposive sampling method the results gained from this study cannot be used to represent the wider population (Cohen, Manion & Morrison, 2000). Nonetheless, choosing subjects based on a set of fixed criteria not only saved time but also allowed me to study each case in-depth.

For the purpose of this study, I selected three schools, namely School A, School B and School C as the main sites for data collection. These schools were chosen based on the language(s) used for the teaching of Science that the school decided. Also, these schools were considered ‘good schools’ in the vicinity of Kuala Lumpur, the capital of Malaysia. School A and School B were awarded the ‘Cluster School of Excellence’¹ (*Kementerian Pendidikan Malaysia*, n.d.), whereas School C received a few awards from the Federal District Education Department of Kuala Lumpur for their excellent performance in the *PMR (Penilaian Menengah Rendah, Lower Secondary Assessment)* in 2012 (SMK Cochrane, 2013).

In section 4.2, I reviewed the objectives of this study and one of the aims is to investigate if classroom CS is a good measure to address the transitional problem Form 6 students may face, i.e. learning Mathematics and Science in Malay during primary and secondary education but switching to English syllabus when entering Form 6. Although the Form 6 students and teachers may seem to be the stakeholders of the result of this research, it was difficult to recruit them as subjects for this study because Form 6 students need to sit for university entry examinations at the end of the

¹The Cluster School of Excellence is a merit system granted to high achieving schools in Malaysia, which are given wider autonomy in their administration and extra funding for the advancement of their niche areas including academic or extra-curricular activities.

year. Due to this, none of the school principals and teachers allowed any research to be carried out in these classrooms.

After much consideration, I decided to use Form 1 (first year of secondary education, 13-year-old) classes as the subjects of this study. I chose Form 1 science classrooms because these students all came from different primary education backgrounds. Therefore, Form 1 is also seen as a transition period for these students as they enter secondary school. This is a similar scenario as the Form 6 students. Secondly, as Form 1 classes have no major national examination at the end of the year, it would be easier to gain access to these classes for observations. Two classes were observed in each of these schools and these classes were chosen based on the recommendation of the school principals. Table 1 gives a summary of all the subjects for this study.

Table 4.1 Summary of all the subjects for this study

School	Observed teacher(s) (Names are pseudonym)	Number of students in each class	Pre- observation interview	Post- observation interview	
A (English only + bilingual stream, uses English textbook)	Farid – teaches in English	24	Yes	No	
	Aminah – teaches in bilingual	24	Yes	No	
B (English as MOI, uses English textbook)	Su Ling – teaches in English	31	Yes	No	
	Fatimah – teaches in English	30	Yes	Yes	
C (uses both English and Malay as MOI, uses English textbook)	Marina – teaches in bilingual	26	Yes	No	
	Shahrul – teaches in bilingual	24	Yes	Yes	
Total:	3 schools	6 observed teachers	159 students	6 pre- observation interviews	2 post- observation interviews

4.3.2 Research Instruments

For the purpose of answering the research questions of this study, I have adopted the following instruments to generate data and evidence.

- A) Classroom observation and audio recording
- B) Pre and post-observation interview
- C) Questionnaire for students
- D) Other materials/documents

A) Classroom Observation and Audio Recording

I observed a total of six classrooms (two from each school) and each classroom was audio recorded for 4 hours. Observational data are interesting because they give me the opportunity to gather ‘live’ data as the lessons are taking place *in situ* (Patton, 1990). This research instrument is also seen as playing the main role of the data collection in this study as it offers in-depth insights to research questions 1–3:

1. Do Science teachers code-switch in class?
2. How often do Science teachers code-switch in class?
3. In what context and for what purpose do Science teachers code-switch in class?

I adopted unstructured observation for this study because I did not go into the classes with a predetermined hypothesis. A structured observation limits what I want to focus on during the lessons and risk missing out on other factors that could potentially affect the data. It was anticipated that an explanation of the classroom code-switching phenomena would be provided only after analysing the unstructured observational data. This ensured that the data collected was “honest to the situation which it finds” (Cohen, Manion & Morrison, 2000, p. 306).

I audio-recorded the teacher’s talk whilst the session was being observed. Four hours of lessons (including the 1-hour pilot study) were audio recorded for each of the teachers observed. This totals 24 hours of classroom recording for this study. Recording was deemed necessary in this study because firstly, it allows other researchers to draw independent conclusions after reviewing the actual data, hence

increases the reliability of this study. It also captures the immediate context of the classroom discourse so that I can analyse the talk in its natural form even after the observation. Finally, together with the transcript, recording acts as a form of evidence to support my analytic claims. These reasons are also supported by Clemente (2008, pp. 177-178).

Audio-recording was chosen instead of video-recording simply because non-verbal visual data are not considered necessary in this study. As the main focus of this study is teacher's code-switching in classroom, recording teacher's speech in class is deemed sufficient. Besides, adopting video-recording may be more intrusive and distracting to both the teacher and the students in the classroom. Although Duranti (1997, p. 118) comments that "people do not invent social behaviour, language included, out of the blue", the presence of a video-recorder is still generally unwelcomed by the teachers. Hence, teachers were only required to have a clip-on microphone while they are teaching. This ensured that the teachers were still able to write and walk around the class as usual.

B) Pre and Post-observation Interview

Besides classroom observation and audio-recording, I also used interviews to collect data for research question 3: "In what context and for what purpose do science teachers CS in class?"

I adopted semi-structured interview (Dörnyei, 2007) for both pre and post-observation interviews. Prior to these interviews, I would prepare a set of guiding questions and prompts (see Appendix C). During the open-ended interviews, interviewees (observed science teachers) were encouraged to further elaborate on their answers. Such interview technique allowed the interview process to be systematic and increased the comprehensiveness of the data.

The pre-observation interviews were conducted before I started the observation of each teachers' lessons. These interviews provided background information on the teacher's language proficiency, training issues, teaching background and their self-perceived practice of code-switching in class (see Appendix D for teachers' portfolio).

As for the post-observation interview, due to limited time and heavy workload, only two teachers (Fatimah and Shahrul) agreed to be interviewed as a follow-up after the classroom observations. I was able to obtain further clarification from the teachers on why they code-switched in class, based on the brief transcripts obtained from the previous lesson.

C) Questionnaire for Students

In order to investigate research question number 4: “What are the students’ views towards teachers’ CS?”, a questionnaire was used to collect such data. Questionnaire is deemed the most appropriate means to collect such data because firstly, it is capable of gathering large information quickly. As it had been anticipated that more than 120 students would be observed, the form of data collection should be easily processed in order to save time. Secondly, attitudinal questionnaires are said to be able to elicit what people think, covering attitudes, opinions, beliefs and values (Dörnyei, 2007). This would certainly help in answering the last research question of this study – “How does CS impact on the lessons and what are the students’ views towards teachers’ CS?”. The administration of students questionnaire was designed to guarantee confidentiality, anonymity and non-traceability of these 13-year-old students in the research. A total of 159 students who were observed, completed the questionnaires.

There were seven questions in the questionnaire (see Appendix E). Different formats of questions were used in order to obtain different responses from the students. For example, multiple-choice questions were asked in order to elicit students’ language background, such as their first language at home, and the language they were taught in during their primary education. Bipolar-type question was adopted to gauge the language that students prefer for their current Science teacher to use in the classroom and finally, the semi open-ended question was designed to allow students to choose the reason(s) why they prefer their teacher to use Malay/English for the teaching of Science. In this question, students were also given the opportunity to write their own response as well. While students were completing the questionnaire, I was there to answer any questions they had. As the questionnaire had been piloted during the pilot study, students could complete it with minimal problems. Through this questionnaire,

it was possible to find out how had their first language or MOI used in primary school affected their attitudes towards code-switching by their current Science teacher.

D) Other Materials/documents

Apart from the four instruments described above, I also collected further material to complement the evidence gathered from the interviews and observations. These are:

- Additional field notes made during the observation and recording of lessons
- Teaching material, e.g. textbooks and handouts used in the lessons
- Official and semi-official written documents concerning the language of instruction for science by schools and education authorities

The field notes taken before or during the observation included elements, such as the layout of the classroom, the seating arrangement, any special equipment used and the number of students present on that day. These notes were taken to provide support while transcribing the recording. Besides, these notes also made it easier to identify individual speakers during transcription. It was also valuable to know when a significant event occurred or if there was any non-verbal action which would help to explain the results of the observation and these would not be recorded in the audiotape. Note was also taken if any circumstantial information is seen to be relevant at that time. These reasons are supported by Heller (2008, p.258):

“Recordings should not be relied on alone. Fieldnotes help contextualise them, providing the information needed to make sense of interactions, and to build up the basis for comparison or developmental analysis that allows us to link interactions to institutional and social processes and structures.”

Teaching material and texts used would be requested from the teacher prior to a lesson. This enabled the researcher to follow the flow of the lesson or to check what is being referred to at any point of time. Lastly, official and semi-official written documents were collected from schools or from the education ministry webpage in order to understand how the aims of language of instruction were formulated in the school and this piece of information would be used to complement the interviews

carried out with head of schools and Science teachers. Table 4.2 provides a summary of data collection methods for each of the research questions.

Table 4.2 Summary of data collection methods for each of the research questions

Research question	Method(s) of data collection/instrument(s)
1. Do science teachers code-switch in class?	<ul style="list-style-type: none"> • Classroom observation + field notes • Audio recording • Pre and post-observation interviews
2. How often do science teachers code-switch in class?	<ul style="list-style-type: none"> • Classroom observation + field notes • Audio recording
3. In what context and for what purpose do science teachers code-switch in class?	<ul style="list-style-type: none"> • Classroom observation + field notes • Audio recording • Pre and post-observation interviews
4. What are students' views towards teacher's CS?	<ul style="list-style-type: none"> • Questionnaire for students • Field notes

Based on the subjects and instruments implemented in this study, it can be seen that both qualitative and quantitative approaches were adopted. Therefore, we can conclude that the research approach for this study is mixed-method approach.

4.4 Data Collection Procedure

In order to ensure smooth execution during the research, a pilot study was carried out prior to the main study. The pilot study provides opportunities to test the research instruments, e.g. questionnaire and interview questions, and for me to familiarise myself with the school setting. Some practical difficulties were met during the pilot study and these helped shaped the current study. In this section, we will first discuss the design and implementation of the pilot study, some lessons learnt from the pilot study and then lay out the research procedure in a flow chart.

The pilot study was conducted in School P, a school which at the point of the abolishment of English for Mathematics and Science policy (ETeMS), decided to revert back to Malay immediately for the teaching of Mathematics and Science starting with secondary year 1 students. Consequently, the Science textbook used was in Malay MOI. The pilot study was carried out over two days. Two science classes

were observed and recorded for 40 minutes each, three teachers and the principal were interviewed and 10 students were requested to complete the questionnaire.

The first difficulty encountered, a practical one, namely, was getting schools to participate in the study. Although relevant permission had been given by the Ministry of Education, it was still up to the principal of each school to decide if they would like to take part in a study. When schools were first approached, I had hoped to video record the lessons for this study but many teachers expressed their reluctance to be video recorded. Some were afraid that the videos could be used against them even though the researcher promised that data collected would be kept private and confidential. So it was difficult to persuade schools to take part in this study. When an alternative, audio-recording option was provided, most teachers had no qualms about being audio recorded as they felt it would be 'safer' for them if it is only the voice which was going to be recorded. Besides the issue of being recorded, many teachers also felt that the study would add to their workload. Therefore, when a school showed sign of interest in the study, I made different trips to the school in order to explain the study to the principal and teachers who were nominated to be observed. It was crucial to make sure that both the observed teachers' lessons did not clash so that the researcher could be present during every observation and to reassure the teachers that this study would not be a burden to them.

During the classroom observations in School P, I found that both teachers were teaching and interacting with the students in Malay all the time and only had 1–2 instances of CS each. With such limited data gathered from School P, I decided that schools which had Malay as the medium for the teaching of Science were not suitable for this study because they do not provide enough instances of CS to analyse teacher language. Therefore, in order to be sure of getting more examples of classroom code-switching, only schools which were teaching Science in English or bilingual (English and Malay) were invited to participate in the main study and Schools A, B, C met this criteria (further characteristics of these schools were discussed in section 4.3.1).

Piloting the interview questions helped me to sharpen my interview technique and refine the questions asked. It also established the timing needed for each interview, thus making it more convenient for me to invite other teachers for interviews as I was

then able to tell them that I only needed 10 minutes of their time. As for the questionnaire, during the completion of the task, I was there in the classroom to answer any questions the students might have. Some minor changes to the questionnaire were made based on the feedback given from the students.

Last but not least, while piloting the study in School P, the researcher was reminded that within the school environment, there would always be various unexpected events and interruptions such as cancelled class or lesson being cut short due to a longer assembly before that. Therefore, when this happened during the main study, the researcher was not caught unprepared and was ready to request permission from teachers to have extra lessons being audio recorded.

It should also be noted that apart from piloting the study in School P, at the beginning of research in each class in Schools A, B and C, the first recorded lesson (range from 40–60 minutes) were also treated as a pilot study for the class. This is to allow the observed teacher to be made familiar with the recording device and also for the whole class to be comfortable with the presence of the researcher sitting at the back of the class.

The figure below gives a summary of the data collection procedure.

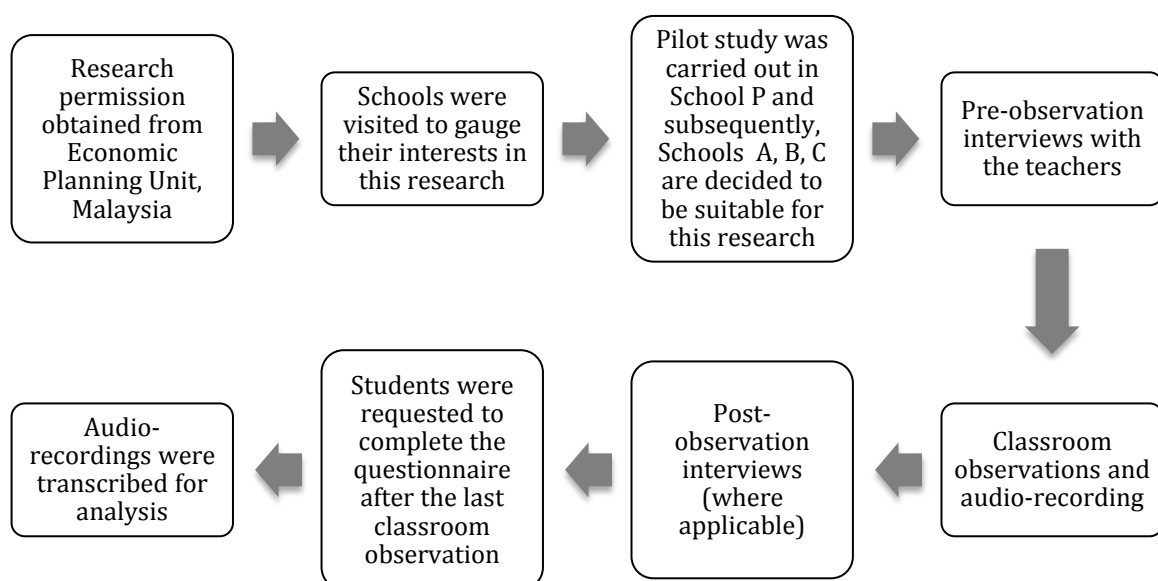


Figure 4.1 Summary of data collection procedure

4.5 Framework for Data Analysis

In this section, I present the two main aspects which form the framework for data analysis: (i) episodes and (ii) pragmatic functions of classroom CS before discussing some exceptions for analysis.

4.5.1 Episodes

Besides grouping these teachers according to the MOI used, I also look at the different activities carried out in each lesson. According to Kress et al., (2014), there are certain conventionalised forms of action in the Science classroom (see section 3.6 for detail discussion). These conventionalised forms are:

- i. Imaginary demonstration
- ii. Demonstration
- iii. Experiment
- iv. Analogy
- v. Visual display through action
- vi. Objects which mediate action in the science classroom

Building upon the activities listed above and having observed both BMI and EMI classes, I identified three main activities in the observed lessons. These activities are teaching, conducting experiment and completing school-based assessment. I decided to use the term ‘episode’ to represent these activities and they are named as the episode of instruction, episode of experiment and episode of assessment.

Each of these episodes is said to be different because their main aims are not the same, i.e. an episode of instruction has the main aim of imparting scientific knowledge to the students whereas an episode of assessment is to examine what the students have learned thus far.

I adapted Coffin et al’s (2009) speech functions to distinguish these episodes. There are four basic speech functions (statement, question, offer and command) but as speakers’ role can be analysed in terms of whether they are initiating or responding,

and whether they are supporting or confronting, a total of twelve speech functions is presented in the following table (Coffin et al, 2009: 357).

Table 4.3: Speech functions

	Initiation	Response	
		Supporting	Confronting
Giving information(e.g. to give explanation)	Statement <i>Air is a mixture.</i>	Acknowledgement <i>Yes, air is a mixture.</i>	Contradiction <i>No, air isn't a mixture.</i>
Demanding information (e.g. to elicit students response)	Question <i>Why is air a mixture?</i>	Answer <i>Because it consists of different gases and water vapour.</i>	Disclaimer <i>No idea. I don't know.</i>
Giving goods and services(e.g. to give attention)	Offer <i>Do you want me to show you how to do this?</i>	Acceptance <i>Yes, please.</i>	Rejection <i>No, thank you.</i>
Demanding goods and services (e.g. to give instruction)	Command <i>Hand in your work now.</i>	Supply <i>OK.</i>	Refusal to supply <i>Wait, I'm not done yet.</i>

Examples given above (in *Italics*) are in the context of teacher being the initiator and student being the responder. It should be noted that the roles can be reversed in the classroom such as a student asking a question (initiation) and the teacher either responds with an answer or a disclaimer (responder). We will now look at how these speech functions can help us distinguish the three main classroom activities: teaching, conducting experiment and completing school-based assessment.

In a teacher-centred classroom, teaching is usually carried out with teacher being the initiator most of the time. Throughout the lesson, main speech functions, such as question, statement, offer and command are frequently seen. Of these, the recurring speech functions would be statement and question as the teacher's responsibility is to impart new knowledge or scientific concept to the students and also to make sure that they understand what is being taught. Therefore, the teacher will constantly be making statements and asking questions to check the students' understanding.

At another stage when students are required to conduct experiments, the interaction between the teacher and students will be more of a two-way conversation with students asking most of the questions. In order to conduct the experiments correctly, students often surround the teacher and ask questions like “Why do I not see a reaction?” “What have we done wrong?” “Is this correct?”. As conducting experiments requires both students’ and teacher’s full attention to avoid unnecessary accidents, teachers will often command students to “Be careful!” and “Don’t do that.”

When it comes to the assessment episode, students are required to be quiet and put their textbooks away. These commands will be made by the teacher to make sure that the lesson has the environment of an examination. However, as it is a continuous school-based assessment, which is less formal than mid-term examinations or other major examinations, some students may not take it seriously, and they may sometimes ask the teacher questions relating to the assessments. At this point, the teacher will mostly give a confronting response (disclaimer) so that he/she does not reveal the answer to the test.

4.5.2 Pragmatic Functions of Classroom Code-switching

Within the literature review, we discussed Ferguson’s (2003) three broad categorisations for communicative functions of classroom CS. Under the first, constructing and transmitting knowledge, we consider how CS is used by teachers to convey and impart Science knowledge and help students understand the content better. Under the second, management of classroom discourse, we consider how teachers regulate classroom interactions with students through CS. Lastly, under interpersonal relations and humanising the classroom climate, we consider how CS is used by teachers to bring their relationship closer to the students in order to create a more harmonious learning environment for the students.

Also, according to Lin (2008) who draws on Halliday’s functional framework of language (1994), CS is seen to achieve the following three purposes:

1. Ideational functions: In order to help students who have limited L2 proficiency understand the subject content in an L2-mediated lesson, teacher translate or annotate key L2 terms in students’ L1: explain, elaborate or

exemplify L2 academic content for students, e.g. drawing on students' lifeworld experience and linking it to the science concept in L2 textbook.

2. Textual functions: Signalling a shift in topics or highlighting the transition from one activity to another or from one focus to the other (e.g. focusing on technical definitions of terms or exemplifications of the terms in students' everyday life).
3. Interpersonal functions: Negotiating the shift in frames and footings; signalling a change of identities and social distance; and appealing to shared cultural values or institutional norms.

By adapting Ferguson's categorisation (2003), Halliday's functional framework (1994) and classroom CS functions obtained by other previous research (see section 3.4.4.2), the following table shows the micro-functions, which are grouped under three macro-functions of classroom CS:

Table 4.4: The macro and micro-functions of code-switching

Macro functions of classroom CS	Micro functions of classroom CS
Constructing and transmitting academic knowledge	<ul style="list-style-type: none"> • To facilitate students' understanding • To emphasise • To read from the text • To link to students' experiences • To check understanding • To provide further information • To detail demonstration • To use content-related words • To recap
Classroom management	<ul style="list-style-type: none"> • To elicit response • To get attention • To give attention • To show disapproval • To admonish • To encourage students • To give instruction • To seek confirmation • To give confirmation • To signal a shift in topic/activity
Interpersonal relations	<ul style="list-style-type: none"> • To shift attention from whole class to individual student • To negotiate different teacher identities • To lighten the mood • To accommodate student's language need

According to the framework I have laid down for the analysis, the procedure of analysing the transcripts is shown in Figure 4.2.

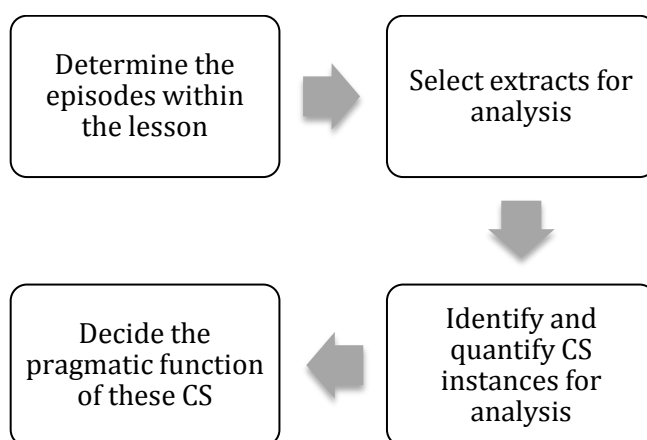


Figure 4.2 Procedure for data analysis

4.5.3 Exceptions for analysis

There are a few categories of words in the transcriptions that are excluded from the analysis of this research. The first exception is the word ‘OK’ (or ‘K’) and ‘-lah’. ‘OK’ or ‘K’ is a common speech filler and ‘-lah’ is an interjection that are widely used within the Malaysian community. For this reason, these fillers are left out from the analysis considering its value to the analysis of the pragmatic function of code-switching is minimal/dispensable and quantifying such filler would, to some extent, compromise the quality of the analysis.

In addition, there are words which have the same pronunciations in both English and Malay and are classed as homophones. It is difficult to define whether a homophone is spoken in English or Malay. Therefore, the occurrences of homophones are also excluded from the analysis and they are spelt in the same language as the adjacent phrase, preceding homophone in the transcription. Some examples of homophones in the research data are as follows:

English	Carbon	Experiment	Oxygen	Theory	Component	Activity	Class
Malay	Karbon	Eksperimen	Oksigen	Teori	Komponen	Aktiviti	Kelas

The third exception is the category of special nouns and acronyms in Malay, which are characteristics of the Malaysian education system, such as the name of the classroom, **PBS** and **PIBG**. Before we start looking at the different CS instances in this episode, there are some exclusions which should be discussed at this point. These terms are:

- **PBS** – acronym for **Pentaksiran Berasaskan Sekolah** which means ‘continuous school-based assessment’
- **Bicara akademik** – academic meeting
- **PIBG** -- acronym for **Persatuan Ibu Bapa dan Guru** which means ‘Parents and Teachers Association’

I do not consider these terms as CS because they are standard technical terms within the Malaysian education context. Of all the three schools that were observed, all teachers, regardless of what MOI they use in classroom, use the acronym **PBS** whenever they make reference to the continuous assessment and none of them used its English variation. **Bicara akademik** might not seem to be a technical term which is used throughout the nation but it is a technical term used within the school context. Speaking about **bicara akademik** in English as ‘academic meeting’ may cause confusion to students’ ears as it is not what they are familiar with. Another example of this would be how the different classrooms are labelled. Most government schools in Malaysia still use Malay words to label their classrooms. For example, 1 **Hormat** and 2 **Dedikasi** which literally mean 1 Respect (Year 1 class Respect) and 2 Dedication (Year 2 class Dedication). Again, these will not be analysed as an instance of CS because no teacher will switch the name of the class to English even if the language of instruction is in English. These are the technical terms which are not expected to be switched.

4.6 Preparation of Data for Analysis

This section details the preparation done prior to the analysis of classroom recording and questionnaire completed by the students.

As the research was carried out in three different schools, it had already been anticipated that there were going to be slight differences in the ways each of these schools conduct their lessons. Two notable differences are the scheduling and duration of lesson in different schools.

The duration per lesson in school A, B and C is 60 minutes, 40 minutes and 30 minutes, respectively. That is to say, school A would require only four lessons for observation purpose to fulfil the four-hour audio-recording target compared with eight lessons required at school C. The scheduling pattern of these lessons, whether delivered as a single lesson or in a series of two consecutive lessons is also another factor to be considered as this will affect the volume of content to be recorded. We will look into how this problem is addressed in the following paragraphs.

A standard science lesson in Malaysia involves different aspects, such as teacher-centred teaching, conducting experiments and continuous in-class assessment, whole class discussion of homework, students' presentations and other classroom management. For this study, we focus on three main episodes: episode of instruction, episode of experiment and episode of assessment (see section 4.5.1 for detailed explanation of these episodes). Staging the lessons in these episodes enables the researcher to organise and choose data, which is suitable for analysis.

Linking back to the duration of lessons in each school, it is now clear that while school A had 1 hour per lesson, all three episodes could be found within this lesson but for school C which only had 30 minutes per lesson, the possibility of having only one episode is rather high. This is why it was crucial to have a systematic way of preparing the data for the analysis.

The first step taken before analysing the data was to listen to all the classroom recordings. This allowed the researcher to make further comments on the written field notes and to make a decision on these matters:

1. The amount of recording to focus on
2. The quality of the recording
3. The availability of the three episodes

An hour of lesson per teacher was selected to be transcribed and analysed in detail for the purpose of this study. This resulted in a pool of 6 hours' worth of recording and transcriptions. The reason for opting for one hour per teacher instead of all four hours was due to the consistency of teachers during their teaching. None of the teachers showed obvious differences in the frequency of their code-switching during the four hours of observation and recording and so an-hour worth of classroom recording was deemed to provide enough data for analysis. As mentioned earlier, each school had different scheduling and duration for a lesson, the 1-hour recording was chosen under the condition that it should be an hour of continuous lesson, i.e. two or more continuous lessons instead of combining two separate 30-minute lessons.

Next, while listening the recording, it was found that due to the microphone being clipped on the teachers during the lessons, most students' voices were indistinct, especially during a time when teacher was teaching at the front of the class. Students' voice was only heard clearly if they had shouted from the back of the class or if the teacher was near to them. Nonetheless, this did not affect our study as our main aim is to focus on teacher's code-switching instead of students'. Any students' voice recorded and transcribed would be seen as a bonus data added to the advantage of this study.

Finally, during the audition of the recording, it was confirmed at least one of the three main episodes – episode of instruction, episode of experiment and episode of assessment was present in the data. Therefore the analysis of the recording could be continued.

A portfolio was created for the observed teachers based on the interviews conducted with them (see Appendix D). I listened to each interview in tandem with the classroom lesson for each teacher and conducted a content analysis of the interviews. Through the interview, I was able to construct a language and education background of each of the teachers. Their comments regarding classroom code-switching were also included in the portfolio and would be used to support the analysis in this study. As for the data collected from the questionnaire, they are entered into a spreadsheet for the convenience of analysis (see Appendix F).

4.7 Ethical Considerations

A few ethical matters have been considered for this study. Firstly, prior to the study, approval was obtained from both the Education Ministry and Economic Planning Unit in Malaysia. It was under the consent of the school principals and the teachers whose lesson I recorded that classroom observation was able to be conducted. The students were only briefly informed of the study (when the teacher introduced me to the class during the first observation) as the principals and school teachers thought it was not necessary to gain permission from the parents as the main subjects of the research are the teachers and not the students. This is in line with the concept of 'ethical relativism' as expressed by Denzin:

I disagree with those who suggest that the sociologist has no right to observe those who have not given their consent. I suggest that sociologists have the right to make observations on anyone in any setting to the extent that they do so for scientific purposes. The goal of any science is not harm to subjects, but the advancement of knowledge.
(Denzin, 1989, p. 257)

As for the confidentiality issue in this study, all the names of schools, teachers and students involved are kept anonymous. Any information gained was solely used for this research. School principals and teachers were required to sign a 'Participant Information Letter' which details the anonymity of their role in this research and the possibility of them choosing not to continue with the study. While conducting the questionnaire, students were also given a choice whether or not they want to complete. Again, students' names were not required hence it is impossible to trace who they are. This will ensure that their privacy has been protected.

4.8 Context for Analysis

Despite the different MOI, all six teachers use the same English medium Science textbook (Yeoh et. al., 2002). However, all students, regardless of the language used in their classrooms, according to the national policy, should be given a Malay Science textbook (Chang et. al., 2011). Nonetheless, all the six observed teachers admitted

that they do not use the Malay Science textbook for teaching even though some of them are teaching the subject bilingually. Besides the textbook, they all share another similarity – the school examinations are all set bilingually, in English and Malay. Students are allowed to answer in these two languages within the same paper but not within the same question. In other words, a student could choose to answer question one in Malay and question two in English but he/she is not allowed to mix two languages in one question.

It should be noted at this point that the lessons taught by two BMI teachers who are from the same school, Marina and Shahrul (pseudonyms), consisted of one episode only, namely, an instructional episode. Each of them had conducted only one episode of instruction during their teachings. Although the same number of hours was observed (as for the rest of the teachers), neither of them conducted any experiments during the period when the researcher was present. Furthermore, whenever it reaches the assessment stage, they would usually sit quietly at their desk and students were required to complete the assessment in an exam-like environment. Therefore, this study does not have data from their experiment and assessment episodes.

Table 4.5, provides a summary of the background information of the lessons analysed for this study, by providing an overview of the teachers' pseudonyms, the assigned medium of instruction and the activity type of the lessons. Any other noteworthy information is shown in the comment column.

Table 4.5: Summary of the observed science lessons

Teacher	Assigned MOI	Episode of	Comments
Farid	English	Instruction	PowerPoint presentation is used.
		Assessment	Teacher answers the students most of the time when they ask questions. He uses many questions to help students find out the answers by themselves.
		Experiment	Teacher is rather relax during this session and is seen even chatting with students as he paces from one group to another.
Su Ling	English	Instruction	Lesson is conducted using interactive CD-ROM.

		Assessment	Rather interactive as students keep asking for clarifications which may help them in answering and the teacher seems alright to answer them
Fatimah	English	Experiment	Teacher seems to be very uptight during lesson as she keeps giving students warning.
Marina	Bilingual	Instruction	PowerPoint presentation is used and students have to copy notes from the slides from time to time. There is also time for whole class to check the answers for their homework together.
Shahrul	Bilingual	Instruction	Power point slides were used and students had to copy notes from the slides from time to time.
Amina	Bilingual	Experiment	After conducting the experiment, the students are requested to answer some questions as a recap to the experiments they have just done.
		Assessment	Students are given a few minutes to revise for the assessment. They then complete the assessment without referring to their textbooks. Teacher has minimal interaction with students here.

4.9 Summary

This chapter has expounded the complete design for the study. To summarise, it has provided descriptive information of the subjects (3 schools, 6 science teachers) and justified the use of audio-recording, classroom observation, interview and questionnaire as the research instruments for collecting data. The framework of analysis is also laid down in this chapter with some exceptions to take into consideration. The preparation done prior to analysing the data is also discussed followed by some ethical considerations. Finally, the context for analysis is included in preparation for the next chapter, the results and analysis.

Chapter 5 Results and Analysis

5.1 Introduction

This chapter is divided into 4 main sections. In this section, the framework used for analysing the data will be recapped. Section 5.2 presents the code-switching (CS) patterns and the students' views on classroom CS within the English as medium of instruction (MOI) classrooms and likewise for bilingual (BMI) classrooms in section 5.3. A summary is provided at the end of the chapter in section 5.4.

In order to analyse the vast amount of data obtained for this research, a systematic and organised framework is needed. I analysed the transcript in a hierarchical method. The first step is to identify the different episodes within the 1-hour lesson. These episodes are of instruction, experiment and assessment (see section 4.5.1 for detailed discussion). After confirming the turns which belong to the episodes, I then looked into the instances of CS within each turn to number each of the switches and attempt on identifying the functions of these CSs. There is a slight difference between EMI and BMI classrooms in numbering the switch. In EMI lessons, only switches from English to Malay are numbered whereas in BMI lessons, an instance is given a number whenever there is a switch from English to Malay or vice versa. This is to investigate how English and Malay are used by BMI teachers in the classrooms. The frequency of the occurrence of the functions of CS is counted and combined at the end of each episode for each teacher.

It should be noted once more the exceptions that I have set down for the analysis (for more detail see section 4.5.3). The first exception is 'OK' or sometimes being used as 'K'. The second exception is homophone words such as carbon, theory and activity. The third exception is the nouns which are commonly spoken in Malay within the Malaysian education system such as the name of the classroom and **PBS** (acronym for classroom-based assessment).

5.2 English as Medium of Instruction (EMI) Classrooms

In this section, I will focus on the analysis of 3 EMI teachers – Farid, Su Ling and Fatimah.

5.2.1 EMI-1: Farid's Lesson

The first case that I am going to study is Farid's lesson. Despite his first language being Malay, Farid received his undergraduate education in the United Kingdom. Therefore, teaching Science in English does not pose much difficulty for him as he has had 3 years of education in English medium and lived in a country where English is the first language. He has had 3 years of teaching experience (till the date of interview was conducted) and in this time, he had not only taught in English medium but also trained teachers to be able to teach Science in English (refer to section 2.5, some school teachers were requested to train other teachers during the implementation of English for the teaching of Mathematics and Science policy).

All of Farid's Science lessons were conducted in the Science laboratory. He was requested to use English medium of instruction by the school. During the lesson under study, Farid used PowerPoint slides (in English) and English-medium textbook as his main teaching material. All three main classroom episodes: instruction, assessment and experiment are found in this lesson.

5.2.1.1 Episode of Instruction

During Farid's episode of instruction, Power Point slides and textbook in English medium were used as his teaching aids. While teaching, Farid was seen to only pacing in front of the classroom and never walking around it.

At the start of the lesson, Farid wants to establish how much his students have already known about the air around us and here is the conversation between him and his students.

Extract 1

Turn	Role	Transcript
3.	T:	So today we're gonna learn about air around us. What did you know about air around us? (.) ¹ Apa (<i>what</i>) you tau pasal (<i>know about</i>) air? Yes, Jonathan.
4.	S:	We breathe it.
5.	T:	We breathe?
6.	S:	It.
7.	T:	We breathe it. Ok. Air we breathe the air. What else? ² Siapa lagi? (<i>Who else?</i>) Hanim? ((S replies but voice unheard)) Air has mass. Good. ³ Betul. (<i>Correct.</i>) Air is a matter so it should have mass. What else?
8.	S:	Air is a mixture.
9.	T:	Air is a mixture, good. Yes Lasi?
10.	S:	They also have types of err air, a lot of types of air.
11.	T:	A lot of types of air? Umm, ok la. Yes? Aiman, why are you so nervous? Yes, Fiquan.
12.	S:	Air cannot be seen.
13.	T:	Air?
14.	S:	Cannot be seen.
15.	T:	Air cannot be seen.
16.	S:	It's needed to sustain life.
17.	T:	Air is needed to sustain life, ok. What else?
18.	S:	Air can be compressed.
19.	T:	Air can be compressed. Very good. What else? (.) ⁴ Siapa lagi nak tambah? (<i>Who else wants to add?</i>) Yes Fiquan?
20.	S:	Air occupies space.
21.	T:	Air occupies space, good. (.) Oh, you know a lot about air already. No need to learn la. Yes Jonathan.

In the above extract, Farid switches to Malay from time to time when he wants to elicit responses or answers from his students. In order to do so, he first asks 'what did you know about air around us?' in English (in turn 3) and after a very short pause, he switches to Malay and asks '**apa** you **tau pasal** air (*what do you know about air*)' (1) in order to elicit response from his students. In this case, Malay is briefly used as the main language as the content words like 'you' and 'air' are kept in during the switch. (2) and (4) show that despite getting some good answers from the students, Farid continues switching from English to Malay after he asks the students 'what else?'. Besides having a function to elicit response from his students, this can be seen as a way of him encouraging all his students, including those who are not confident to answer in English, to participate in the discussion.

In (3), Farid compliments a student by saying 'good' when the student gives a correct answer. Immediately after that, he switches to Malay and says '**betul**' which means 'correct' instead of translating the 'good' to '**baik**'. The purpose of such switch is not to compliment his student but to emphasise the fact that 'air has mass'. This is supported by the utterance made right after – 'air is a matter so it should have mass'.

In the following Extract 2, Farid switches from English to Malay in order to explain the concept of ‘air pollution’ to his students.

Extract 2

Turn	Role	Transcript
23.	T:	Ok. So, what is around us? K, recently we are talking about A.P.I. A.P.I. What is A.P.I.?
24.	SS:	Air pollution index.
25.	T:	Air Pollution Index. This is the current issue, just happened last week, is it?
26.	SS:	Yes.
27.	T:	Ok, why do we need this A.P.I.? (.) Why do we need this A.P.I.? (.) Ah, can someone tell me. In Malay we call it ¹ IPU .
28.	S:	So that we know how polluted our air is.
29.	T:	Yes, very good, this is an indicator for us to measure the amount of pollutant in the air. K. ² Pencemaran udara . (<i>Air pollution</i>) So what are the recent cases, recent tragedy happen to Malaysia?
30.	SS:	Haze.
31.	T:	Haze. K, is this the first time?
32.	SS:	No.

The start of this extract shows Farid checking his students’ understanding on API (air pollution index) which the students answer correctly in turn 24. Right after he asks for the function of API in turn 27, he explicitly mentions that in Malay, the API is called **IPU** (1). This switch is a direct translation of the preceding utterance and because Farid does not comment further on this, (as the students have shown earlier that they do know the meaning of the acronym), I believe that on this instance, he is only providing extra information, which may or may not be important, to his students.

I also notice that Farid uses explicit metalanguage ‘we call it (or that)’ whenever he provides translation (turn 27). This happens again in turns 134 and 177.

Turn	CS instance
134	...when the plant start to spread, ah, and start to ah, what <u>we call that</u> , reproduce, membangkitkan, makin banyak , (<i>reproduce, getting more</i>) when the plant is growing, yes.
177	K noble people means, this is ah, in Malay <u>we call it</u> bangsawan la, golongan bangsawan , (<i>the nobles, group of nobles</i>) so they don’t want to mix with others.

Back to Extract 2 turn 29, Farid switches during mid-turn to Malay and says (2) ‘**pencemaran udara** (*air pollution*)’. It can be deduced that although one of the students is able to answer the question correctly, Farid wants to make sure all his students can understand what is being discussed now. Although students may be familiar with the word ‘pollution’, they may not be so with ‘pollutant’. Hence, by

switching to Malay and saying ‘**pencemaran udara**’, he helps students to link the preceding ‘pollutant in the air’ with air pollution. What Farid does here is to facilitate students understanding by providing a Malay term to explain what has been said in English. He is expecting the students to be able to make the connection between different terms used for the idea of pollution. Farid ends turn 29 in a question and this time, instead of only one student giving the answer, the whole class answers unanimously and accurately.

Extract 3

Turn	Role	Transcript
64.	T:	I think he’s just outside the Dome, the coffee shop. K, but we can’t really see the err KLCC. This is how the, err this is how bad is the haze last time. (.) Ok. So umm, we’re gonna talk a little bit on the atmosphere, right. (.) Ok, so, our atmosphere, what did you know about atmosphere?
65.	S1:	It (?) us from (?)
66.	T:	Ah, ¹ kejap , Khairul, Khairul, apa? Pusing, pusing . (<i>Ah, wait, Khairul, Khairul, what? Turning, turning.</i>) What are you working a circle? What is atmosphere? (.) Anything?
67.	S2:	Ah.
68.	T:	Ah, you ² apa buat tadi circle? (<i>Why did you do a circle?</i>)
69.	S2:	I circle je (<i>only</i>).
70.	T:	Yes, atmosphere in a circular form. ³ Bentuk dia bulat, tak ada (<i>Its shape is round, there’s no</i>) atmosphere, you don’t have a flat atmosphere, ⁴ tak ada . (<i>don’t have</i>) ((Students laugh.)) You don’t have a box. What else? Yes.

In turn 64, Farid asks his students what do they know about the atmosphere. Student S1 attempts to answer in turn 65 but is interrupted by Farid’s turn 66 (1). Here, he switches to Malay while speaking to student S2 to signal a change of footing from talking to whole class to addressing an individual student. What happens here is, student S2 catches the teacher’s attention when he draws a circle in the air with his fingers (observed and recorded in field note by researcher). Upon seeing this, Farid interrupts student S1 while he tries to elicit answer from student S2. When Farid notices S2’s hesitation in turn 67, he tries to encourage his student by switching to Malay and rephrasing his question (2). It seems that the answer student S2 has in mind, is the one anticipated by Farid. This is seen by Farid’s confirmation in turn 70 ‘yes, atmosphere in a circular form’.

In turn 70 (3), Farid is trying to reiterate in Malay the idea that the shape of the atmosphere is round. The abrupt stop right at the point ‘**tak ada** atmosphere’ shows that he is self-correcting, as the correct phrase ‘you don’t have a flat atmosphere’

comes right after. This self-correction is also seen as an emphasis for the idea that the atmosphere is indeed round and not in any other shape. Also note that while switching into Malay on this instance, there is a change back to English at ‘atmosphere’. One possible explanation for this is that ‘atmosphere’ is the main topic being taught today and it is important for students to be familiar with this term. Hence, Farid was drilling this term into the students by constantly repeating the word. Farid switches to Malay once again to give emphasis to the point that there is no flat atmosphere (4).

Throughout the episode of instruction, Farid appears to have a good rapport with his students. He hardly raises his voice at them and tries to make the lesson more lively. Although it does not happen all the time, there are a few occasions that Farid switches to Malay in order to lighten the mood within the classroom. The first instance happens in the following Extract 4.

Extract 4

Turn	Role	Transcript
102.	T:	Sorry, ah yes, how high is our atmosphere? (S) Eleven kilometres? Nah. So, if eleven kilometres means Everest is just outside the atmosphere. ((Students laugh.)) So if we have for example, say, 10 kilometres, this is our earth, so if you have a Mount Everest over here, so the atmosphere ((teacher draws on white board, students giggles.)) So if you say la, 10 kilometres so the atmosphere should be here so if somebody go on top of the Everest, he’s out of atmosphere. Dia orang keluar kat sini ah. (<i>These people are out here</i>). ((Students laugh.)) Wah, so the moon is here. Wow!

While explaining the layers of atmosphere in turn 102, Farid draws Everest and the earth on the blackboard. He then tries to explain that it is impossible for the atmosphere to be lower than Everest because that will mean that the climber will be out of the atmosphere. Besides drawing on the blackboard and showing the students, he further paraphrases the idea into Malay, stressing that the climber will be out of the atmosphere and this makes the students laugh. When students laugh, it is an indication that they understand what the teacher says and it lightens the mood of the classroom as well. This is also an example of a multifunctional switch where it serves both to give explanation and to lighten the mood in the classroom functions. I will present another example of Farid switches to Malay for lightening the mood within the classroom in Extract 8.

The following extract is taken when Farid is trying to get his students to share their experiences which would prove that the higher you go, the thinner the atmosphere will become.

Extract 5

Turn	Role	Transcript
106.	T:	Ok, so, ah, what's ok, atmosphere ok, as we go up, as we go higher, k, that atmosphere become thinner (.) k, why? For example la, if you go ah from (.) have any of you went to Kinabalu? Mount Kinabalu, on top, (S) oh ¹ tak sampai atas lagi , (<i>haven't reached the top yet</i>) elsewhere in? in Limbao? Where's Limbao?
107.	S:	I went half way and came down.
108.	T:	Oh, you only half way, why you quit half way? (S) Oh ok,. Anyone else? Yes, Shengkil? Top. So what, what did you feel up there? How do you feel?
109.	S:	(??)
110.	T:	It's hard to breathe. Good. Hey, it's not good. ((Students laugh.)) Means, ah, that's the, what do you call this? That's the reason why you hardly, you cannot really breathe up there. Anyone else? ² Siapa yang pernah pergi? (<i>Who've been before</i>) who went to top of the KLCC before? Are you sure? How? (S) Half way. I thought like somebody went out to KLCC ³ panjat yang , the lightning punya conductor tu . (<i>climb the, the lightning's conductor that</i>) (S) The what?
111.	SS:	Spiderman.
112.	T:	Oh the spiderman yes. The real spiderman or the spiderman guy? I'm confused now, which one?

In turn 106 (1), the switch to Malay '**tak sampai atas lagi** (*haven't reached the top yet*)' is a switch which allows Farid to move his attention to a single student (change of footing) because this seems to be a repetition of his student's words which are not recorded clearly (only shown as (S) in the above transcript). Then in turn 110, we see two different forms of CS. The (2) '**siapa yang pernah pergi** (*who've been before*)' can either be seen as a question to elicit information from the students or it also serves the function to help students personalise what they are learning now. Farid is trying to link the fact that the higher you go, the more difficult it will be for breathing. Assuming that students may have experienced this before, he tries to help them to link it with their personal experience.

The switch in turn 110 (3) is different from what we have seen so far. It is not a switch for a phrase or a clause. The switches occur at the grammatical form. If we break the sentence down, we see that the switch happens as follows:

- **panjat yang** (*climb which*) → verb phrase
- **punya** ('s) → possessive pronoun
- **tu** (*clipped of itu, that*) → determiner

Combining these switches, I believe that Farid is trying to lighten the mood in the class by telling a joke.

In order to close the interpersonal gap with his students, Farid sometimes switches to Malay to lessen the authoritative figure he is playing in the classroom. Extract 6 presents such evidence.

Extract 6

Turn	Role	Transcript
146.	T:	OK, so mixture, remember mixture ah, Nadia, ¹ apa (<i>what is</i>) mixture? What is mixture?
147.	S1:	Ah. (...)
148.	S2:	((replies in English))
149.	T:	K, can you help Nadia? Nadia, ² malu-malu ni, biasa tak malu je. (<i>being shy, usually you're not shy at all</i>) (.) You know what is mixture Nadia? You should know right? OK. So, ³ apa (<i>what</i>) Syazah?

In Extract 6, S1 is Nadia and S2 is Syazah. Farid first tries to get Nadia's attention by calling her name and switching to Malay when asking '**apa** (*what is*) mixture'. Nadia is seen having difficulty in providing an answer. She takes quite a long pause (more than 5 seconds) in turn 147 and turn 148 shows that Syazah is eager to help. Seeing the hesitation from Nadia and wanting to move on from there, Farid allows S2 to answer the question and at the same time, switches to Malay to address Nadia specifically and to put her at ease before switching to Malay and signalling Syazah to reply (3).

The following Extract 7 shows Farid checking his students' background knowledge on the content of air (turns 157–164). The subject changes to 'what is inert gases' from turn 165 to 173.

In the first part of the extract (turns 157–164), Farid and his students are discussing the content of air. In turn 157, we see that Farid asks three questions – two in English and one in Malay. The first question 'what did you know inside air' is to be understood as a question asked to determine the students' background knowledge about the air. Perhaps sensing the grammatical error in his question, Farid self-corrects and ask the second time 'what are the things inside air'. When he finally wants to invite his students to participate in discussion, he switches to Malay (1). This

is an invitation to all the students in the class, including students who may not be fluent in English. Thereafter, we see many students contributing to the discussion.

Extract 7

Turn	Role	Transcript
157.	T:	OK, what did you know inside air? What are the things inside air? ¹ Siapa tau? (<i>Who knows?</i>)
158.	SS:	Nitrogen.
159.	T:	Nitrogen.
160.	SS:	Carbon dioxide.
161.	T:	Carbon dioxide.
162.	SS:	Oxygen.
163.	T:	Oxygen.
164.	SS:	Inert gases.
165.	T:	Inert gases. (.) What is inert gases?
166.	S:	Inert.
167.	T:	Inert. What is inert? Who knows what does it mean by inert?
168.	S:	Nadir. (<i>Inactive</i>)
169.	T:	² Nadir? (<i>Inactive?</i>) OK in Malay we call it ³ nadir (<i>inactive</i>). What is inert? (SS) Gas? (SS) No no no, the word inert, what does it mean? Inertia? No. It's a gas? Ah, not really. K, there's a word, there's an English word, inert, was it the, never heard of it before? (SS) ⁴ Seorang pun tak pernah dengar? (<i>Not even one of you heard of it before?</i>) Inert.
170.	SS:	(??)
171.	T:	What? Ah ⁵ apa? (<i>what?</i>) K, it's in your glossary. Was it? In page 1? 139. ⁶ Tengok sendiri, (<i>look at it yourself</i>) don't be lazy. Aisyah, check. (SS) What? OK, ah, k, chemically inactive gas or people, some people not some people la, all people call it noble gases. Other name for inert gases are noble gases. OK, inert, what it's inert? Inert means, (...) so our class until? 9? No.
172.	SS:	10:10.
173.	T:	10:10, we have about an hour to go. So inert means k, the word inert k, normally we use this in chemistry. ((Teacher writes on the board)) Inert means it's chemically inactive, or ⁷ kita boleh cakap pemalas, siapa yang inert ni macam orang yang pemalas, (<i>we can say idler, whoever that's inert is like a idler</i>) It does not, it doesn't want to do anything, ok, this thing, yes, they are not, they don't want any changes.

In turn 164, students are saying 'inert gases' as an answer to what is inside the air. However, when Farid asks for the meaning of inert in turn 165, one student replies, yet not with a correct answer. When Farid asks again in turn 167, another student (or possibly the same student as turn 166 but this cannot be determined from recording) replies by giving the translation of 'inert' in Malay, which is '**nadir**'. Farid first echoes his student's (2) '**nadir**' in a rising tone, perhaps to show his surprise as this is not a frequently used word or to seek confirmation from his student that this is the word he has said. He then uses the metalanguage (3) 'we call it' to help students learn that the Malay equivalent to 'inert' is '**nadir**'. By providing a translation to the word, Farid helps to facilitate student understanding of the word. Towards the end of turn

169 Farid expresses his surprise (rising tone heard in recording when asking '**seorang pun tak pernah dengar** (*not even one of you have hear of it before*)' when he seeks confirmation from his students that none of them have heard of 'inert' before. This is a sign for Farid that he has to explain the term further so that the students grasp the meaning of it, instead of just giving the answer blindly.

In turn 171, we how Farid expresses his impatience and surprise when he switches to Malay to request the students to repeat again by asking (5) '**apa**' and also instructing them to look at the definition of 'inert gas' on page 139 by themselves (6). So, in turn 173, the word 'inert' remains in English although the switch to Malay confirms that Farid tends to keep scientific terminology in English while he explains the idea to students. Despite explaining 'inert' means 'chemically inactive', Farid elaborates the explanation by using personification. He switches to Malay and describes being 'inert' means being lazy and whoever that is 'inert' is just like (7) '**orang yang pemalas** (*person that is lazy/idle*)'. This is seen as a way to further elaborate the preceding idea to the students by linking students' understanding of a 'lazy person' in their personal experience to the characteristic of inert gases. He then switches back to English to emphasise that inert gases are indeed gases that 'don't want any changes'.

Similarly to Extract 4, which shows us how Farid CS to lighten the mood within the classroom, when talking about greenhouse effect and the uses of carbon dioxide in Extract 8, many students might have thought that it is actually a phenomenon to have too much carbon dioxide in the air. However, in order to correct his students' mindset and to stress that carbon dioxide does have a function, Farid does it in a more comical way and switches to Malay (2) in order to encourage his students to not hate the gas. Such switch makes the students giggle and it would very well help them to remember the uses of carbon dioxide better. Turn 238 (1) is an example of Farid switching to Malay in order to give emphasis to the point made earlier. For this instance, '**sikit je** (*just very little*)' is switched to stress that the content of carbon dioxide within the air is just 0.03%, which is really low.

Extract 8

Turn	Role	Transcript
237.	S:	Carbon dioxide is more than nitrogen is it?
238.	T:	Ah no no no no no, ah, the carbon dioxide it cannot exceed 0.05% or else we'll have global warming, you might suffocate and die. Yes, carbon dioxide, the normal content of carbon, let's say it's only 0.03%, k, ¹ sikit je (<i>just very little</i>), very small amount but it will affect us. If it goes lower it's good, but when it goes lower, ah, (S) yes, plant will die, they don't have any supply of carbon dioxide, they cannot make their food, and also we might freeze to die. Ah, greenhouse effect, have you heard about greenhouse effect, so later on we gonna learn about greenhouse effect, there are uses of carbon dioxide as well, ² jangan lah benci dia , (<i>don't hate it</i>) no. ((Students giggle.)) We do have use of carbon dioxide. So we have about 40, no no about 50 more minutes, I'm gonna do a simple experiment.

Due to the scope of this thesis, I will not be able to discuss all instances of CS found within Farid's episode of instruction. Therefore, I have summarised my findings in the following table. Table 5.1 shows the functions identified and their instance number (see Appendix G).

Table 5.1 Functions of CS identified in Farid's episode of instruction

Function	Instance Number*	Total number of occurrence
To facilitate understanding	7 ,8, 11, 19, 24, 26, 27, 32, 34, 36, 47, 51, 52, 53, 54, 57, 67	17
To elicit response	2, 3, 5, 6, 10, 13, 14, 17, 21, 23, 28, 45, 59, 70	14
To shift attention from whole class to individual student	6, 13, 18, 20, 38, 39, 41, 43, 49, 55, 56, 61	12
To give emphasis	4, 15, 16, 25, 29, 42, 58, 63, 64, 66, 69	11
To lighten the mood	9, 19, 22, 27, 35, 37, 59, 62, 71	9
To encourage students	3, 5, 6, 10, 14, 17, 28, 45	8
To seek confirmation	1, 12, 30, 31, 46, 48, 60	7
To link to students' experiences	21, 33, 51, 65	4
To negotiate different teacher identities	23, 40, 66, 68	4
To check students' understanding	28	1
To admonish	44	1
To give instruction	50	1

*As some of the switches are multifunctional, this is not a one-to-one mapping of a switch to a singular function. It is just to show the occurrence of a certain function throughout the episode, i.e. for CS which has more than one function, its instance number will appear in more than one category in the above table.

From the above table, it is clear that Farid switches mostly when he facilitates students' understanding. He does this by switching from English to Malay whenever he gives an example, explains the meaning of a term or elaborates a point. He also switches a lot whenever he wants to elicit response from his students and such switch is often seen to have the function of encouraging his students to participate in discussion too. Also, because there are many occasions where Farid has to shift his attention from whole class teaching to an individual student (whether to elicit response or answer to student's question), there are many switches which have this function. It is shown here that during his episode of instruction, Farid switches from English to Malay primarily to facilitate students' understanding, to elicit response and to shift his attention from whole class to individual student.

5.2.1.2 Episode of Assessment

The episode of assessment took place about 45 minutes into the 1-hour lesson. Within this short episode that lasts for 8 minutes, there are 5 turns made by Farid and a total of 11 CS instances.

In this episode, it is useful to mention once again that there are certain standard technical terms within the Malaysian education context that I do not consider them as CS (see section 4.5.3 for detail discussion). Some of the examples are **PBS** (acronym for **Pentaksiran Berasaskan Sekolah** which means 'continuous school-based assessment'), **bicara academic** (academic meeting) and name of the class (e.g. 1 **Amanah**, 2 **Hormat**).

One of the significant functions of CS in the episode of assessment is for Farid to seek confirmation from his students. These switches are not only in question form, but they also have the cue '**kan**'. When '**kan**' is used alone with a rising intonation, it is understood as a slang which means 'right?' In the following examples, we see how Farid uses the slang **kan** to seek confirmation from his students.

Extract 9

Turn	Role	Transcript
240.	T:	Ok, please clear your table, oh alright, umm, (.) just look at this paper, everyone should take out this paper and piece of no, this paper and a pen. K, the rest put it inside, (S) yup. (S)Yes, everything should be inside the file, so we gonna do the PBS , (<i>continuous school-based assessment</i>) umm, hopefully next week we'll settle everything, maybe after the Bicara Akademik , (<i>academic meeting</i>) oh ah, this morning, there was no briefing about bicara akademik (<i>academic meeting</i>), ada juga kan (<i>there was, right</i>)? So your parents, I'll be seeing your parents next week, right?
241.	SS:	Yes! No! ((some students shout yes, some shout no, all simultaneously.))

Towards the end of Farid's turn in Extract 9, he first uses '**kan**' to confirm whether students have heard about the academic meeting that is going to take place in the following week during this morning's assembly. Then he does it again at the end of the turn by posing a question in English – 'I'll be seeing your parents next week, right?' to seek confirmation on whether he will be seeing the parents in the academic meeting next week.

Extract 10 (shown below) starts off with a student asking Farid regarding the problem of the experiment in Malay (a question he needs to answer in the assessment, not the real experiment). Farid does not reply immediately in Malay but in English. Then he switches to Malay asking a rhetorical question (1). This question is not asked to elicit response from his student but to facilitate his student's understanding and also to lighten the mood. He then switches back to English to stress that there is no way they conduct an experiment before knowing the problem.

When Farid switches to Malay saying to his students that they '**dah belajar** (*have already learnt*)' passive form before, his switch is to make a link to students' past experience because this is something that they have learnt before. But different students continue to ask about passive form, for example in turn 247, a student is asking Farid what passive form is. Here, Farid facilitates student's understanding by switching to Malay (3) and expressing that it is like writing a report.

Extract 10

Turn	Role	Transcript
243.	S1:	Sir.
244.	T:	Yes?
245.	S1:	Kan kita tak buat lagi eksperimen ini macam mana nak tahu masalah? (<i>Since we haven't started the experiment, how do we know the problem?</i>)
246.	T:	((chuckles)) Scientific investigation, we identify the problem then need to experiment. ¹ Mana boleh ada dah ada buat eksperimen baru cari masalah? (<i>How could you only look for problems after you conduct the experiment?</i>) No way. The other way round. OK, look at the procedures, look at the method, ok, write the instruction form of the method, I need you to convert it into a passive form. K, change to passive form, like doing your report, your normal report, change it to passive form, past tense. (S) Essay? Passive form, class, yes, ah, you ² dah belajar , (<i>have already learnt</i>) you learnt this before, you've done your report last time. Ah, why got gold fish memory? Three seconds only ah? Forgot everything. (S) Remember good. Yes, yo, ah, need ah, but now all you need to do is change the method to passive form.
247.	S1:	Teacher, passive form tu apa (<i>what is that</i>)?
248.	T:	We change it to passive form, ³ macam buat (<i>just like doing</i>) report.
249.	S1:	Ah.
250.	T:	Oh, ah, yes, good, yes past tense, but passive is more like, passive form, you ⁴ belajar inggeris, kan? (<i>learn English, right</i>) (S) Hmm, Jar has been divided into five sections using? ⁵ Betul-lah (<i>correct</i>). Heh, ⁶ Jangan-lah cucuk dia, kesian Shafiqah. (<i>Don't poke her, pity Shafiqah</i>) Why are you playing with the thing? Yes. Hmm, yes, I still have, the number of (??) Why why, why Azira your notebook is with you? (S) Ahh, because they hand in earlier, so chop, sign, you late, ⁷ orang lain dah siap dah (<i>others have finished</i>). ((Teacher walks around the class)) Aiman, why you took so long to think? Just two, just two sentences. MmmHmm..Mmmhmmm, mmhmm, yes Sara, why? Why with the sulky face. ⁸ Kenapa muka sedih sangat ni? (<i>Why is the face so sad?</i>) Ah, are divided, eh D, sorry, yes my dear. Aha.

On (4), Farid once again seeks confirmation from his students by switching to Malay and using the suffix 'kan'. Then on instance 5, although it is unclear as to why Farid says 'betul-lah' but it can be assumed that he switches to Malay here to give his confirmation to his student because that switch means 'correct'. Farid is also seen switching to Malay when he admonishes a student who is seen poking one of the students, Shafiqah. Besides having the function of admonishing his student, switch (6) is also seen as having the function that helps Farid negotiate his identity. Although he wants to be stern with his students, he wants to understand and be close to them at the same time as well, hence he uses interjection like 'lah' and Malay word 'kesian Shafiqah'. Similar to (6), Farid tries to admonish Azira in (7) by switching to Malay and using a heavier tone. He negotiates his identity once again in (8) when he switches to Malay in order to close the personal gap with his student and to show his concern.

As a summary, Table 5.2 shows the functions of CS and their frequency found within Farid's episode of assessment. For all instances of CS, see Appendix G.

Table 5.2 CS functions identified in Farid's episode of assessment

Function	Instance Number*	Total number of occurrence
To facilitate understanding	3, 4, 6	3
To seek confirmation	1, 7	2
To negotiate different teacher identities	9, 11	2
To admonish	9, 10	2
As a linking word	2	1
To lighten the mood	4	1
To link to students' experiences	5	1
To provide confirmation	8	1

* As some of the switches are multifunctional, this is not a one-to-one mapping of a switch to a singular function. It is just to show the occurrence of a certain function throughout the episode, i.e. for CS which has more than one function, its instance number will appear in more than one category in the above table.

The above table shows that Farid's CS during episode of assessment are still mainly for facilitating students' understanding followed by to seek confirmation, to negotiate different teacher identities and to admonish.

5.2.1.3 Episode of Experiment

The episode of experiment takes place from turn 254 to turn 295 (the end of the lesson) of Farid's lesson. Within this episode, there are some similar functions of CS as the previous two episodes, such as to provide explanation, to seek confirmation and to encourage students response.

During the episode of experiment, I am able to see more interactions such as individual talk, correcting student's procedure and demonstrating the steps, between Farid and his students because he moves around the classroom to check his students' progress. At times, when Farid sees his students misbehaving or not following the experiment procedures correctly, he switches to Malay in order to admonish them.

Instruction giving is an important discourse within the episode of experiment because the teacher will need to make sure that all students understand the instruction and follow the instruction well. Failing to do so, students may cause an accident or even hurt themselves in the process of conducting an experiment. In Extract 11 (shown below), students are instructed to come to the front and collect the apparatus needed. After instructing students to only ‘send two representatives to the front’ (so that students do not crowd around the teacher’s desk) in English, Farid switches to Malay and emphasises through repetition in Malay that he only needs ‘**dua orang sahaja** (*two people only*)’.

Extract 11

Turn	Role	Transcript
254.	T:	Ok, so each group k, please send two representatives to the front, dua orang sahaja , (<i>two people only</i>) each group. ((students collect apparatus)) So, this is your, water basin, fill up, look at the procedure, fill up with water up until here, k you don't need to plasticine because you stick it with the wire already. So where's your another group member? Jia Jit. (...) Off you go.

One new function of CS to Malay that I find in Farid’s episode of experiment is ‘to express disapproval’. Such function is found in Extract 12 below.

Extract 12

Turn	Role	Transcript
268.	S:	Racist.
269.	T:	Racist? Why am I being racist?
270.	S:	Tak apa, kita bagi dua special. (<i>Never mind, we give two special</i>).
271.	T:	Eh?
272.	S:	Saya dengan dia . (<i>me and him</i>)
273.	T:	Nadia ¹ minta apa lagi (<i>asking for what again</i>)?(S) I thought you have six groups? Oh ² tak boleh (<i>cannot</i>), we only have six. So Fiquan.
274.	SS:	((talks in Malay, unclear but sounds like a request to form a new group))
275.	T:	Ah. Ah ³ tak ada (<i>don't have</i>), you stick with your group. Oh, careful Aiman. OK. What's that? EPM? Yes. OK first, right, look at your method carefully, what are the things that you need to do? K? ⁴ Dah baca (<i>read already</i>)? I give you two minutes. I'll give you two minutes to read out the procedures before we start. (...) ⁵ Tak siap lagi (<i>not done yet</i>)? Cepat siapkan (<i>finish it quickly</i>). Oh you doing at the back? OK.

Turn 273 starts off with Farid switching to Malay asking what is it that Nadia needs (1). Presumably Nadia has asked for extra material for her experiment (which could not be recorded), Farid rejects her request because he has only prepared enough for all six groups of students. Instead of saying ‘cannot’, he expresses his negation when he

switches to Malay and says ‘**tak boleh**’ to turn Nadia down (2). And when students try to justify their request for more material (in turn 274), Farid (in turn 275) once again refuses in Malay and says ‘**tak ada**’(3) and that they should ‘stick with your group’. On these two instances, it can be seen how Farid switches to Malay in order to express his disapproval to the students.

Later in turn 275, Farid first seeks confirmation from his students whether they have finished reading what they have been told to do (4). However, when the students say that they have not completed the task even though Farid has given them 2 minutes, he shows his disapproval by switching to Malay and asking a rhetorical negative question ‘**tak siap lagi**’ to express his surprise and impatience that the students are taking too much time (5). On this instance, Farid also instructs his students in Malay to finish reading quickly by using the imperative verb ‘**cepat siapkan** (*quickly finish it*)’. This is also another example of a multifunctional CS.

In the following Extract 13, Farid code-switches a few times for different functions such as giving instruction and expressing disapproval while interacting with S1 who communicates with him in Malay.

Extract 13

Turn	Role	Transcript
286.	S1:	Sir, tadi kan, tadi kita nyalakan (<i>just now right, just now we light it</i>).
287.	T:	Yes?
288.	S1:	Lepas tu kita letak kat situ. Lepas tu nak buat apa? (<i>After that we place it there. After that what do we do?</i>)
289.	T:	Tengok-lah (<i>look-interjection</i>). Write down your observation.
290.	S1:	Ha, apa dia I tak jumpa? (<i>Ha, what is it I don't see?</i>)
291.	T:	Apa-apa tak jumpa (<i>See nothing at all</i>)?
292.	S1:	Yang kita orang nampak (<i>things that we see</i>), I (?)
293.	T:	Hmm mm. Yes? Dah habis (<i>already finished</i>)? Anyone with the extra match? ((Thud sound at the background)) Wow careful! Can I have the match? No no. Ah k. Ah no. Ah ok, there's a problem in your set up of experiment. Apparatus used. The water level should be higher than the candle. So, or else the (??) (SS) Ah, sikit sangat air (<i>water is too little</i>).
294.	S1:	Saya ingat nak separuh, separuh lah ni. (<i>I thought it needs half, this is half</i>).
295.	T:	Tak, tak separuh (<i>not, not half</i>). (SS) Ah ah the air should flow inside. (.) So just a little bit more water.

S1 first comes to Farid with the intention of asking for the next step after lighting up the candle (turns 286–288). S1 does that in Malay and despite Farid first replies to his student is in English (turn 287), he switches to Malay in turn 289 to instruct the student to ‘**tengok** (*look*)’ at the set up and then switches to English and instruct the

student ‘write down the observation’. Another student catches Farid’s attention with the issue of match (stick) briefly in turn 293 before Farid comes back to S1 and finds that there is a problem with the set up. He then shows his disapproval by switching to Malay and commenting that there is too little water ‘**sikit sangat air** (*water is too little*)’ in turn 293. Such a switch has a function of facilitating his student’s understanding. When S1 tries to explain what he thinks in turn 294, Farid emphasises in Malay (in turn 295) saying ‘**tak, tak separuh** (*not, not half*)’ – that it is not half that is required, S1 needs to have ‘just a little bit more water’ for the set up to be correct and for the student to be able to see the outcome of the experiment.

To summarise, Farid switches primarily to seek confirmation, to facilitate understanding, to negotiate different teacher identities and to show disapproval during the episode of experiment. Table 5.3 shows the functions of CS and their frequency found within Farid’s episode of experiment (see Appendix G).

Table 5.3 Functions of CS identified in Farid's episode of experiment

Function	Instance Number*	Total number of occurrence
To seek confirmation	8, 14, 16, 17	4
To facilitate understanding	4, 11, 18	3
To negotiate different teacher identities	2, 3, 13	3
To show disapproval	6, 7, 9	3
To give emphasis	1, 19	2
To give instruction	9, 15	2
To lighten the mood	3	1
To provide confirmation	10	1
To elicit response	5	1
Unknown due to lack of context	12	1

* As some of the switches are multifunctional, this is not a one-to-one mapping of a switch to a singular function. It is just to show the occurrence of a certain function throughout the episode, i.e. for CS which has more than one function, its instance number will appear in more than one category in the above table.

5.2.1.4 Farid’s Code-switching across Three Episodes

By doing a word count for the two languages used in Farid’s lesson, I find the word count distribution as shown in the following Table 5.4.

Table 5.4 Approximate percentage of English and Malay used in Farid's lesson

Episode	Approximate % of languages used in class (based on word count)	
	English	Malay
Instruction	95.71	4.29
Assessment	96.29	3.71
Experiment	91.83	8.17

The above table shows that although instructional episode takes up most of the 1-hour lesson time (45 minutes), Farid code-switches the least during this episode but he code-switches most during episode of experiment. I believe such a distribution occurs because Farid is required to interact more with his students during this episode.

Amongst the functions of CS that are found within Farid's lesson, he switches mostly from English to Malay for the purpose of facilitating students' understanding during episode of instruction and episode of assessment. As for his episode of experiment, Farid switches most when he wants to seek confirmation from his students, checking that they are doing the correct procedure for the experiment. One particular function that occurs frequently in episode of instruction but is not seen in the other two episodes is the function of shifting attention from whole class to individual student. During the episode of instruction, Farid is often teaching from the front of the class and he was adopting teacher-centred teaching method. Therefore, he is seen to shift his attention mostly in this episode. However, for episode of assessment and experiment, Farid is seen pacing around the classroom mostly. Hence, his chances of speaking individually to students is much higher than speaking to the whole class and this results less of him shifting his attention from whole class to individual student.

In the next section, I present data obtained from students' questionnaire in order to study their views on classroom code-switching.

5.2.1.5 Farid's Students' Views on Classroom Code-switching

Farid's class consists of 24 students. There are more than half of the students (14 out of 24) speak Malay as their first language at home and one-third of the students who

speak English as their first language. The table below shows the students' first language at home and the MOI for science during their primary school.

Table 5.5 Farid's students' language background

	First language at home				MOI for science in primary school		
	Malay	English	Mandarin	Tamil	Malay	English	Mandarin
No. of students	14	8	1	1	5	16	3

Table 5.5 above shows that more than half of Farid's students (66.67%) have learnt Science in the medium of English during their primary education. Based on this number, it can be expected that most students do not have problem learning Science in English during Farid's lessons and it also means that Farid has less problem when teaching these students Science in English since there are familiar with learning the subject in English. The Table 5.6 below shows the students' preference of MOI based on their MOI during primary school.

Table 5.6 Farid's students' preferred MOI for Science in secondary education

Science MOI in primary school	Number of students and their preferred MOI (The higher the number, the more English they prefer) 1= Only Malay is used in class 10= Only English is used in class									
	Malay as MOI			Bilingual as MOI			English as MOI			
	1	2	3	4	5	6	7	8	9	10
English					1	4	3		3	5
Malay					2	3				
Mandarin									2	1

The above Table 5.6 shows that half of the students (8 out of 16) who received primary Science education in English prefers to have as much English to be used in their current Science lessons as possible. Many of them feel that with more English being used in the class means it saves time for the teacher to explain, i.e. if the teacher teaches more in Malay, he will need to spend more time explaining the Malay terms. The one student who despite receiving primary Science education in English, prefers to have half of the lesson being taught in Malay and the other half in English gives a reason citing that such a use of language in class will help him to understand the

teacher better. One possible explanation to this may be the fact that this student has Malay as his/her first language at home. However, it should be noted that first language at home is not a deciding factor for students' preference in choosing the MOI that they want. This is because out of the 11 students who prefer to have mostly English as their science MOI, 5 of them speak English as their first language, 4 Malay, 1 Mandarin and 1 Tamil. With such a varied first language background, it can be certain that first language at home does not play a main part in students' preference.

Also note that there are only 6 students who prefer to have an all-English science classroom whereas 18 out of 24 students in Farid's class have expressed their preference for both English and Malay (either as a bilingual classroom or EMI classroom with some use of Malay) to be used in their science lessons. This shows that students' acceptance to the use of classroom code-switching is generally good.

5.2.2 EMI-2: Su Ling's Lesson

Su Ling's first language is Mandarin and she has been teaching in the same school for the past 3 years. Being taught in mostly Malay during her undergraduate years, she admits during the interview to having difficulty when she first started teaching Science in English. However, as there are many reference books and information readily available online in English, she is starting to get more confident in teaching the subject in English.

According to Su Ling, the school policy requires Science teachers to teach in English if the class is one of the better performing classes. They should teach in both Malay and English if it is an average-performing class and only Malay if it is a low-performing class. This class in study is labelled as the second-best performing class amongst the Form One (secondary year one) students. Therefore, Su Ling has been requested to teach science in English. During this observed lesson, Su Ling uses English-medium CD-ROM as a teaching aid and there are two main classroom episodes within the lesson: episode of instruction and episode of assessment.

5.2.2.1 Episode of instruction

Usually at the start of the lesson, Su Ling has students taking turns to share science facts that they learn at home with the whole class. On this occasion as shown in the extract below, a student is sharing something about a snail and its teeth in Malay.

Extract 14

Turn	Role	Transcript
44	S:	Seekor siput mempunyai empat belas ribu tujuh ratus empat puluh lima gigi. (<i>a snail has fourteen thousand seven hundred forty-five teeth</i>)
45	T:	Siput (<i>snail</i>). Gigi (<i>teeth</i>). OK I'm sure none of you know about it. OK, again again, loud and clear, seekor siput (<i>a + collective noun snail</i>),
46	S:	Seekor siput mempunyai empat belas ribu tujuh ratus empat puluh lima gigi. (<i>a snail has fourteen thousand seven hundred forty-five teeth</i>)
47:	T:	OK, that's so interesting, ok, 14700 teeth right, a siput (<i>snail</i>), a snail, who found out the scientist ya of course. Ya the scientist. OK thank you very much MH, very good.

During my observation, most students who share a Science fact in class do it in English. However, on this occasion, the student in Extract 14 chooses to share in Malay and yet Su Ling does not object or even make any comment about it. This shows that it is acceptable in Su Ling' class for students to express themselves in the language that they are most comfortable with. After the student has shared her Science fact in turn 44, Su Ling switches to Malay in turn 45 to repeat the key points of '**siput** (*snail*)' and '**gigi** (*teeth*)'. I believe that she does that in order to emphasise the key point to what her student is saying. This can also be seen as a way for her to get other students' attention by switching to Malay. As for the noun phrase '**seekor siput** (*a + collective noun snail*)' in turn 45, these are actually the first two words of what the student is saying. By echoing her student's words, she not only encourages her student to repeat the Science fact, but also to get the attention of the whole class and signal to them that their classmate is about to repeat what has been said earlier. Therefore, from the above extract, we see how Su Ling switches to Malay in order to emphasise a point, encourage her student and to get her students' attention.

In Extract 15 (shown below), right after saying 'my question is', Su Ling switches and asks in Malay '**kenapa** (*why*)' before switching back to English saying 'why'. Although within the episode of instruction, this is the only time she switches to Malay to ask a question, we do get students replying her in the next turn and so it should be safe to assume that this switch is indeed for getting her students' attention and eliciting answers from them.

Extract 15

Turn	Role	Transcript
71	T:	OK, so we know that carbon dioxide is very important for plants to make food through photosynthesis. OK, now my question is, (.) kenapa (<i>why</i>), ok, why we are encouraged to plant more trees around our house?
72	SS:	To get more oxygen.

Although Su Ling does not joke with her students very often, I observed that she does have a good rapport with her students. This is seen through how a student is willing to share a secret with the teacher when she answers a question wrongly. In turn 101 (shown below), it starts off with Su Ling getting a secret from a student who has previously given a wrong answer to the question. When Su Ling moves to another student, instead of requesting him to share a secret if he answers wrongly, she says to him in Malay that if he answers wrongly, he should not sleep in class – ‘**kalau jawab salah** (*if answer wrongly*), make sure you don’t sleep in the class.’ Depending on the teacher’s intonation, this sentence may seem to be a warning to the student. However, with the students laughing in turn 102, it can be deduced that Su Ling is trying to lighten the mood in the classroom by bantering with Imiran and switching to Malay briefly instead of being stern and giving a warning to the student.

Extract 16

Turn	Role	Transcript
101	T:	Just tell me, just tell me, I won’t tell anybody. (S) OK, I know the secret already. OK next one, umm come, Imiran. OK, kalau jawab salah (<i>if answer wrongly</i>), make sure you don’t sleep in the class.
102	SS:	((students laugh))

Before looking at the instances of CS in Su Ling’s episode of assessment, Table 5.7 below shows a summary of Su Ling’s CS within the episode of instruction (see Appendix H).

Table 5.7 Functions of CS identified in Su Ling’s episode of instruction

Function	Instance Number*	Total number of occurrence
To get attention	1, 2, 4	3
To give emphasis	1, 3	2
To lighten the mood	5	1
To elicit response	4	1
To encourage student	2	1

* As some of the switches are multifunctional, this is not a one-to-one mapping of a switch to a singular function. It is just to show the occurrence of a certain function throughout the episode, i.e. for

CS which has more than one function, its instance number will appear in more than one category in the above table.

The data above shows that within her 42 minutes of episode of instruction (including time spent listening to the English-medium CD-ROM), Su Ling only has 5 instances of code-switching and three of these CS have a function of getting the students' attention.

5.2.2.2 Episode of Assessment

Su Ling also switches quite a few times to Malay in order to get her students' attention during the episode of assessment. For example,

Extract 17

Turn	Role	Transcript
147	T:	What exercise, very simple exercise. I think you can answer it within 10 minutes. AK, this one is the jadual peperiksaan (<i>exam timetable</i>), you paste it in the class, right.
148	S:	Teacher everybody same one ah?
149	T:	Ya, same one. and 1 Berdikari (<i>independent [name of class]</i>), this is the timetable for your coming penilaian (<i>assessment</i>) 2. So make sure you go and fotostat (<i>photocopy</i>), ask the bendahari (<i>treasurer</i>) to fotostat (<i>photocopy</i>) for you, each and every one of you.

In Extract 17, nouns, such as **jadual peperiksaan**, **penilaian**, **fotostat**, **bendahari** are switched to Malay. These words are not considered as special terms within school context because they are just common words used every day. Nonetheless, Su Ling's choice to switch at these instances could be explained as her wish to stress the importance of these and to get her students' attention.

When in Extract 18 a student comes to Su Ling asking her a question in Malay '**apa makshudnya** (*what is its meaning*)', her first instinct is to reply and provide an explanation in Malay (turn 226). We can be certain that such a switch is used to provide explanation because she starts her sentence with **maksudnya**, which in English means, 'its meaning is'. This is a verbal cue for facilitating understanding.

Extract 18

Turn	Role	Transcript
225	S:	Apa maksudnya? (<i>what is its meaning?</i>)
226	T:	Maksudnya, kenapa air tu akan terbentuk di permukaan dinding sana. (<i>Its meaning, why does the water form on the surface of that wall there.</i>)
227	S:	Oh.
228	T:	So we call what kind of process is that? Start with C. Start with C.
229	S:	Condensation.
230	T:	Yes.

Even though the student shows understanding in turn 227, Su Ling decides to help the student further with the assessment question by giving a prompt in English in turn 228 ('start with C'). It is believed that she switches back to English this time because it is important for the student to learn the word 'condensation' in English instead of in Malay. Having the question explained in Malay by Su Ling in turn 226, I can infer that the student now fully understands the question because he/she is able to answer correctly in turn 229.

To summarise, Table 5.8 below shows functions of Su Ling's CS within the episode of assessment (see Appendix H):

Table 5.8 Functions of CS identified in Su Ling's episode of assessment

Function	Instance Number*	Total number of occurrence
To get attention	1, 2, 3, 4, 9	5
To give emphasis	1, 2, 3, 4	4
To facilitate students' understanding	5, 6	2
To give confirmation	7	1
Unknown due to lack of context	8	1

* As some of the switches are multifunctional, this is not a one-to-one mapping of a switch to a singular function. It is just to show the occurrence of a certain function throughout the episode, i.e. for CS which has more than one function, its instance number will appear in more than one category in the above table.

From the above table, once again it is shown that Su Ling uses CS mainly when she wants to get her students' attention during the episode of assessment.

5.2.2.3 Su Ling's Code-switching across Two Episodes

By doing a word count for the two languages used in Su Ling's lesson, I find the word count distribution as shown in the following Table 5.9.

Table 5.9 Approximate percentage of English and Malay used in Su Ling's lesson

Episode	Approximate % of languages used in class (based on word count)	
	English	Malay
Instruction	99.73	0.27
Assessment	97.72	2.28

The table above shows that within her 1-hour lesson, Su Ling has very minimal switches from English to Malay. Between the two episodes, she switches more in the episode of assessment than in the episode of instruction. The explanation for this could possibly be due to the increased interaction she has with her students during the episode of assessment as compared to when she is doing whole class teaching. It is also interesting to find that during these two episodes, the primary functions of her switches are the same – to get her students' attention and to give emphasis to a point. As the macro-function for these functions is 'classroom management', I believe that this might be Su Ling's personal style of CS.

5.2.2.4 Su Ling's Students' Views on Classroom Code-switching

There are 30 students in Su Ling's class of which 12 of them (40%) speak English as their first language at home. There are 8 Malay speakers and 9 Mandarin speakers in the class, and only one student speaks Tamil as his/her first language. 16 students used to learn science in the medium of English during their primary school. Table 5.10 below shows the language background of Su Ling's students.

Table 5.10 Su Ling's students' language background

	First language at home				MOI for science in primary school		
	Malay	English	Mandarin	Tamil	Malay	English	Mandarin
No. of students	8	12	9	1	3	16	11

As slightly more than half the class have learnt science in English during their primary education, it is no wonder Su Ling has very minimal code-switching in her lessons because English is the language most students have no problem learning science in. To study students' preferred MOI for Science in their secondary education, the Table 5.11 below is presented.

Table 5.11 Su Ling's students' preferred MOI for Science in secondary education

Science MOI in primary school	Number of students and their preferred MOI (The higher the number, the more English they prefer) 1= Only Malay is used in class 10= Only English is used in class									
	Malay as MOI			Bilingual as MOI			English as MOI			
	1	2	3	4	5	6	7	8	9	10
English								8	5	3
Malay		1								2
Mandarin								2	4	5

It is quite surprising to find that despite the fact that there are 20 students (out of 30) who do not speak English as their first language at home and also 14 students (out of 30) who have not received primary Science education in English, 29 of the 30 students in class would prefer to have mostly English as the MOI for their secondary science education and only one student would prefer to have Malay as MOI. This seems to work very well with Su Ling's minimal use of code-switching in her lessons. Another interesting data to note from the above table is the two extreme preference made by three students who received primary Science education in Malay. When checked with their first language spoken at home, the two students who prefer to have an only-English Science classroom have English as their first language, whereas the one who prefers to have Malay as MOI has Malay as his/her first language. Once again, although it cannot be generalised, students' first language does play a role in affecting their choice of MOI for Science education.

5.2.3 EMI-3: Fatimah's Lesson

The final case of EMI classroom that I am going to present is Fatimah's lesson. Both Fatimah and Su Ling teach in the same school and are required to use English as the medium of instruction for the teaching of Science. Fatimah has had 10 years of

teaching experience and her first language is Malay. Her undergraduate study was completed locally yet the MOI was in English. When English for the Teaching of Maths and Science policy was first implemented, she struggled a little as she was teaching in a school based in rural area in East Malaysia. The students there communicated mostly in the indigenous language. Hence, teaching the subject in English was difficult. However, since her transfer to this school, she has had less difficulty teaching Science in English as most of her students are proficient in the language.

This lesson that I observed was conducted in the Science laboratory. Fatimah spends this 1-hour of lesson conducting experiment with her students. Hence, only CS in Fatimah's episode of experiment will be discussed here.

5.2.3.1 Episode of Experiment

Before the students are allowed to start their experiments, Fatimah goes through the experiment procedures with the students from turn 1 to turn 27. Within this stage, Fatimah's turns are always very long and students only respond when she checks for their understanding. One of Fatimah's longer turns is shown in Extract 19.

Extract 19

Turn	Role	Transcript
19.	T:	OK, ahh, do you have your textbook with you. OK, open your textbook page, yes, fifty-six. K, ¹ Saya ulang balik ya, apa yang kamu dah baca, (<i>I repeat alright, what you've read</i>) Ashrin. K, the first experiment, we would like to test about the solubility in water for oxygen and carbon dioxide. K, what you have to do is, k, I don't want you to use the ² bikar (<i>beaker</i>), so instead I give you the basin, ok? So, fill up the basin with water and then ³ tak payah banyak-banyak (<i>don't need to have too much</i>), sikit je (<i>a bit only</i>), as long as you can make sure that it can immerse, ⁴ boleh masukkan (<i>can be inserted</i>). OK? And then, open up the stopper, ⁵ buka (<i>open</i>) stopper ⁶ ini (<i>this</i>), bila (<i>when</i>), listen, Aina, k ⁷ pandang sini (<i>look here</i>). Everybody look at me. When you open the stopper, ⁸ kamu terbalikkan ia dulu, balikkan macam ini (<i>you make it upside down, reverse like this</i>), there's water inside, ⁹ bayangkan (<i>imagine</i>) you got water inside, and then what you do is ¹⁰ masukkan di dalam air (<i>place it in the water</i>), open the stopper inside the water. ¹¹ Kalau kamu (<i>if you</i>) open as usual, ah, for example, you ¹² sembang-sembang (<i>chit-chat</i>), heh this is very good, I want to see! Ah, and then you just open, what happened to the gas inside?

Within the above Extract 19 there are 12 instances of switch from English to Malay. The function of the above turn is to give students instruction on how to carry out the experiment. However, there are also other functions within this big turn of instruction.

The first switch Fatimah makes is to do a recap with her students on what they have read (1). Then she switches again at the use of a content-related word – ‘**bikar** (*beaker*)’ (2). It should be noted here that throughout the lesson, Fatimah always uses Malay when she says ‘**bikar**’. As ‘**bikar**’ has a very similar pronunciation to ‘beaker’, it may be the case that such is not a switch and it is just the case of Fatimah mispronouncing the word.

When Fatimah instructs her students to ‘fill up the basin with water’, she switches to Malay and elaborates the point by saying that it does not need to have too much water – ‘**tak payah banyak-banyak** (*don’t need to have too much*)’ (3). Such a switch is seen to be used to give further information on how much water is needed. She further emphasises this point in Malay by saying ‘**sikit je** (*a bit only*)’ to make sure that all students follow this instruction. As soon as she says the word ‘immerse’ in English, Fatimah switches to Malay ‘**boleh masukan** (*can be inserted*)’ (4) to provide an explanation for the term which means can be inserted. As she starts her demonstration, she switches to Malay to detail whatever that she is doing (5). She also requests Ainato ‘**pandang sini** (*look here*)’ by switching from English to Malay in order to get her attention to look at her demonstration. Switches (8), (9) and (10) all have the function of detailing what she is demonstrating to the students. Fatimah switches on (11) and (12) in order to get the students’ attention and to remind them to focus while conducting the experiment or else the gas might be gone after they open the stopper.

After Fatimah demonstrates the experiment and gives instruction to the whole class, she then paces around the class to check on her students’ progress. As the students start conducting the experiment, they also start facing different procedural problems or have difficulties getting the expected results. Although most of the students’ voices were not recorded, Extract 20 below shows how Fatimah interacts with her students at this stage.

Extract 20

Turn	Role	Transcript
71.	T:	((T demonstrating at one of the tables)) Yes? ¹ Itu, sekejap ye (<i>That, wait a while alright</i>). Ah wait, Lee, we don't need that, we only need the bunsen burner. OK, ² naik tak (<i>rise or not</i>)? OK, which one ³ yang tak naik langsung (<i>that doesn't rise at all</i>)? It should be like one of it will ⁴ naik (<i>rise</i>) slightly.
72.	SS:	(??)
73.	T:	⁵ Nampak (<i>see</i>)? OK, OK. Tak apa, tak kisah air dia kotor ke apa (<i>nevermind, doesn't care if the water is dirty or what</i>). This is from the tank, don't worry.
74.	S:	(??)
75.	T:	No, we just need the bunsen burner. Ya. I don't say you take this one, I said take this one.
76.	S:	(??)
77.	T:	Ok good, very good. OK, that one, you take the sodium hydroxide from there, put 100ml inside. K ⁶ dapat (<i>get</i>) result? ((T moves to another table.))
78.	S:	(??)
79.	T:	K you won't need the basin, now the basin what you do, you put all the test tubes that you have used. Har? ⁷ Dah dah guna belum (<i>have you used it</i>)?
80.	S:	(??)
81.	T:	Ah ⁸ tak apa, buka je la, dah guna tak apa (<i>never mind, just open it, used already nevermind</i>). Ok, ⁹ cepat-cepat (<i>quick</i>), use that one and then after that litmus paper over there.

Unfortunately, due to the lack of content, it is unknown as to why Fatimah switches on instance (1) in Extract 20. Then as Fatimah checks her students' progress, she switches to Malay in order to elicit response from them, checking if they manage to get the expected results (2) and (3) before emphasising in Malay that the water level should '**naik** (*rise*) *slightly*' (4). In turn 73, Fatimah switches again to seek her students' confirmation, to check if they see what happens to the water level. In both turns 77 and 79, Fatimah is seen switching again from English to Malay in order to elicit response from her students while checking their progress. Once again, due to the lack of recording from the students, it is unclear as to why Fatimah switches on instance (8) but I believe the switch on instance (9) is made because Fatimah wants to emphasise that the students need to react quickly while conducting the experiment in order to achieve a desirable result.

In Extract 19, I presented an example of Fatimah's longer turn and studied the CS instances found within that turn. On other occasion, there are also short turns which consist of many instances of CS. An example is shown in Extract 21 below.

Extract 21

Turn	Role	Transcript
87.	T:	Why you put inside? My God. Look at the picture inside. ¹ Tengok gambar muka surat (<i>look at the picture page</i>), ay!! I ask you to do different thing you did different thing. That one ² tak guna (<i>no use</i>). K this one, ah, ³ keluarkan yang dah guna, buang air tu (<i>take out what has been used, throw the water away</i>). OK, ok, basically ⁴ macam ni kan, buka cover dia , and then ⁵ cepat-cepat tutup (<i>like this, open its (cover), (and then) quickly close it</i>). And then ⁶ masukkan macam ni dan tolak je masuk (<i>insert like this and push in only</i>). OK? OK, ah, ⁷ cepat (<i>quick</i>). Ah, ok. Yes. Ah, don't worry. It's diluted. Yes?

Within such a short turn, if I analyse the instances of CS separately, the functions of the CS instances are as follow:

- (1) – to admonish students/to give instruction/to emphasise (multifunctional CS)
- (2) – to facilitate students' understanding
- (3) – to give instruction
- (4) – to detail demonstration
- (5) – to detail demonstration
- (6) – to detail demonstration
- (7) – to give instruction

However, if I look at the English words in this turn, I find that most of the English words are only used as Fatimah's 'fillers'. If I take out the English 'fillers' from line 4 to 8 of Extract 21, it will look like this:

keluarkan yang dah guna, buang air tu, macam ni kan, buka dia, cepat-cepat tutup, masukkan macam ni dan tolak je masuk (*take out what has been used, throw the water, like this right, open it, quickly close, insert like this and push in only*)

It can be deduced that as Fatimah is being agitated at the beginning of this turn (shown in her switch to Malay to admonish her student (1)), she takes it as a signal that her students have not understand her instruction previously. Therefore, she switches more frequently in this turn in order to get the students' attention and for them to fully understand these instructions.

On another occasion, we also see how Fatimah switches to Malay and repeat the term throughout her turn just to emphasise on its importance. The term we are looking now is ‘**serentak** (*simultaneously*)’, underlined in the following Extract 22. The word ‘**serentak**’ occurs six times in the turn below. This shows that Fatimah puts great stress while reminding the students to put both the red and blue litmus paper into the test tube simultaneously. It is also in her plan for the whole class to complete this step of the experiment together. Therefore, there is the occurrence of the drill of ‘**serentak**’.

Extract 22

Turn	Role	Transcript
107.	T:	I don't know. Red and blue. That one, who's is that? No, everybody takes blue. No put <u>serentak</u> (<i>simultaneously</i>). One red and one blue. Why? Because the teacher so nice. Heeerrrr! You haven't got the blue colour"? After that the indicator you put back here ok? So that the rest can use. Eer..what, why you waiting for that? The rest can use this one ya. The litmus paper. K letak serentak ya (<i>put simultaneously alright</i>). Eh wait, nanti kita buat serentak (<i>later we do simultaneously</i>). We switch off the light, eh light, the fan. OK. Satu (<i>one</i>) for carbon dioxide satu (<i>one</i>) for oxygen, <u>serentak</u> (<i>simultaneously</i>). <u>Serentak</u> (<i>simultaneously</i>) with the red one. K put together. Dah? Have you taken this? Dah ambil (<i>have taken</i>)? K you put it together ok? Satu (<i>one</i>) blue satu (<i>one</i>) red, together, <u>serentak</u> (<i>simultaneously</i>). Jangan (<i>don't</i>)..ay, dah ambil dah (<i>have taken already</i>). Dah (<i>already</i>)? Have you taken this paper?

Fatimah seems to be more anxious and is seen switching to Malay on a few occasions to admonish her students.

Extract 23

Turn	Role	Transcript
121	T:	Fit everything in, really like squish everything. Eh why you put the indicator together with the..no, indicator different. And then after that you put, why don't you read the procedure? Eh don't play please, Ashwin. Eh put down.
122	S:	(??) ((in Malay))
123	T:	Jangan (<i>don't</i>) main. Eh, please do not play.

In turn 121 (shown above), Fatimah gives a warning to Ashwin to not play and put down whatever he is holding at the moment. Assuming Ashwin still continues to do so despite the teacher’s first warning, Fatimah switches to Malay and puts a stress on ‘**jangnan** (*don't*)’, hoping that Ashwin will now get the warning and stop doing what he is doing. This agrees to what Amina reports in her interview that she tends to switch to Malay whenever she wants to admonish her students. She even says that her students will know that she is angry if she uses a lot of Malay in her speech.

In another example, Fatimah switches to Malay when expressing her disapproval and also to admonish her student.

Extract 24

Turn	Role	Transcript
141.	S1:	Carbon dioxide is because of water.
142.	T:	Yes, I think the water inside. ((sound of glass being broken)) Ah! Pecah (<i>broken</i>)! What are you doing?
143.	S2:	No that thing fell.
144.	T:	Kenapa kamu masuk balik (<i>why did you put it back</i>)? Mana yang you letak (<i>where did you put</i>)? Don't put back inside here. This is the gas.
145.	S2:	No, I thought I thought that was like no wanna pecah (<i>break</i>) then it hit this thing.
146.	T:	Aiyoo, careful. Don't please, that's why I said do not play in lab.

The above example starts with Fatimah speaking to S1 and her attention and taken away by the sound of glass being broken. Although she first tries to understand the situation by asking S2 in English ‘what are you doing?’ and despite the student’s reply in English, she switches to Malay with higher intonation to question what exactly has the student done. As Malay is Fatimah’s first language, it can be deduce that Malay is still the language she uses and is more comfortable with whenever there is a rise in her emotion. Once she finds out the root of the problem, she switches back to English advising her student to be careful and reminding him to not play in the lab.

There is also another example where Fatimah switches her language not to admonish her students but to compliment them.

Extract 25

Turn	Role	Transcript
212.	S:	Teacher ni tutup (<i>close this</i>) (?)
213.	T:	Ya, pandai (<i>clever</i>), yay, hou ye ((<i>This is Cantonese, which means clever</i>)). Where’s the cover? No that’s not the cover.

In the above extract, Fatimah not only compliments her student in Malay **pandai** but also does it in Cantonese. It should be noted that Fatimah does not speak Cantonese personally but there is a possibility that this student whom she is speaking to is a Chinese and understands Cantonese. Unfortunately, the student’ response has not been recorded on this occasion hence it is impossible to determine if such deduction is correct.

5.2.3.2 Fatimah's Code-switching in Episode of Experiment

Within Fatimah's one-hour of episode of experiment, approximately 84.7% of the word count is in English whereas 15.3% of words are in Malay. This is a huge increase as compared to the language used by Farid and Su Ling in their classrooms.

There are as many as 172 instances of code-switching found in this lesson and the functions are listed as below (see Appendix I):

Table 5.12 Functions of CS identified in Fatimah's episode of experiment

Function	Instance Number*	Total number of occurrence
To give instruction	12, 14, 22, 24, 32, 36, 37, 40, 41, 43, 44, 46, 50, 56, 59, 63, 64, 75, 76, 79, 81, 85, 89, 94, 96, 103, 108, 109, 117, 118, 123, 125, 140, 144, 146, 148, 153, 156, 162, 163, 164	41
To facilitate understanding	4, 6, 11, 22, 30, 31, 35, 51, 52, 54, 60, 61, 62, 80, 86, 97, 100, 102, 105, 110, 113, 122, 135, 138, 142, 154, 158, 161, 170, 171	30
To give emphasis	5, 21, 28, 53, 68, 73, 74, 79, 101, 104, 106, 107, 111, 114, 126, 147, 167	17
To elicit response	2, 66, 67, 70, 71, 87, 90, 91, 112, 119, 121, 132, 143, 169, 172	15
To seek confirmation	48, 49, 58, 69, 99, 115, 129, 151, 155, 157, 159, 160, 166	13
To detail demonstration	15, 16, 17, 27, 82, 83, 84, 92, 93, 94, 145	11
To admonish	7, 42, 79, 124, 127, 131, 132, 141,	8
To get student's attention	1, 14, 18, 19, 20, 57, 152	7
Linking words / pre-fix	25, 77, 88, 134, 149, 150	6
To give attention / confirmation / approval	78, 116, 120, 136, 137, 168	6
Unknown due to lack of context	3, 65, 72, 128, 130, 165	6
To give further information	10, 26, 39, 45, 95	5
To use content word	9, 34, 38, 55, 98	5
Determiner	13, 133, 139	3

Possessive pronoun	23, 28, 29	3
To accommodate student's language need	51, 54	2
To recap	8	1
To lighten the mood	33	1
To show disapproval	47	1

* As some of the switches are multifunctional, this is not a one-to-one mapping of a switch to a singular function. It is just to show the occurrence of a certain function throughout the episode, i.e. for CS which has more than one function, its instance number will appear in more than one category in the above table.

Within Fatimah's 172 instances of CS, the table above shows that she switches primarily to give instruction and followed by to facilitate students' understanding. It is easy to understand why language is switched mostly for these functions because during an episode of experiment, it is utmost important for all students to understand the instructions given for the experiment and for them to fully understand the knowledge and the outcome that they are expected to achieve. Also note that Fatimah switches frequently for emphasising, eliciting response and seeking confirmation from the students. These actions are important within an episode of experiment because the teacher has to constantly remind the students regarding the important points and to also check their progress and understanding from time to time.

5.2.3.3 Fatimah's students' views on classroom code-switching

There are 30 students in Fatimah's class. According to the way students are streamed, this is the best performing classroom among all Form One classes in this school. A total of 40% of the students (12 out of 30) speak Malay as their first language at home while 33.33% (10 out of 30) students speak English as their first language. A total of 7 students speak either Mandarin or Cantonese at home and only one student speaks Tamil at home. The table below shows the students' first language and their MOI for Science in primary school.

Table 5.13 Fatimah's students' language background

	First language at home				MOI for science in primary school		
	Malay	English	Mandarin	Tamil	Malay	English	Mandarin
No. of students	12	10	7	1	3	22	5

The table above shows that a huge majority of students in Fatimah's class received science education in English during their primary school. In order to study these students' preferred MOI for Science in their secondary education, the Table below is presented:

Table 5.14 Fatimah's students' preferred MOI for Science in secondary education

Science MOI in primary school	Number of students and their preferred MOI (The higher the number, the more English they prefer) 1= Only Malay is used in class 10= Only English is used in class									
	Malay as MOI			Bilingual as MOI			English as MOI			
	1	2	3	4	5	6	7	8	9	10
English					1	1	3	4	4	9
Malay						2		1		
Mandarin									2	3

A total of 26 out of 30 students in Fatimah's report preferred a science class where more English is used in the class. In fact, 12 of them actually prefer to have English only lessons. As most students learnt Science in English MOI during their primary education, it is understandable that they want to continue learning this subject in a language that they are familiar with. Many of them cite that by having more English within the classroom, it helps them to understand the teacher better, to pay attention in the class and also to improve their English.

It is interesting to note that the two students who received primary Science education in English have stated that they prefer equal use of English and Malay in the class. When checked with their first language used at home, they both actually speak English as their first language. This is quite perplexing as both students who assumed to have good proficiency in English or at least be competent in English-medium Science lessons would prefer to have nearly equal use of both English and Malay

medium in their secondary Science lessons. Both students states that the reason for such a preference is that it helps them to pay attention in the class and one of the students even believe that having both languages used equally in the class can not only improve his/her English but Malay as well.

5.3 Bilingual as Medium of Instruction (BMI) Classrooms

In this section, I will focus on the analysis of 3 BMI teachers – Marina, Shahrul and Amina. Due to the fact that these lessons are taught in bilingual medium, I will look at the different functions both Malay and English are trying to achieve instead of only looking at the functions whenever there is a switch from English to Malay. Due to the vast amount of data achieved under this method, it is impossible to label functions onto every utterance the teachers make (in both languages). Hence, the summary of CS functions at the end of each case study will be based on the extracts discussed and there will not be a reference to the Appendix. However, each of these teacher's lesson transcript are included as Appendix J, K, L for Marina, Shahrul and Amina respectively.

5.3.1 BMI-1: Marina's Lesson

The first bilingual-medium lesson that we are going to study is Marina's lesson. Marina's first language is Malay and she received her undergraduate education in the medium of Malay as well. Within her 15 years of teaching experience, Marina has experienced different phases in her teaching career – from teaching only in Malay to teaching Science in English and now teaching the lessons bilingually.

All of Marina's Science lessons were conducted in the Science laboratory. She is currently teaching this class that I observe in both English and Malay medium because the school policy has requested teachers to teach better performing class bilingually whereas the lower performing classes are taught solely in Malay medium. During this lesson that I will be analysing, Marina used PowerPoint slides (in English) and English-medium textbooks as her main teaching material. This recorded lesson consists of only an episode of instruction (see section 4.8 for explanation on why only one episode is analysed).

5.3.1.1 Episode of Instruction

At the start of the lesson, Marina speaks mostly in Malay and only switches to English on a few occasions.

Extract 26

Turn	Role	Transcript
1.	SS:	Selamat sejahtera cikgu Marina. (<i>good day teacher Marina.</i>)
2.	T:	K duduk. (<i>sit</i>)
3.	SS:	Terima kasih cikgu Marina. (<i>thank you teacher Marina.</i>)
4.	T:	K rekod sains sila hantar. (<i>science record please submit</i>)
5.	S:	Apa cikgu? (<i>what is it teacher?</i>)
6.	T:	K rekod sains hantar. (<i>k science record submit.</i>) ok, ¹ class, table five point two ² sudah ada? (<i>already had it?</i>)
7.	S1:	err ada. (<i>have.</i>)
8.	T:	Dah siap? (<i>already done?</i>) (.) Dah siap? (<i>already done?</i>)
9.	S1:	Dah. (<i>already.</i>)
10.	T:	OK. Hmm? (??) jawapan dalam (<i>answer inside</i>)?
11.	S:	Ya. (<i>yes</i>) (??)
12.	T:	Ya tu je nak (<i>yes that only needs to</i>) ³ measure, the (??) pendulum, yesterday, k write the answer (.) for the (density) of the pendulum.

Within the first three turns that Marina makes, she uses Malay imperatives – ‘**duduk** (*sit*)’, ‘**sila hantar** (*please submit*)’ and ‘**hantar** (*submit*)’ to give instructions to her students. The first switch of language happens in turn 6, from Malay to English, when the text used in class is referred, as Marina wants to get her students’ attention to ‘table five point two’ within the worksheet (1). The function of such switch from Malay to English is to read from the text used in classroom. Immediately after this, she shifts back to Malay by asking (2) ‘**sudah ada** (*already had it*)’ in order to get students’ confirmation on whether they have had ‘table five point two’. It should also be noted that the term ‘**rekod sains** (*science record*)’ happens in turns 4 and 6 may be a borrowing from English as the only difference between the Malay term and English term is its word order. In English, it would be ‘science record’.

In turn 12, due to the unintelligible student’s comment in turn 11, I can only assume that Marina starts the turn by giving a confirmation to her student in Malay but switches to English when she mentions the key word (3) ‘measure’. It is deduced that ‘measure’ is spoken in English because of its connection to what is coming up next – Marina provides help to her student with the exercise. Due to the fact that all their textbooks and workbooks are in English, when Marina helps her students with their work, she will have to converse in English in order to help them make sense of what

is in the books. Any answers to be written into the books will need to be in English as well. Hence, Marina has to switch to English at this point in order to provide help to her student. She then shifts back to Malay in order to bring her students' attention back to the fact that she is still waiting for them to submit their Science record. Up till here, I observe that Marina has been shifting her language with a clear aim – Malay for classroom management and English for reference to the teaching material.

The following extract shows a time when Marina gives out worksheets to her students and she is unhappy with the fact that there are so many students who do not have the worksheets which she has given out before.

Extract 27

Turn	Role	Transcript
68.	T:	Eh, (around this). You ⁴ ambil-lah (<i>take-interjection</i>), ⁵ start from beginning five point one. ⁶ Berapa paper you tak dapat (<i>how many paper you didn't get</i>)?
69.	S1:	tiga. (<i>three</i>)
70.	S2:	dua. (<i>two</i>)
71.	T:	Siapa lagi yang tak ada (<i>who else don't have</i>) ⁷ paper?
72.	S:	saya saya (<i>me me</i>).
73.	T:	⁸ Kenapa ramai sangat yang tak ada (<i>why so many don't have</i>)? ((teacher giving out worksheets to students)) eh ⁹ number two (?) number two. ¹⁰ Ini ada? (<i>have this one?</i>)
74.	S1:	Ada. (<i>have</i>)

In turn 68 of Extract 27, Marina starts her turn in English and then switches to Malay imperative verb plus interjection ‘**ambil-lah**’ to instruct her student to take the required worksheet before switching to English on (5) to get students’ attention to the worksheet. On (6), Marina switches back and forth between Malay and English within the clause and such a switch has a function of eliciting response from her students. Then in turn 71, she switches to English when she wants to direct her students’ attention to the ‘paper’ that she is distributing (7). In turn 73, Marina first admonishes through Malay (8) before switching to English to refer to the ‘number two’ worksheet and directing her students’ attention to it (9). Once again, she switches back to Malay at the end of this turn when she wants to get confirmation from her students on whether they have received the certain paper (10).

The following extract shows how Marina shifts between two languages during teacher-centred classroom teaching.

Extract 28

Turn	Role	Transcript
111.	T:	Organ involved in the respiration, organ. Hashwin, answer question based on the question. OK, the? Stomata! Stomata at the leaf and the lenticels at the stem. Ah, ¹¹ semua sekali (<i>all together</i>). OK, ¹² number eight, during breathing, they are inhale and exhale air. OK now, do one by one. In inhale. k, inhale air is air breathe into the lungs. Exhale air is air breathe out of the lungs. OK, ¹³ tahu tak apa maksud (<i>do you know the meaning of</i>) ¹⁴ inhale and exhale?
112.	SS:	Tahu. (<i>know.</i>)
113.	T:	Inhale, ¹⁵ udara masuk (<i>air goes in</i>). ¹⁶ Exhale, ¹⁷ udara hembusan (<i>exhaled air</i>). Farah? Tahu (<i>know</i>) ¹⁸ inhale, exhale? K ¹⁹ tempat kosong, tulis jawapan, (<i>blank space, write the answer,</i>) ²⁰ into. K, number two, out. K number three, the exchange of gases takes place in the lung when air is breathed in, oxygen is? ab? sorbed. Why oxygen must absorb?
114.	S:	because (??) air.
115.	T:	Because the oxygen and glucose, ah, to produce the energy ²¹ yang kamu nak buat bising ni, datang dari mana? (<i>that you make so much noise, where does it come from?</i>)
116.	SS:	Air.
117.	T:	Har? Dari (<i>from</i>) ²² air?
118.	S1:	Oxygen.
119.	S2:	Glucose.
120.	T:	K the oxygen is absorbed and carbon dioxide and water vapour are released by the lungs. K as a result, exhaled air contains? Less oxygen, more carbon dioxide and more water vapour. The exhale air also warm than inhale air. The composition, ok. We stop. OK, this is the pathway, ⁶ laluhan, laluhan udara semasa kamu (<i>pathway, pathway for air when you</i>) ²⁴ inhale and exhale. K, number one. Iffan! Mukri! Nose. ²⁵ Siapa yang ada banyak sangat (<i>who has a lot of</i>) ²⁶ mucus ²⁷ dekat dia punya (<i>near his</i>) nose, ²⁸ tak boleh nak (<i>cannot</i>) breathing, ²⁹ buka mulut besar-besar (<i>open the mouth big</i>), ha ha ha. Ah, guna ni (<i>use this</i>), sama juga, sebab apa (<i>it's the same, why</i>)? Dia ada (<i>it has</i>) ³⁰ link. ³¹ Sama juga (<i>it's the same</i>) (??) Ah, bila kamu lari (<i>when you run</i>) hundred meter, ³² kan, macam mana (<i>right, how</i>)? Tak boleh awak guna (<i>you can't use</i>) ³³ nose, ³⁴ kena guna (<i>have to use</i>)..ah, juga (<i>also</i>). Alright, lepas tu, udara masuk terus ke (<i>after that, air goes straight into</i>) ³⁵ trachea. Trachea ³⁶ panjang (<i>this is long</i>). Ini sama je, kamu makan guna sini, kamu ³⁷ breathing pun guna sini (<i>It's the same, you use here to eat, use it to breath also</i>).

In (11), after explaining ‘stomata’ and ‘lenticels’ in English, Marina switches to Malay and says ‘**semua sekali** (*everyone together*)’ in order to get all the students’ attention. She then switches to English to read the text from the worksheet (12) before switching back to Malay to check the students’ understanding and elicit their response (13). This is another example of a multifunctional switch. Once again, she switches to English when using content related words (14).

In turn 113, Marina switches to English every time she uses content related words ‘inhale’ and ‘exhale’ (16 & 18). She does this because these are important scientific terms within this lesson and it is vital that the students are familiar with these terms. Despite the students expressing that they understand the meaning of these words (in

turn 112), she switches to Malay in order to explain these terms (15 & 17) to make sure that all students in the class understand the meaning of these words. She also uses Malay to give instruction for the students to write the answer in the blank space given (19) but switches to English when she says the answer (20). This is because the worksheet is in English-medium and so it requires the answer to be in English. Following this, the tone and the sentence structure inform us that she is now reading from the worksheet instead of speaking to the students. This signals a change in the classroom activity, from classroom management (giving instruction) to reading the English-medium science content.

In turn 115, Marina wants to relate glucose to energy. Therefore, she switches from English to Malay in order to explain the concept by linking the idea to the students' personal experience (21). She wants to explain that 'energy' is not something unfamiliar to the students, it is in fact the one thing that helps them make all the noise in the classroom. She expresses her surprise in turn 117 by using the interjection 'har' and asking her students a question 'dari (from) air?' for confirmation when the students give a wrong answer. Nonetheless, she continues using English for content-related words (22).

In turn 120, again, the first part of the turn being spoken is in English. Although it is difficult to determine whether this is spoken by Marina or a text that she is reading, I am more inclined to believe she is indeed reading from the worksheet at this moment. This is due to the question she asks: 'exhaled air contains?' and the answer that she provides ('less oxygen, more carbon dioxide and more water vapour'). As we understand that from the beginning of the lesson till now, she has been discussing worksheets with her students. Therefore, it is important that she gives the answers in English in order to help her students to fill in the worksheet with the correct answer. When she gives the signal by saying 'we stop' (turn 120 line 4), this is a cue that they are moving from one stage to the other i.e. they are now moving away from discussing the exercise to learning about the breathing pathway. Instance (23) takes place because Marina is explaining the term 'pathway' in Malay in order to facilitate her students' understanding. Then she switches back to English for the words 'inhale and exhale' (24). On instance (25), Marina switches to Malay hoping to make link between the pathway of air to students' personal experience with blocked nose.

Therefore, (26) is switched to English because it is a content related word and (27) is to once again, link the idea to the students' personal experience. Further information is given in mixed instance in (28) and the demonstration explained in (29). On (30), Marina switches to English for a content-related word 'link' before she switches to Malay to give the students another example by linking another personal experience to facilitate the understanding (31).

On (32), Marina switches to Malay in order to elicit response from her students and she switches back to English on (33) when she uses the word 'nose' which is a content-related word. Further information is provided in (34) before Marina introduces another new scientific term in English 'trachea' (35). Marina elaborates 'trachea' by switching to Malay describing that it is long. Besides saying the content word 'breathing' in English again in the intra-clausal switch in (37), Marina also facilitates students' understanding within this switch.

Continuing from the above Extract 28, we see how Marina provides more explanation regarding the concept of breathing in the following Extract 29.

Extract 29

Turn	Role	Transcript
121.	S:	Teacher, which part of trachea? Hmm?
122.	T:	Which part?
123.	SS:	(??)
124.	T:	OK. ³⁸ Sebab itu bila kamu cakap (<i>that's why when you talk</i>), eh, Derrick, bila kamu bercakap, boleh tak bernafas (<i>when you talk, can you breathe</i>)?
125.	SS:	Tak! (<i>cannot</i>) Boleh! (<i>can</i>) ((some students say can't, some say can)
126.	T:	Boleh tak (<i>can or not</i>)? Ataupun bila kamu makan (<i>Or when you eat</i>), ³⁹ same time ⁴⁰ boleh tak kamu (<i>can you</i>) ⁴¹ breathing?
127.	SS:	Boleh (<i>can</i>).
128.	T:	Ah, ⁴² masa telan tu, boleh tak nak (<i>when you swallow, can you</i>) ⁴³ breathing? ⁴⁴ Tak boleh, sebab apa (<i>cannot, why</i>)? Ah dekat sini dia ada satu saluran yang sama (<i>Ah near here there is a same pathway</i>). Ni ada (<i>it has</i>) ⁴⁵ glottis, ⁴⁶ bila kamu cakap, bila kamu nak makan, ⁴⁷ glottis ⁴⁸ nak atas baru makanan jatuh bawah (<i>when you talk, when you want to eat, glottis will be raised and then the food will drop</i>). Satu masa nak cakap nak makan nak (<i>one time wants to talk wants to eat wants to</i>) ⁴⁹ breathing, ⁵⁰ batuk semua keluar (<i>cough everything out</i>) OK. ⁵¹ Continue. K ini bron? K ⁵² ada dua cabang di sini (<i>there are two branches here</i>), bron? ⁵³ Bronchus. ⁵⁴ Lepas itu pergi kat (<i>after that it leads to</i>) ⁵⁵ bronchioles then finally ⁵⁶ dekat mana ni (<i>near where</i>), kecil-kecil ni (<i>these small ones</i>), sekarang ni saya cerita paru-paru lah (<i>I'm talking about the lungs + interjection</i>). Ah, ⁵⁷ sekarang saya cerita last sekali, ⁵⁸ final pergi dekat (<i>now I'm telling the last time, the final is near</i>) al? veo?
129.	S:	Alveoli.

At the beginning of the above extract, students ask Marina a question regarding the trachea and she switches to Malay to provide an explanation (38). Then she poses a question to Derrick in Malay where the rest of the class answers differently in turn 125. Because of this, Marina knows that they are not sure about whether or not a person can talk and breathe at the same time. This leads her into checking her students' understanding further in turn 126 by asking in Malay if they can eat and breathe at the same time. She switches to English for 'same time' (39) in order to give emphasis to these words.

However, as she continues explaining in turn 128 because students give the wrong answer in turn 127, she now uses '**satu masa** (*one time*)' (in line 6 of turn 128) instead of 'same time' which is used in turn 126 earlier. Both 'same time' and '**satu masa** (*one time*)' mean happening simultaneously. I believe that this is one strategy that Marina adopts when she realises students do not understand the previous explanation. Hence she has to paraphrase the key content words into Malay and elaborate the idea to the students again. Nonetheless, the word 'breathing' has been kept in English throughout (41, 43, 49). And as they continue on with the lesson, again, key scientific terms such as 'bronchus', 'bronchioles' and 'alveoli' are uttered in English. The purpose of such a shift is to place emphasis on the key content terms and to provide opportunities for students to be more familiar with these terms by frequently repeating them in the classroom.

5.3.1.2 Marina's use of 2 Languages in Episode of Instruction

Although this is a bilingual lesson, Marina uses more Malay than English in her teaching. In fact, approximately 63.48% of the words spoken are in Malay and only 36.52% are in English.

Within the 4 extracts that are discussed here, there are a total of 58 instances of CS (all numbered in the extracts) and the following table shows the functions identified and the number of occurrences.

Table 5.15 Functions of switches identified in Marina's episode of instruction

Function	Instance number of switch to Malay	Instance number of switch to English
Reading from the text		1, 12
To seek confirmation	2, 10	
To use content-related word		3, 14, 16, 18, 20, 22, 24, 26, 30, 33, 35, 37, 41, 43, 45, 47, 49, 53, 55
To give instruction	4, 19	
To get attention	11	5, 7, 9, 51, 58
To elicit students' response	6, 13, 32, 40, 42	
To admonish	8	
To check understanding	13	
To facilitate students' understanding	15, 17, 23, 38, 44, 46, 48, 50, 52, 54, 56	
To link to students' personal experience	21, 25, 27, 31	
To provide further information	28, 36	
To detail demonstration	29	
To emphasise	57	39

The above table shows that Marina switches to English primarily when she uses content-related words in her speech whereas Malay is used mainly when she wants to explain and facilitate students' understanding.

5.3.1.3 Marina's Students' Views on Classroom Code-switching

Marina's class consists of 26 students. Half of the class speaks English at home and more than 76% (20 out of 26) of the students were taught Science in English during their primary school. The table below shows the language background of these students.

Table 5.16 Marina's students' language background

	First language at home				MOI for science in primary school			
	Malay	English	Mandarin/ Cantonese	Tamil	Malay	English	Mandarin	Tamil
No. of students	6	13	6	1	2	20	3	1

As more than 50% of the students learnt science in English during their primary school, I would assume that most students prefer to have an English-medium Science lesson during their secondary education. Nonetheless, there are students who actually prefer to have Malay as the MOI for secondary Science education. The table below shows Marina's students' preference of MOI.

Table 5.17 Marina's students' preferred MOI for Science in secondary education

Science MOI in primary school	Number of students and their preferred MOI (The higher the number, the more English they prefer) 1= Only Malay is used in class 10= Only English is used in class									
	Malay as MOI			Bilingual as MOI			English as MOI			
	1	2	3	4	5	6	7	8	9	10
English			1		2	2	1		5	9
Malay			1	1						
Mandarin							1			2
Tamil					1					

The student who received primary Science education in English yet still prefer to have Malay as MOI in current Science lesson has Malay as his/her first language at home. The reasons for such a preference is because he/she believes that with more Malay being used in the class, it helps him/her to understand the teacher better and also to pay attention in class. In fact, he/she comments that the current use of 2 languages by Marina actually confuses him/her a little. These reasons justify why he/she prefers to have more Malay in class and very minimal of English.

It is interesting to find that despite most (18 out of 26) students' preference is to learn science in English MOI, Marina uses English only in the 36% of the lesson, which includes the English-medium text that she reads or key content words that she chooses to say in English. This means that her use of English for facilitating understanding or even classroom management is very minimal. This is probably the reason that causes 19 students to express that they sometimes get confused during the lesson because of the amount of Malay being used in class.

5.3.2 BMI-2 Shahrul's Lesson

Shahrul's first language is Malay and he has been teaching for the past 6 years. At the time of this research, he was teaching in the same school as Marina. Therefore the same school policy applies to him as well – better performing classes are taught using both Malay and English whilst lower performing classes are taught solely in Malay. This class that we observe Shahrul in is being taught bilingually.

The recording of Shahrul's lesson is taken from two lessons. Even though the first lesson observed and recorded was 1-hour lesson, Shahrul spent the first half of the lesson talking about an external assessment that the students were going to take soon. As this has nothing to do with the teaching of science, I have chosen to omit this part and use only the second half of the lesson. In order to have an hour's worth of data for the analysis, I have included another 40-minute lesson that took place on the next day.

5.3.2.1 Episode of Instruction

Throughout Shahrul's lesson, he uses English and Malay evenly, especially when making reference to the English-medium PowerPoint slides or textbook. Here is one of the examples:

Extract 30:

Turn	Role	Transcript
1.	T:	OK, class, you have learnt in chapter 4 that air is one of the resources on earth. K, udara merupakan salah satu sumber in permukaan bumi yang penting kepada kita la. (Okay, air is one of the most important resources on earth to us.) ² It is needed to sustain life, ³ diperlukan untuk meneruskan kehidupan kita (it is necessary for us to carry on living), ⁴ and then air is all around us. ⁵ Sekarang ni, awak duduk dalam makmal ni, ada udara ke tidak? (Now, you're sitting in this laboratory, has air or not?)
2.	SS:	Ada! (have)
3.	T:	Ah siapa kata tak ada udara? Sean? Ada udara ke tidak? (Ah, who said there is no air? SieLee? Has air or not?)
4.	S:	Ada. (has)
5.	T:	Ah kalau tak ada itu, maksudnya awak tak dapat nak bernafas. Ataupun menjalankan proses semula jadi awak. (Ah, if no, that means you're unable to breath. Or you're carrying out your natural process.) K, dah, dah bersedia ya? Dah tulis tajuk semua? (Okay, are all of you ready? Have you written your title?) OK, kelas, kita teruskan kepada yang pertama sekali sebelum tu kita lihat dulu (Okay class, let's go on to the very first part before looking at) ⁶ five point one ya. Look at your textbook 5.1 what is air made up of? K look at the learning outcomes there. ⁷ Cuba lihat pada bahagian hasil pembelajaran. (Try looking at the learning outcomes section.) ⁸ K by the end of this lesson, you should be able to, the first one, state what air is made up of? K, ⁹ apakah yang membina udara tersebut (Okay, what makes up the air), ¹⁰ and

	<p>then explain why air is a mixture? ¹¹Awak perlu nyatakan kenapa udara tu adalah suatu campuran.<i>(You need to state why air is a mixture.)</i> K ¹²and then state the average percentage of nitrogen, oxygen and carbon dioxide in air. ¹³Awak perlu juga nyatakan apakah er, peratusan purata bagi setiap kandungan udara k?<i>(You also need to state the average percentage of each composition, okay?)</i> Khususnya, ah, terdiri daripada gas la.<i>(Specifically, ah, it consists of gas.)</i> OK, ¹⁴our earth is surrounded by a layer of air called the atmosphere. ¹⁵Kalau awak lihat, sekarang ni awak berada di permukaan bumi dan juga terdapatnya udara yang meliputi permukaan bumi kita, yang kita panggil sebagai lapisan atmosfera.<i>(If you look, you're now on the surface of the earth and there is a layer of air that envelops our earth's surface. This is what we call the atmospheric layer.)</i></p>
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The above extract happens after Shahrul has spent around 25 minutes discussing with the students regarding an upcoming external assessment. Before starting with new topic, he wants to do a quick recap with his students. Therefore, starting from turn 1, Shahrul translates and paraphrases almost every sentence he says in English to Malay. He first translates ‘air is one of the resources on earth’ (1) followed by ‘it is needed to sustain life’ (3). And when he says ‘air is all around us’, instead of translating this statement, he asks his students a question in Malay (5) in order to check their understanding. The main reason for having a recap at the beginning of the lesson is to check students’ understanding and establish the background knowledge that they have learnt. Therefore, it is important that all the students are clear and reminded of what they have learnt in the previous lesson. This is the main reason these shifts are made in turn 1.

Turn 5 of Extract 30 (shown above) starts with Shahrul speaking in Malay and checking if the students are ready for the lesson. The shift happens when Shahrul wants to bring his students’ attention to the textbook and to look at ‘section 5.1’ (6). Although Shahrul does not switch to Malay after his first request (for students to look at the textbook) is made, he translates his second request – ‘to look at the learning outcomes’ (7) and all the rest of his speech in turn 4 from English to Malay. Table 5.19 below shows us how every time after Shahrul says something in English (in the left column) he either translates to or paraphrases in Malay immediately after it. From the content of his speech, it can be understood that Shahrul is giving an overview to his students on what they will achieve by the end of this lesson. Therefore, we also understand why he has to translate or paraphrase these items to his students – so that the students are able to pay attention and grasp the important points for today’s lesson.

Table 5.18 Abstract 30 Turn 5

<p>Ah kalau tak ada itu, maksudnya awak tak dapat nak bernafas. Ataupun menjalankan proses semula jadi awak.K, dah, dah bersedia ya? Dah tulis tajuk semua? OK, kelas, kita teruskan kepada yang pertama sekali sebelum tu kita lihat dulu five point one ya.<i>Ah, if no, that means you're unable to breath. Or you're carrying out your natural process. K, are all of you ready? Have you written your title? OK class, let's go on to the very first part before looking at five point one.)</i> Look at your textbook 5.1 what is air made up of?</p>	
<p>K look at the learning outcomes there.</p>	<p>Cuba lihat pada bahagian hasil pembelajaran.<i>(Try looking at the learning outcomes section.)</i></p>
<p>K by the end of this lesson, you should be able to, the first one, state what air is made up of?</p>	<p>K, apakah yang membina udara tersebut <i>(Okay, what makes up the air),</i></p>
<p>and then explain why air is a mixture?</p>	<p>Awak perlu nyatakan kenapa udara tu adalah suatu campuran.<i>(You need to state why air is a mixture.)</i></p>
<p>K and then state the average percentage of nitrogen, oxygen and carbon dioxide in air.</p>	<p>Awak perlu juga nyatakan apakah er, peratusan purata bagi setiap kandungan udara k?<i>(You also need to state the average percentage of each composition, okay?)</i>Khususnya, ah, terdiri daripada gas la.<i>(Specifically, ah, it consists of gas.)</i></p>
<p>OK, our earth is surrounded by a layer of air called the atmosphere.</p>	<p>Kalau awak lihat, sekarang ni awak berada di permukaan bumi dan juga terdapatnya udara yang meliputi permukaan bumi kita, yang kita panggil sebagai lapisan atmosfera.<i>(If you look, you're now on the surface of the earth and there is a layer of air that envelops our earth's surface. This is what we call the atmospheric layer.)</i></p>

During Shahrul's teaching, the main function is to transmit content knowledge to his students. Therefore, besides the above shifts of language which play a role in explaining and emphasising today's lesson, Shahrul does change language in order to explain key scientific terms to his students as well. Such examples can be seen in Extract 31.

Extract 31:

Turn	Role	Transcript
10.	S:	Sinaran UV <i>(UV ray)</i>
11.	T:	Ah, yang kita panggil sebagai sinaran UV, <i>(Ah, that is what we call UV rays),</i> k, ¹⁶ ultraviolet. ¹⁷ Kenapa? Awak pegang tu kenapa? Tak kenal sinaran

		UV ke? (<i>Why? Why are you holding that? You don't know what are UV rays?</i>) OK, ¹⁸ air is colourless. ¹⁹ Udara ni adalah tidak berwarna (<i>Air is colourless.</i>) Awak nampak ada warna ke? (<i>Do you see any colour?</i>)
12.	SS:	Tak (<i>no</i>).
13.	T:	K, kadang warna hijau, kadang warna kelabu, itu adalah daripada cahaya ok? (<i>Okay, sometimes it is green, sometimes grey, that is due to light okay?</i>) ²⁰ And then no colour, tasteless, ²¹ tidak ada rasa (<i>tasteless</i>) ²² and odourless, ²³ tidak ada bau (<i>odourless</i>). ²⁴ We cannot see air but we can feel it. When it moves as wind. K, ²⁵kita tak ada, kita tak nampak udara tu. (<i>Okay, we don't have, we don't see the air.</i>) Nampak ke? Nampak? (<i>Do you see it? Can you see it?</i>)
14.	SS:	Tak (<i>no</i>).
15.	T:	Ya, tapi kita boleh rasa, rasa dekat mana? (<i>Yes, but we can feel it. Where can we feel it?</i>) Bukan rasa dengan lidah (<i>Not using your tongue</i>)
16.	S:	Skin!
17.	T:	ah, pada permukaan kulit kita (<i>on the surface of our skin</i>). K kita dapat rasa tiupan angin, ok? (<i>Okay, we can feel the wind blowing, okay?</i>) Itu adalah daripada udara. (<i>That is from air.</i>) OK, ²⁶ can I proceed?
18.	SS:	No.

In turn 10 of the above extract, a student talks about UV ray in Malay. After acknowledging the student's answer, Shahrul translates the term 'sinaran UV' to 'ultraviolet' (16). The function of such a switch is to help his students learn the English scientific term. This is a way to facilitate the students' understanding of 'sinaran UV'. Then he switches his language back to Malay when a student catches his attention. The switch here is for Shahrul to shift his attention from whole class to an individual student.

In second part of turn 11 and turn 13, we notice a recurring pattern where Shahrul states the important characteristics of air in English, translates to Malay right after and then check his students' understanding by asking a question in Malay. On (18), Shahrul reads from the slide that 'air is colourless' and then he translates to Malay immediately (19). Followed by that, he asks a question in Malay to check his students' understanding. In turn 13, he continues reading from the slides (20, 22, 24) and also translating/paraphrasing his reading to Malay in (21, 23, 25). He then states in English that air is tasteless, odourless and something that we cannot see but can feel. Each of these characteristics is followed by a direct translation before he asks a question in Malay to check his students' understanding again.

One very interesting CS instance in this extract happens in turns 16 and 17. In turn 16, a student shouts out the correct answer in English to Shahrul's Malay question in turn 15. However, when acknowledging the student's answer, Shahrul does not repeat the

word ‘skin’. Instead, he responds in Malay and provides a direct translation to ‘skin’ in Malay – **permukaan kulit**. It is uncertain as to why Shahrul does not reply in English as we thought this would be an important term for the students to know. The only explanation we have for this is that Shahrul is actually in the middle of his elaboration which he has started off in Malay and the student has interrupted the explanation when he shouts out ‘skin’ suddenly. Therefore, similar to the beginning of turn 13, he continues his explanation in Malay rather than shifting to English. Therefore, if we look at this extract, we learn that Shahrul’s teaching pattern is this:

scientific statement + translation / paraphrase + further elaboration
(in English) (in Malay) (in Malay)

Finally, in turn 17, Shahrul switches to English on (26) to get his students attention so that he can proceed with his lesson. Instead of just teaching at the front of the class, Shahrul frequently asks questions to his students and encourages them to respond. Here is one of the examples.

Extract 32:

Turn	Role	Transcript
25.	T:	OK, for the first box there at your left, ²⁷ pada bahagian kiri awak (<i>on your left</i>), siapa yang boleh bagi saya, k udara terdiri daripada apa (<i>who can tell me what is air made up of</i>)? Yang pertama sekali (<i>The first</i>).
26.	SS:	((Some students shout ‘carbon dioxide’ some say ‘oxygen’, simultaneously))
27.	T:	²⁸ Main.
28.	SS:	Oxygen.
29.	T:	²⁹ Yang utama sekali. (<i>the most important.</i>)
30.	SS:	Oxygen!
31.	T:	Terdiri daripada yes, oxygen tu apa? (<i>Made up of, yes, what is oxygen?</i>)
32.	S:	(??)
33.	T:	Pandai. (<i>Clever.</i>) Oxygen lagi apa lagi? (<i>Oxygen and what else?</i>)
34.	SS:	Nitrogen.
35.	T:	Nitrogen, lagi (<i>some more</i>)?
36.	SS:	Carbon dioxide.
37.	T:	Carbon dioksida lagi? (<i>Carbon dioxide, and?</i>)
38.	SS:	Inert gases!
39.	T:	Inert gases itu semua apa benda? (<i>What are those inert gases?</i>) Hah? Kan tu jatuh. Apa dia? (<i>What? Look, that fell. What is that?</i>)

In the above extract, after getting students’ attention (to look at ‘first box there at your left’) in English, Shahrul translates his instruction to Malay (27) and then continues asking his students questions in Malay in order to elicit their response. However, when students give different answers in turn 26, Shahrul thinks that they might not have understood the question and so, switches to English to emphasise the key word

of the question, the ‘main’ gas in the air (28). As soon as he says that, some students then shout out the answer ‘oxygen’. Perhaps he senses that there are still some uncertainties amongst the students, he then translates ‘main’ into ‘**yang utama sekali**’ in turn 29 in hope that every student understands exactly what is he asking. This proves to be a good strategy as all the students then shout out the correct answer together in turn 30. Once they have all established that oxygen is the main gas in the air, Shahrul proceeds with the lesson by asking them what other gases are there in the air. He does so in Malay in turns 33, 35 and 37 by repeating the Malay word **lagi** which means ‘what else’.

In this extract, we also see how Shahrul uses Malay word **pandai** when giving compliments to his students in turns 33 and 39. We mentioned in the teachers that we have discussed earlier, many of them tend to switch to Malay when expressing their disapproval or dissatisfaction on students’ action or behaviour. This is because Malay is the first language to most of the teachers, hence, it is frequently chosen to express their feelings. Thus, the same applies here. Shahrul is certainly happy at this point that the students are able to give the correct answers. Therefore, he switches to Malay when complimenting his students.

Extract 33:

Turn	Role	Transcript
97.	T:	Sorry? yes. inert gasses consist of argon, krypton ³⁰ lagi (<i>what else</i>)? Helium, and neon? Lagi (<i>what else</i>)? ³¹ Saya minta awak semalam apa (<i>what did I request yesterday</i>)? Ni tak catat lah ni (<i>didn't take note</i>). Ha! Sepatutnya awak catat (<i>you were supposed to note it</i>). Saya minta cari apa Afif (<i>what did I ask you to search for Afif</i>)?
98.	S1:	Ha?
99.	T:	Saya minta cari apa (<i>what did I ask to search</i>)?
100.	S1:	Kegunaan argon (<i>uses of argon</i>).
101.	T:	Ha, kegunaan gas-gas nadir tu (<i>the uses of the inert gases</i>). Antara satu lah yang awak boleh berikan kepada saya (<i>one of those that you can give me</i>). Apa (<i>what</i>)? Ha apa (<i>what</i>) Shapnam? Semua tak boleh (<i>all cannot</i>).
102.	S2:	Ok teacher if it's wrong then (???)
103.	T:	Ha, ³² never mind, you can try.
104.	S2:	Ok, I think helium, helium is used for filling (?) balloon and it is a much safer gas and it is inflammable.
105.	T:	Ok very good Shapnam. OK, ³³ tadi Shapnam kata apa (<i>what did Shapnam just say</i>)? Helium. Dia bagi contoh kegunaan gas helium (<i>he gave example of uses of helium gas</i>). K apa kegunaan dia (<i>what is its use</i>)? Untuk diisi ke dalam belon (<i>to be filled into ballon</i>). Digunakan dalam belon, untuk apa (<i>to be used in ballon, what for</i>)? Maksud saya awak beli belon dekat pasaraya tu kan, yang dia terapung , dia naik, sebab apa gas helium ni sangat ringan dan berketumpatan rendah berbanding dengan oksigen (<i>I mean when you buy ballon at the supermarket, the ones that float, it rises, because of gas helium is very light and its density is lower as compared to oxygen</i>). Ok ³⁴ other uses of

		helium gas? ³⁵ Apa kegunaan lain (<i>what are other uses</i>)? Siapa boleh bagi saya (<i>who can give me</i>)? Takde (<i>no</i>)? Ha ni lambat ni kenapa (<i>ha this is late, why</i>)?
106.	SS:	Solat (<i>prayer</i>).
107.	T:	Alhamdulillah. Heh solat, tapi awak kena tepati masa. Betul atau tidak (<i>Heh prayer. But you must be on time. Correct or not</i>)?
108.	SS:	Ye betul cikgu, tepat sekali (<i>correct teacher, exactly</i>).

Prior to turn 97, Shahrul has been trying to elicit response from his students regarding the uses of inert gases that he had requested them to find out the previous day. However, students are not responsive to this and through my observation, I notice there is a change of mood in Shahrul. He is now getting a little annoyed as his students do not seem to have completed the task that he had requested the day before. So in turn 97, Shahrul switches from English to Malay in order to encourage his students and elicit response from them (30). He then complains in Malay about how the students have not taken the note of the task given yesterday.

An interesting switch happens when Shapnam volunteers to answer in turn 102 yet is afraid that his answer may be wrong. Shahrul has previously been seen speaking in Malay frequently when talking to individual students. However, on this occasion, he switches to English in (32) in order to encourage Shapnam to give it a try and then compliments Shapnam in English in turn 105. An explanation for this difference is that Shahrul has been using Malay to express his negative feelings in the preceding turns. Hence, when a student volunteers to answer, he needs to separate the negative feeling from the encouragement that he wants to give to Shapnam. Therefore, there is a switch in the language when he encourages and compliments Shapnam. On (33), he switches to Malay in order to shift his attention back to the whole class and to get the students' attention on what has been said by Shapnam earlier. He then continues in Malay to explain the uses of helium gas. On (34), he switches to English to elicit response from his students and switches back to Malay immediately to repeat the question (35). This is seen as his way of encouraging and eliciting response from his students.

5.3.2.2 Shahrul's Use of 2 Languages in Episode of Instruction

Within Shahrul's 1-hour of episode of instruction, his distribution of English and Malay is very similar to Marina's. For Shahrul, approximately 64.37% of the words

he has spoken are in Malay and the other 35.63% are in English. This shows that despite teaching in a bilingual classroom, Shahrul does not use both Malay and English equally. In fact, he uses Malay much more than English during his teaching. The following table shows the different functions of Malay and English being used in Shahrul's lesson.

Table 5.19 Functions of switches identified in Shahrul's episode of instruction

Function	Instance number of switch to Malay	Instance number of switch to English
Reading from the text		2, 4, 6, 8, 10, 12, 14, 18, 20, 22, 24
To encourage students	30, 35	32
To give instruction	27	
To get attention	33	8, 26
To elicit students' response	30, 35	34
To admonish	31	
To check understanding	5	
To facilitate students' understanding	1, 3, 7, 9, 11, 13, 15, 19, 21, 23, 25	16
To shift attention from whole class to individual student	17, 33	
To emphasise	29	28

Table 5.19 above shows that within analysed extracts, Shahrul switches to Malay primarily to facilitate students' understanding and he switches to English mainly when he reads from the text (either in PowerPoint slides or textbooks).

5.3.2.3 Shahrul's Students' Views on Classroom Code-switching

Within the 24 students in his classroom, almost 50% of the students (11 out of 24) speak Mandarin as their first language and 9 of these students have learnt Science in Mandarin during their primary education (the other 2 students speak English as their first language). The table below shows Shahrul's students' language background.

Table 5.20 Shahrul's students' language background

	First language at home				MOI for science in primary school		
	Malay	English	Mandarin	Tamil	Malay	English	Mandarin
No. of students	7	4	11	2	8	5	11

As almost half of the class come from Chinese background, it is assumed that these students might face problems when the MOI is changed to one that they are not familiar with. The following Table 5.21 shows Farid's students' preference of MOI for their science lessons.

Table 5.21 Shahrul's students' preferred MOI for Science in secondary education

Science MOI in primary school	Number of students and their preferred MOI (The higher the number, the more English they prefer) 1= Only Malay is used in class 10= Only English is used in class									
	Malay as MOI			Bilingual as MOI			English as MOI			
	1	2	3	4	5	6	7	8	9	10
English						1	2	1	1	1
Malay					4	1	1			1
Mandarin					2	3			2	4

It is interesting to learn that 11 students who have learnt Science in Mandarin during their primary education now have different and quite a contrast preference in the MOI for secondary Science lessons. 5 of these students prefer to have a balance distribution of English and Malay as MOI whereas 6 of them prefer to have more English and less Malay as MOI in class.

The 4 students who prefer English-only MOI have all explained that such an arrangement can help them understand the teacher better and also improve their English language. It is unsure why these students who have not learnt Science in English before and do not speak English as their first language express their preference for an all-English Science classroom. There are a few possible reasons to explain this:

- 1) The exposure to English language through reading materials, entertainment, and tuition classes readily available in urban area

- 2) Their unfamiliarity with the Malay language. Although Malay is the National language, it does not necessarily mean everyone is proficient in it and confident to learn Science in Malay

The other 5 students who learnt Science in Mandarin and now prefer a bilingual Science classroom have expressed that such classroom not only helps them to understand the teacher better and to pay attention in the class, but also improves their English. It is very surprising to learn that all of them think a bilingual Science lesson helps to develop their English language skill but only 1 student thinks that such arrangement helps to improve his/her Malay as well. Once again, this shed lights on students' expectation in EMI and BMI Science classroom. Besides gaining scientific knowledge, they also view it as a way to improve their language skills, especially in English.

5.3.3 BMI-3: Amina's lesson

Amina is the teacher with the longest teaching experience in this study. She has been teaching for 23 years and has experienced both language policy changes in year 2003 and 2011. Through our interview, she admitted that having Malay as her first language and being educated in Malay during her undergraduate years made it difficult for her to teach Science in English when the English for Mathematics and Science (ETeMS) policy was implemented in 2003. She commented that the most challenging part of the change was adapting to the scientific terminology in English. Based on her experience and the complaints received from her students that they had difficulty understanding her teaching in the EMI period, she thought the best solution is to teach the subject bilingually. Nonetheless, the English-medium textbook should still be used because English is still the main language in the scientific field.

All of Amina's lessons were conducted in the Science laboratory. Instead of PowerPoint presentations, Amina used English-written transparency slides and an English-medium textbook in the class. Within the lesson that I observed, both, episode of assessment and episode of experiment occurred. I will now analyse how English and Malay were used in these episodes during Amina's lesson.

5.3.3.1 Episode of Experiment

After doing a short recap with her students (not shown in extract), Amina conducts the first experiment of today's lesson with her students. Before she lets her students to carry out the experiment by themselves, she goes through the experiment procedure with them and this is shown in Extract 34.

Extract 34:

Turn	Role	Transcript
11.	T:	<p>Kita ada satu eksperimen(<i>we have one experiment</i>). Ok, sebelum membuat eksperimen(<i>before doing experiment</i>), kita tengok ini dulu (<i>we look at this first</i>). ¹To show the percentage of oxygen in the air. K, so ²kita ada(<i>we have</i>)³candle, ⁴kita ada(<i>we have</i>) (?), kita ada(<i>we have</i>) (?) ⁵and water. K, this one, at the beginning of the experiment, k, this one after the experiment (??). OK, variable, control variable volume of air, (?) ⁶sama ya, dua-dua sama sais(<i>same alright, both are same size</i>), ⁷k and then second manipulated candle flame, candle flame ok, ⁸sama ada menyala(<i>whether it's also lighted</i>), ⁹second, ¹⁰ia padam(<i>it's extinguished</i>), ¹¹then ¹²selepas padam kamu tengok apa berlaku kepada(<i>after it's extinguished you look at what happen to</i>) ¹³water level. Rises or drop? Ok, procedure, set up the apparatus as shown in the figure. Ok, second, light the candle (??) third, observe what happen after that. (??) K ¹⁴ambil besin ni, isikan air, (<i>take this basin, fill in water</i>) ¹⁵fill up water until the water level ¹⁶sampai palang ni(<i>reaches this level</i>). Ok? Sikit mesti naik. (<i>a bit of it must rise</i>) (??) ¹⁷I give you ten minutes. K? ((Students getting all materials needed for the experiment)). K, switch off the fan. ((Students work together in groups)) ¹⁸Cepat, cepat, jangan main. Panas.(<i>Quick, quick, don't play. Hot.</i>) Eh, siapa ¹⁹move ²⁰ke sana(<i>who move there</i>)? Duduk kat meja awak(<i>Sit at your desk</i>). Gunting (?) macam mana boleh berlaku(<i>cut ? how can that happen</i>)? (students should cut the candle for the tip). Satu per lima saya nak(<i>One fifth I want</i>). ((Teacher going around to the different groups. Giving instructions and correcting them in Malay. Students speak Malay to teacher all the time.)) ((About 3 minutes later)) Ini kemas semua(<i>tidy up all these</i>). Cepat sikit(<i>hurry up</i>). (...) Kenapa awak ganggu orang punya eksperimen(<i>why do you disturb other's experiment</i>)? (...)</p>

Amina starts off by speaking in Malay and getting her students' attention to look at the transparency slide projected in front. The slide is in English and it details the experiment procedure that they are about to do. Her first switch happens when she switches to English in order to read the title of the experiment – (1) 'to show the percentage of oxygen in the air'. This switch is seen to have the function of making a reference to the teaching material. Then, while explaining the apparatus and materials they have for the experiment, she switches three times (instances 2, 3, 4) into Malay saying '**kita ada** (*we have*)' but continues in English for the noun that follows after e.g. candle. However, the second and third nouns are not intelligible. It can be explained here that the use of Malay to say '**kita ada** (*we have*)' is to get all the

students' attention, to make sure that they are aware of what equipment is needed for the experiment. As for switches 3 and 5, although 'candle' and 'water' are not specific nouns for items that can only be found in the scientific genre, they are however, very much related to the Science content that the students are learning at the moment. Hence, such a switch to English can be explained because it is a content-specific noun. She then switches to Malay (instance 6) to give emphasis to the fact that 'both are the same size'.

In instance 7, Amina switches back to English in order to refer to the text shown on the transparency slide '...second manipulated candle...' She then switches to Malay (instances 8 and 10) to provide further information regarding the candle flame '**sama ada menyala** (*whether it's lighted*)' and '**ia padam** (*it extinguished*)'. Linking instances 8 and 10 is a switch to English 'second' but it is hard to explain what its function is. Instance 11 indicates a switch to English where 'then' links to the next step that the students should pay attention to. As it is important for the students to know what the main purpose of this experiment is, Amina switches to Malay (instance 12) in order to get all her students' attention on what is it that they should observe during the experiment. However, she switches to English (13) mid-clause and says 'water level, rises or drop?' I believe that as soon as she catches her students' attention on instance 12, Amina switches to English (13) because these are content-related words and therefore important for the science instruction. One of the questions students will need to answer in their experiment report is whether or not the water level rises at the end of the experiment. Therefore, instead of continuing her sentence in Malay, she gives a signal in English to the students expecting that their answer should either be 'water level rises' or 'water level drops'.

Amina then continues in English while explaining the procedure of the experiment. She summarises the three steps in English ('set up the apparatus...second, light the candle...third, observe what happen after that'). She then shifts to Malay (14) to give instruction, using imperative verbs like '**ambil** (*take*)' and '**isikan** (*fill it*)' to signal students to get the basin and fill it up with water. She repeats her instruction in English (15) before she further stresses in Malay (16) that the water should '**sampai palang ini** (*reaches this level*)'. Amina switches to English (17) to inform the students that she is giving them 10 minutes to complete the experiment. This switch

has the function of signalling a change of footing where the teacher has now finished giving instructions and the students can now get started with their experiment.

At this point, Amina has left the voice recorder on her desk, while she paces around the laboratory to check on her students' progress. Therefore, the interaction between Amina and her students is not fully intelligible from this point of the extract. Despite this, we can still see Amina using Malay when she admonishes her students (18), making sure that they focus while conducting the experiment and are careful with any hot materials. She also stresses in Malay saying what kind of outcome she is expecting them to achieve – '**satu per lima saya nak**' (*one fifth I want*). At the end of the experiment, she continues giving instruction in Malay and getting the students to clear up the table quickly by remaining in Malay.

In Extract 35 (as shown below), Amina is preparing her students for the experiment which studies the properties of oxygen and carbon dioxide.

Extract 35

Turn	Role	Transcript
89.	T:	Ok awak tengok (<i>you look</i>), ²¹ turn to page 56. Ok listen. 56. To show the properties of oxygen and carbon dioxide, ok ²² ini yang (<i>this is that</i>) ²³ you ²⁴ kena buat lepas ni (<i>need to do after this</i>). (??) Ok ²⁵ first, ok follow ²⁶ dia punya (<i>its</i>) ²⁷ procedure 5.5. Place the (?) with water. Fill a basin with water. ²⁸ Pakai besen je (<i>use the basin only</i>). Faham tak (<i>understand or not</i>)?
90.	SS:	Faham (<i>understand</i>)!
91.	T:	Ok, ²⁹ second remove the stopper of the test tube contain oxygen, ³⁰ yang ada getah ini adalah gas apa (<i>the one with rubber is what gas</i>)?
92.	SS:	Carbon dioxide.
93.	T:	OK. Ini ialah oksigen (<i>this is oxygen</i>). Jangan biar buka je benda ni (<i>don't just let it open</i>). Gas akan keluar lah (<i>gas will come out lah-interjection</i>), sebab dalam ni ada gas (<i>because there's gas in it</i>). Faham tak (<i>understand or not</i>)? Ok? Ok ³¹ remove and then ³² kamu dah (<i>you already</i>) ³³ remove ³⁴ kamu masuk ke dalam air (<i>you place it into the water</i>). Sebelum tu kamu kena (<i>before that you have to</i>) (?) dengan air (<i>with water</i>). Faham tak (<i>understand or not</i>)? Sampai (<i>until</i>), ³⁵ until 200ml. ³⁶ Boleh (<i>can</i>)? Ok. Buka terus masukkan ke dalam air ³⁷ and then ³⁸ kamu goncangkan (<i>Open and straight away place it in the water and then you shake it</i>). Goncang sikit (<i>shake a little</i>). Masukkan ke dalam air dan goncang (<i>place into the water and shake</i>). ³⁹ Very simple ⁴⁰ je punya eksperimen (<i>only + possessive word experiment</i>). Ok kamu tengok (<i>you look</i>) ⁴¹ you ⁴² punya (<i>possessive word</i>) ⁴³ water level ⁴⁴ naik ke tak (<i>rises or not</i>). Ok ⁴⁵ second, ⁴⁶ tadi (<i>just now</i>) ⁴⁷ you ⁴⁸ guna oksigen (<i>use oxygen</i>), ⁴⁹ second one you ⁵⁰ guna gas (<i>use gas</i>) ⁵¹ carbon dioxide, ⁵² sama je cara dia (<i>the method is just the same</i>), ⁵³ to compare. K ⁵⁴ kalau teori kita dah buat kita tahu (<i>if we make the theory we already know</i>) ⁵⁵ both are slightly soluble in water. So water level rises a little bit. Ok and then ⁵⁶ kamu tak perlu gunakan (<i>you don't need to use</i>) ⁵⁷ nitrogen hydroxide mixture because ⁵⁸ dia punya larutan ini sangat (<i>its mixture is very</i>)?
94.	S:	Cair (<i>soluble</i>).

In Extract 35 turn 89, Amina first uses Malay – ‘**awak tengok** (*you look*)’ to get her students’ attention and then the first switch happens when she instructs them to ‘turn to page 56’ of the workbook. She then continues in English to read out the title of the experiment – ‘to show the properties of oxygen and carbon dioxide’. She switches to Malay (22) to get her students’ attention but switches immediately to English for personal pronoun ‘you’ during mid-clause before switching back to Malay (24) to bring her students’ attention to what they are about to do. She switches to English on 25 and uses an imperative verb ‘follow’ to instruct her students but again, she switches mid-clause to Malay for possessive word ‘**dia punya** (*its*)’ before continuing her instruction in English again (27). On 28, she switches to Malay in order to repeat the previous instruction which has been said in English. This shows that the switch serves to emphasise the previous point made.

At the beginning of turn 91, she switches to English (29) (she has been talking in Malay towards the end of her previous turn) to read the procedure from the workbook and then she switches to Malay to point her students’ attention to the test tube with rubber that she is holding (observed and recorded as field notes). By switching to Malay (30), Amina not only manages to catch her students’ attention to the test tube, she is also able to elicit response from her students. This is one example of how a switch can have more than one function.

Amina continues speaking in Malay from the end of turn 91 into turn 92. She switches to English on (31) where she uses an imperative verb ‘remove’ to give instruction to her students. However, this instruction is interrupted with the switch to Malay ‘**kamu dah** (*you already*)’ on (32) where she emphasises the ‘remove’ by switching back to English on instance 33 before giving further instruction in Malay on (34) – ‘**kamu masuk ke dalam air** (*you place it into the water*)’. On (35), ‘until’ is a translation to the preceding word ‘**sampai**’ uttered and the function of this switch from Malay to English is to give further information on how much water the students should fill the basin with. She then switches to Malay in order to check her students’ understanding on (36) by asking ‘**boleh** (*can*)?’

The function of the switch (37) is not clear but the conjunctive phrase ‘and then’ can be seen as a form of linking words joining the two instructions given in Malay before

and after this instance. After giving much of the instruction in Malay on (38), Amina switches to English on (39) to express that the experiment is ‘very simple’. This is a way to encourage her students so that they do not get too nervous about the experiment that they are about to do.

Following that once again, Amina switches to Malay for the use of the possessive word ‘**punya**(‘s)’ on (40). A similar switch happens again (42) right after she uses English personal pronoun ‘you’ (41). When she refers to content-related words ‘water level’, she switches to English but back to Malay immediately to emphasise that the main objective of the experiment is to see whether the water level ‘**naik ke tak** (*rises or not*)’. She switches to English briefly on (45) to bring her students’ attention to the next step. But before she continues with the next step, she does a brief recap in Malay (instances 46 and 48) ‘**tadi** you **guna oksigen** (*just now you use oxygen*)’ (with a brief switch to English for personal pronoun ‘you’ on instance 47). Then on (49) she once again signals the students of the next step in English – ‘second one you’ before giving the instruction in Malay on instance 50 – ‘**guna gas** (*use gas*)’. Although the word ‘carbon’ is one of the homophones that I discussed in the exceptions for analysis (see section 4.5.3), it is not spelt as ‘**karbon**’ and be treated as part of instance 30 because ‘carbon dioxide’ on (51) is a noun phrase by itself. As Amina uses ‘dioxide’ instead of ‘**dioksida**’ in Malay, it is certain that the word ‘carbon’ is also in English and not Malay. Such a switch has the function of referring to content-related words.

A switch to Malay happens on (52) because Amina wants to encourage her students that although there are two experiments (one for oxygen and the other for carbon dioxide), the steps are the same – ‘**sama je cara dia** (*the method is just the same*)’, so that the students will not feel burdened by the amount of work they need to do. She switches to English to provide further information regarding the purpose of conducting these two experiments, which is ‘to compare’. Amina then switches to Malay on (54) to do a brief recap with her students, reminding them of the theory that they have learnt but switches to English on (55) to state exactly what the theory is – ‘both are slightly soluble in water’. This theory is expressed in English because it is related to the content that they are currently learning. Lastly, Amina switches to Malay on (56) to give instruction, stating that the students can omit the experiment –

‘**kamu tak perlu gunakan** (*you don't need to use*)’, which requires ‘nitrogen hydroxide mixture’ (switched to English on (57) because these are content related words) and then switches back to Malay to warn the students by giving further information and saying that the mixture is ‘**bahaya** (*dangerous*)’ (58).

To summarise, the functions of switches to either English or Malay for Amina’s episode of experiment are shown in Table 5.22 below.

Table 5.22 Functions of switches identified in Amina's episode of experiment

Function	Instance number of switch to Malay	Instance number of switch to English
Reading from the text		1, 7, 29
Getting students’ attention	2, 4, 12, 22, 24	45, 49
Using content related words		3, 5, 13, 43, 51, 55, 57
Giving emphasis	6, 10, 16, 28, 32, 44, 50	33
Providing further information	8, 10, 58	35, 53
Linking word		11, 37
Giving instruction	14, 34, 38, 56	15, 21, 25, 27, 31
Signaling a change of footing		17
Admonishing students	18, 20	
Elicit students’ response	30	
Check understanding	28, 30, 36	
Encourage students	52	39
Give recap	46, 48, 54	
Personal pronoun ‘you’		23, 41, 47
Possessive word ‘ punya ’	26, 40, 42	
Unknown		9, 19

After combining the data from Extracts 34 and 35 in the Table 5.22 above, we can safely conclude that during episode of experiment, Amina uses English primarily when she is using content related words followed by giving instruction. She uses Malay mainly for emphasising a point and getting students’ attention.

5.3.3.2 Episode of Assessment

Different teachers conduct their assessment in different ways: Su Ling informs her students about an upcoming assessment so that they can prepare for it at home and

during the assessment time, she would have minimal interaction with her students. Similarly, Marina allows her students to prepare for the assessment at home and she does not interact with her students during the completion of the test. As for Amina, she does the assessment in a more spontaneous way. She does not inform her students regarding the test beforehand, i.e. students do not get the opportunity to study at home, but she gives them a few minutes to study just before the test. During the assessment time, she has minimal interaction with her students.

Extract 36

Turn	Role	Transcript
11.	T:	OK, sekarang kamu buat kamu punya PBS (<i>now you do your PBS</i>). OK, sebelum itu kamu ¹ refer ² kepada (<i>before that you refer to</i>) ³ textbook, ok, page, turn page twenty. OK first step, you must read the procedure. K, one two three four and then you make the conclusion, what you observed just now. OK? That procedure, ⁴ langkah-langkah, ada empat langkah (<i>steps, there are four steps</i>), k? ⁵ Last ⁶ sekali (<i>very</i>), kamu buat (<i>you make</i>) ⁷ conclusion, conclusion ⁸ yang nombor tiga tu (<i>the number three</i>), yang ⁹ last ¹⁰ sekali (<i>the very last one</i>). ¹¹ Conclusion that you make from the observation, ¹² tolong baca ya (<i>please read alright</i>), (??) ¹³ is supported by ¹⁴ apagas (<i>what gas</i>)? Ya oksigen (<i>yes oxygen</i>), ¹⁵ so the flame of the candle goes off, means all the oxygen has been used up. So the water level rises one? One? One fifth. Not one five. One fifth. ¹⁶ Faham tak (<i>understand or not</i>)? Satu per lima (<i>one fifth</i>). ¹⁷ One fifth of the air space in the gas jar. K, it shows the percentage of oxygen in air is about? About twenty percent. Twenty percent. K? After that, (?) procedure and conclusion. K you ¹⁸ punya ni (<i>possessive word + this</i>), ¹⁹ you ²⁰ punya sangat ringkas (<i>possessive word + is very brief</i>). (??) K, ²¹ water level rises one fifth. K, ²² sudah ya (<i>done already</i>). K ²³ close your textbook. K write your name. ²⁴ Tutup buku ya (<i>close book alright</i>). ²⁵ Write today's date. ((students are given time to complete the PBS by themselves. The teacher was sitting in front of the class, waiting for them to complete it.)) K number one you write about setting up the apparatus. And show in the, the picture. Set up, the set up of it. ((School announcement through speaker made in Malay)) ((students continue completing the test)) ((about 5 minutes later)) ²⁶ Dah siap belum (<i>are you done</i>)?
12.	SS:	Belum (<i>not yet</i>). (??)
13.	T:	K dah siap belum (<i>are you done</i>)?
14.	SS:	Belum (<i>not yet</i>).
15.	T:	K ya, hantar (<i>alright, submit</i>). Siapa yang belum siap (<i>who is not done yet</i>)? K, hantar hantar (<i>submit submit</i>). K semua berhenti dan hantar, cepat (<i>everyone stops and submit, quick</i>). Tak mau lagi lama menunggu (<i>don't want to wait for long</i>). K semua hantar (<i>everyone submits</i>). Hantar dulu (<i>submit first</i>). OK. Hantar dulu (<i>submit first, quick</i>). Sudah habis ni (<i>this is already done</i>).

In turn 11 of Extract 36, Amina does a quick revision with her students before giving them some time to complete the assessment by themselves. The first switch happens when Amina requests her students to 'refer' to the textbook and turn to page 20. Therefore, (1) and (3) have a function of giving instructions to the students. A linking word (conjunction) is switched to Malay 'kepada (to)' on (2). On (4), 'langkah-

langkah (*steps*)’ is a translation to the previous word ‘procedure’ and combining with the next clause ‘**ada empat langkah** (*there are four steps*)’, it shows that Amina is trying to emphasise the point on the 4 steps and students should pay attention to this while doing their revision. Then she switches to English ‘last’ (5) to get the students’ attention for the emphasis that is happening with her switch to Malay (6). She switches to English (7) when she uses the content-related word ‘conclusion’ but switches back to Malay again to give further information regarding the ‘conclusion’ mentioned earlier. Besides giving further information on (8) regarding the ‘conclusion’, which says it is the number three ‘**yang nombor tiga tu** (*the number three*)’, Amina gives more information on (11). She instructs them that ‘conclusion’ consists of the inference from observation. Then on (12), Amina switches to Malay saying ‘**tolong baca ya** (*please read or write*)’. This switch has the function of giving her students instruction.

Following that, Amina switches to English on (13) to read from the text ‘is supported by’ but she switches to Malay on (14) in order to elicit response from her students by asking ‘**apa gas** (*what gas*)’. She once again switches to English to read from the text on (15). Then on (16), she switches to Malay in order to check her students’ understanding by asking ‘**faham tak** (*understand or not*)’. On (17), Amina translates from Malay to English in order to emphasise ‘one fifth’. This instance continues in English with her stressing that the percentage of oxygen in the air is about 20%. On (18), Amina switches to Malay for the possessive word ‘**punya** (*possessive word*)’ and back to English on (19) for the personal pronoun ‘you’. She switches again to Malay on (20) for the use of possessive word and what follows after ‘**sangat ringkas** (*very brief*)’ is to encourage her students, giving them confidence that the assessment is not difficult. This is another example where one instance of CS has 2 functions.

Amina switches to English (21) in order to stress for the last time, the point that ‘water level rises one fifth’. This point is emphasised many times because Amina is preparing her students for an English-medium assessment. Therefore, she will need to stress or hint at the answers in English so that the students are able to pick up the cues and study for the test accordingly. When she switches to Malay and says ‘**sudah ya** (*done alright*)’, she sends a signal to the students informing them that revision time is over and there is a change of footing now – they are starting the assessment now. She

then instructs her students in English for them to close their books. This instruction is repeated in Malay (24) in order to emphasise that they need to close the book now for the assessment. Further instruction is given on (25) where Amina requests her students to ‘write today’s date’. During the assessment, Amina has very minimal interaction with her students and they complete the test by themselves. About 5 minutes later, Amina asks her students in Malay ‘**dah siap belum** (*are you done*)?’ in order to check their progress. Towards the end of this episode in turn 15, Amina speaks in Malay while getting the students to finish and submit the test paper.

Extract 37 is another example of Amina’s episode of assessment but this time, she interacts a little with her students during the completion of the test.

Extract 37

Turn	Role	Transcript
79.	T:	Ok kita buat yang paling senang (<i>ok we do the easiest</i>). Yang tadi tak perlu sebab susah sangat (<i>don't need to do (the one mentioned) just now because it's too difficult</i>). Cikgu bagi yang (<i>teacher give you the</i>) ²⁷ composition of air, and then percentage. Ok, percentage of air. Oxygen how many percent? Carbon dioxide, inert gasses. Give examples of inert gasses. Page 49. Keep quiet, page 49 you can refer now. Ok, ²⁸ tiga minit (<i>three minutes</i>). ((Time given for students to revise for their PBS)) Ok dah (<i>done</i>). Tutup (<i>close</i>). Ok, ²⁹ close your textbook. Very simple. Band 2. ³⁰ Ini kamu boleh buat (<i>this you can do</i>). Dah mengantuk dah (<i>already feeling sleepy</i>)? Mesti tidur lambat (<i>must have slept late</i>)? ³¹ Ok write your name and date. Class. Very simple. (??) Three components. Gasses inert.
80.	S:	Teacher yang A tu (<i>the one in A</i>), yang inert gas tu boleh namakan yang xenon dan lain tu (<i>the inert gas can name those xenon and others</i>).
81.	T:	³² Apa (<i>what</i>)? A?
82.	S:	Ya (<i>yes</i>).
83.	T:	Ini tak perlu namakan (<i>this doesn't need to be named</i>). Itu (<i>that's</i>) ³³ component of the gas. (??) ³⁴ Yang tiga tu (<i>it's that three</i>). ³⁵ No, no need to write the name of the inert gasses. ³⁶ Faham ke tak (<i>understand or not</i>)? Gas apa (<i>what gas</i>)? Ok ³⁷ done, ³⁸ senang je (<i>easy only</i>). Tengok kat atas tu (<i>look at the above</i>). Itu pun tak tahu ke (<i>that also don't know</i>). Ok ketiga-tiga gas yang utama tu apa (<i>what are all the three important gases</i>)? Cepat (<i>quick</i>). Nak kena ni (<i>you</i>) going to get it (<i>from me</i>). ³⁹ Percent ⁴⁰ tu kamu dah tau kan gas apa (<i>you already know which gas it is</i>). Yang utama sekali gas apa (<i>the most important gas is what</i>)? Tak tahu gas pun kena (<i>don't know the gas will also get it (from me)</i>). Gas utama (<i>important gas</i>). ⁴¹ Three main gas. ⁴² Gas yang utama (<i>gas that's important</i>). Ok cepat sikit (<i>hurry up</i>). Ok ada dua lagi tugas (<i>there are two more gases</i>). Ok yang (<i>that</i>) B tu, Yazmeen, tolong fikir tiga komponen gas yang utama (<i>please help to think about three important components of gas</i>). Tengok yang utama (<i>look at the important</i>), ⁴³ main ⁴⁴ tu (<i>that</i>). Bukan yang paling baik, yang utama (<i>not the best, the main</i>). ⁴⁵ Be careful ⁴⁶ dengan soalan itu (<i>with that question</i>). ⁴⁷ Either inert gasses ⁴⁸ ataupun gas (<i>or gas</i>) ⁴⁹ carbon dioxide. ⁵⁰ Yang mana lebih utama (<i>which is more important</i>)?
84.	SS:	Inert gases.
85.	T:	Mana lebih utama (<i>which is more important</i>)? Kalau tidak adagas (<i>if don't have gas</i>) ⁵¹ carbon dioxide, ⁵² apa berlaku dengan tumbuhan itu (<i>what will happen to the plants</i>)?

86.	SS:	Mati (<i>die</i>).
87.	T:	Kalau tidak ada inert gas tu apa yang akan berlaku (<i>If there's no inert gas what will happen</i>)? Siapa yang mati (<i>who will die</i>)? Mana yang lebih penting (<i>which is more important</i>)?
88.	SS:	Carbon dioxide.
89.	T:	Mesti fikir ya, macam mana ni (<i>must think alrgiht, how can it be like this</i>). Ok ada dua lagi cepat (<i>there are two more</i>). Lagi lambat saya bagi lima lagi (<i>if you are slow I give five more</i>). Cepat (<i>quick</i>). Sebab minggu lepas kan cuti banyak (<i>because last week had a lot of holidays</i>). Ok. Cepat cepat cepat (<i>quick quick quick</i>).

Turn 79 starts off with Amina stating what they are going to do next in Malay. The first switch happens when she reads in English the title of the assessment ‘composition of air, and then percentage’. On (28), she switches to Malay to signal a change of footing by telling the students that they have ‘**tiga minit** (*three minutes*)’ to revise for their assessment. When the time is up, she gives instruction on (29) in English to request her students to ‘close your textbook’. Following that, she encourages her students by telling them that this test is manageable and she switches to Malay by saying ‘**ini kamu boleh buat** (*this you can do*)’. She switches to English on (31) to instruct her students to write their names and dates on the paper.

When a student speaks to her in Malay in turn 80, Amina responds to the student’s question on (32) in Malay. As she has earlier ended turn 79 in English, this switch to Malay is her effort to accommodate to the student’s proficiency in the chosen language, which is Malay. She is also closing her relationship gap with the student by interacting in the language of the student’s choice. She switches to English on (33) when using content-related words ‘components of the gas’. Although students’ voices are not intelligible at this point, I observed that students are going to the teacher individually while the test is ongoing. On instance (34), Amina is seen switching to Malay when giving her students a hint to the answer of the test. She has to do this subtly because after all this is still an assessment. Then on (35), assuming that another student asked her a question in English (which is unintelligible), Amina switches to English in reply to this student. Such switch can be seen as a way of her accommodating to her student’s language needs. She then switches to Malay on (36) to check her students’ understanding. Unfortunately for (37), it is unsure why Amina switches to English and says ‘done’. But she quickly switches back to Malay on (38) in order to encourage her students by saying that the test is very easy.

Amina switches to English on turn 13 when she uses the content-related word ‘percent’. Right after that, she switches to Malay to hint the students that they should know what the gas is based on the percentage given (40). Amina switches to English not only to emphasise the preceding point (made in Malay) but also to give further information (41). She emphasises this important point in Malay ‘**gas yang utama** (*gas that is important*)’ (42). On (43), we see her switching from Malay to English in order to translate and to emphasise the word ‘main’. On (44), she further emphasises in Malay that the question is asking for the main gas but not the best -- ‘**bukan yang paling baik, yang utama** (*not the best, the main*)’. On (45), Amina draws her students’ attention by switching to English, informing them to ‘be careful’ and she directs their attention to the specific question in the paper by switching to Malay on (46).

On (47) and (49), Amina switches to English when she uses content-related technical words ‘inert gases’ and ‘carbon dioxide’. Meanwhile, she switches to Malay on (48) when using the linking word ‘**ataupun** (*or*)’ in between adjacent instances. On (50) at the end of turn 83, Amina switches to Malay in order to elicit response. She switches to English on (51) for the use of content-related word ‘carbon dioxide’ before she switches back to Malay on (52) to elicit response from the student.

By combining both Extracts 36 and 37, the distribution of functions for each Malay and English in Amina’s episode of assessment is obtained as follow:

Table 5.23 Functions of switches identified in Amina's episode of assessment

Function	Instance number of switch to Malay	Instance number of switch to English
Reading from the text		13, 15, 27
Getting students’ attention	46	5, 9, 45
Using content related words	7	33, 39, 40, 49, 51
Giving emphasis	4, 6, 10, 42	11, 17, 21, 41, 43
Providing further information	8, 44	11, 41
Linking word	2, 48	
Giving instruction	12, 24	1, 3, 23, 25, 29, 31
Signaling a change of footing	22, 28	37
Elicit students’ response	14, 26, 50, 52	
Check understanding	16, 36	

Encourage students	20, 30, 38	
Accommodating to student's language needs	32	35
Giving hints to students	34, 40	
Personal pronoun 'you'		19
Possessive word ' punya '	18, 20	

After combining the data from Extract 36 and 37, it can be concluded from the Table above that during the episode of assessment, Amina uses English primarily when she is giving instruction, using content-related word and giving emphasis. She uses Malay mainly for when she wants to give emphasis to a point and elicit students' response.

5.3.3.3 Amina's Use of 2 Languages across 2 Episodes

By doing a word count for the two languages used in Amina's lesson, I find the word count distribution as shown in the following Table 5.24.

Table 5.24 Approximate percentage of English and Malay used in Amina's lesson

Episode	Approximate % of languages used in class (based on word count)	
	English	Malay
Experiment	43.62	56.38
Assessment	24.92	75.08

The Table above reveals that Amina uses more Malay during the episode of assessment than in episode of experiment. In fact, this result may suggest that Amina has shifted from a bilingual lesson to a Malay-medium lesson with some switching to English. One possible explanation for this is that during the episode of assessment, Amina is rather strict as she hardly helps students with the test. She would just sit at her desk and let the students complete the task by themselves. Therefore, when a student comes up to her, she would tend to speak only in Malay to the student as it is not a whole-class teaching. Such data may affect the word count of both languages within the lesson.

From the analysis, it reveals that during episode of assessment, Amina uses English mainly for when she gives instruction, use content-related words or give emphasis.

Malay is used primarily to elicit students' response. Similar result is found in her episode of experiment where English is mainly used for using content-related words and giving instruction whereas Malay is used for emphasising a point and getting students' attention. It seems that most of these functions belong to the macro-function of classroom management because data from episode of instruction is lacking from here where the genre of speech could be different and may call for other functions of CS.

5.3.3.4 Amina's Students' Views on Classroom Code-switching

There are 24 students in Amina's classroom and 14 students have Malay as their first language. 25% (6 out of 24) of the students speak English at home while 3 students speak Mandarin at home and 1 speaks Tamil as his/her first language. Table 5.25 shows the students' first language at home and their MOI for Science in primary school.

Table 5.25 Amina's students' language background

	First language at home				MOI for science in primary school			
	Malay	English	Mandarin	Tamil	Malay	English	Mandarin	Tamil
No. of students	14	6	3	1	7	13	3	1

We see from the table that most of the students (54.17%) have learnt Science in English during their primary education. When the students are asked to state how much Malay or English they wish their current Science teacher (Amina) to use in the class, they responded as below:

Table 5.26 Fatimah's students' preferred MOI for Science in secondary education

Science MOI in primary school	Number of students and their preferred MOI (The higher the number, the more English they prefer) 1= Only Malay is used in class 10= Only English is used in class									
	Malay as MOI			Bilingual as MOI			English as MOI			
	1	2	3	4	5	6	7	8	9	10
English				1	4	1	3	3	1	
Tamil									1	
Malay					2	3	1		1	
Mandarin								1	1	1

From the table above, we see that out of 7 students whose MOI was Malay during their primary school, only 2 students (28.57%) prefer to have English as MOI in science lessons because they think that by having an English as MOI classroom, it will give them more chances to listen to English and to improve their English. The other 5 students still prefer to have a bilingual classroom and the one common reason that they have all chosen is that a bilingual classroom can help them to understand the teacher better.

As for the 13 students whose Science MOI during primary school was English, 7 of them have wished for an English-medium classroom with very minimal use of Malay. Most of them think that with more English being used in the class, it gives them more chances to listen to English and helps them to understand the teacher better. Some of the students also cite that having more English in class helps them to pay attention in class.

All the students in the classroom are aware that Amina is using both languages in her teaching. Furthermore, 20 of the students think that she uses both the languages equally while 4 students think that she uses Malay more than English in the classroom. Despite this, only 9 students feel that the use of two languages in the class confuses them a little while the rest of the class thinks it is acceptable. It should be noted that 5 out of these 9 students are the ones who prefer to have English as MOI lessons.

5.4 Summary

This chapter has analysed the pattern of CS in 3 EMI science classrooms and 3 BMI science classrooms. Many of the pragmatic functions found here agree to the previous studies such as CS for disciplining students and giving task instructions (Lin, 1996; Canagarajah, 1995), CS for facilitating students' understanding (Rollnick and Rutherford, 1996), CS for text-dependant talk (Lin, 1996) and CS for change of footing (Ferguson, 2003). However, no two teachers have the same patterns and styles of CS and hence, result cannot be generalised. The students' views on classroom CS has also been studied and tabulated in this chapter. The findings show that students' generally do not reject the idea of their teacher using more than one language in

teaching. In fact, many of them view CS in EMI or BMI classes as a chance to be exposed to English language and develop their language skills. The next chapter will disseminate the findings further and comparisons of CS functions will be made across three different episodes and across EMI and BMI classroom.

Chapter 6 Discussion

6.1 Introduction

This chapter conducts further discussion and interpretation of the research findings presented in Chapter 5. It compares the research findings from the English-Medium Science Classrooms (EMI) and Bilingual Science Classrooms (BMI). More specifically, this chapter compares and interprets the code-switching (CS) patterns across all observed teachers during the different episodes within a lesson. These episodes are the episode of instruction, episode of assessment and episode of experiment.

There are 6 sections in this chapter. Section 6.2 compares the CS pattern amongst the EMI teachers, whereas section 6.3 compares the CS pattern amongst the BMI teachers. Section 6.4 attempts to explore the different patterns of code-switching between EMI and BMI classrooms. Section 6.5 examines the students' attitudes towards classroom CS within EMI and BMI classrooms. Finally, Section 6.6 summarises the research findings and interpretation.

6.2 Code-Switching (CS) in English as Medium of Instruction (EMI) Science Classrooms

This Section is split into 3 sub-sections. Section 6.2.1 will throw light on the EMI teachers' view on classroom CS and their actual behaviour as observed during this research. Section 6.2.2 will bring together the three episodes: episode of instruction, episode of assessment and episode of experiment and compare how each EMI teacher code-switches within these episodes.

6.2.1 EMI Teachers' Language Use in Science Classrooms

During the pre-observation interview, all three EMI teachers – Farid, Su Ling and Fatimah report that under their current school policy, they have been assigned by their schools to teach science fully in English for the classes that were chosen for this research. Despite this, they admit that they do use more than one language i.e. both English and Malay in their classroom.

For Farid, he thinks that using more than one language in English-medium science classroom is good especially when English is not the first language of the students. According to him, since Malay is the native language for all, the easy way to explain difficult concepts to the students is to communicate in Malay.

As for Su Ling, she has mixed-opinion about using more than one language in the classroom. From her experience, she learns that students, especially those in lower performing classes, tend to get confused when she mixes her language during teaching. Nonetheless, there are indeed some students who have low proficiency in English language and have difficulty in understanding the lesson if it is fully taught in English. Hence, while trying her best to teach in English as much as possible, Su Ling confesses that sometimes she does translate her utterances from English to Malay in order to help the students to understand the lesson fully. She also said that she usually translated an idea into a full sentence rather than mixing the language in mid-sentence (intra-sentential switching) so as to avoid confusion among the students.

Fatimah also expressed in her interview that it was unavoidable for her to use more than one language in her classroom. She added that she liked speaking in Malay with her students as Malay was her native language, and made her feel comfortable when conversing with students. Moreover, switching from English to Malay is also seen as a way to compensate for her lack of vocabulary in English. She comments that many a times when she uses Malay, it is because she cannot find a better word in English to express whatever she wants to say at the moment. Another reason for her to switch language was because she wanted to show her assertiveness to the students. She added that she would usually admonish her students using Malay language and they would know that it was not a good time for them to joke around.

Despite their similar views to use more than one language in the classroom, it was noticed during observations that there was a great difference in the amount of Malay being used by each of them in their lessons. As the switches vary in forms i.e. some of the switches are in a full sentence, while some are using just one word within a phrase, it is impossible to calculate the amount of Malay being used in the classroom based on the duration of the switch. Hence, a decision to use word counts was taken instead. Table 6.1 given below shows the amount of Malay used by these teachers during their lessons.

Table 6.1 Amount of Malay used by EMI teachers

Teacher	Episode	Approximate % of languages used in class (based on word count)	
		English	Malay
Farid	Instructional	95.71	4.29
	Experiment	91.83	8.17
	Assessment	96.29	3.71
Su Ling	Instructional	99.73	0.27
	Assessment	97.72	2.28
Fatimah	Experiment	84.70	15.30

Table 6.1 shows that Fatimah uses Malay the most, whereas Su Ling uses Malay the least during their lessons. It is assumed that the more Malay words are used in a class, the more CS instances are made. Seeing the different amount of CS in their lessons, I want to find out the reason which causes such results.

My first hypothesis is that the likelihood of an EMI teacher to switch from English to Malay is higher when his/her first language is Malay. As Fatimah comments in the interview that she feels more comfortable speaking in Malay with her students, it makes me think that familiarity to Malay is the main reason that encourages classroom code-switching. However, upon checking with Farid whose first language is also Malay, this hypothesis cannot be accepted because the amount of Farid's CS is half of what Fatimah has. If familiarity to Malay is the main reason that influences the amount of CS, Farid's CS should come close to Fatimah's, yet it does not. Farid mentions in the interview that although he prefers to use Malay in class, he has been assigned to teach science in English. This shows that there is an explicit effort on Farid's part to use as much English as possible in his classroom.

I also hypothesised that the likelihood of an EMI teacher to switch from English to Malay while conducting a class is higher if he/she has received education and training in Malay medium. However, Fatimah who claimed to have been educated fully in English during her undergraduate degree and also worked in an environment (prior to joining the teaching profession) which required much communication in English, code-switches the most among the three EMI teachers. On the contrary, Su Ling who received her undergraduate education mostly in Malay is the one who code-switches the least in her lessons. This shows that the

language in which a teacher received training and education in does not influence the amount of a teacher's classroom CS.

There is probably another reason that may affect the amount of teacher's CS in the class – the teacher's proficiency in English. I believe that if a teacher has low proficiency in English or low confidence in his/her command of the language, the teacher tends to code-switch more often to Malay, a language that he/she is more fluent in. However, this hypothesis cannot be proven right or wrong as this research has not collected such data for analysis.

Besides these personal language backgrounds that may be the motivations behind the amount of teacher's CS in class, this research gives more focus on the pragmatic functions of classroom CS. I will now discuss the different functions of classroom CS found within these EMI teachers.

6.2.2 Comparison of CS across Episodes of Instruction, Assessment and Experiment in EMI Classrooms

A) Episode of Instruction

The Table 6.2 below shows the Top 2 functions of CS found within Farid's and Su Ling's episode of instruction.

Table 6.2 Top 2 Functions of CS in Farid's and Su Ling's episode of instruction

Farid	Su Ling
To facilitate students' understanding	To get attention
To elicit response	To emphasise

In Section 4.5.1, I discussed the different speech functions found within each episodes and episode of instruction is expected to have more statements and questions as the teacher's main responsibility during this episode is to impart new knowledge or scientific concept to the students and also to make sure that they understand what is being taught. Table 6.2 above shows that Farid's CS in the episode of instruction is primarily to facilitate the understanding of students' and to elicit response from them. In other words, most of Farid's CS is done in order to construct and transmit academic knowledge to his students, following by classroom

management. During this episode, there are many occasions where Farid switches to Malay in order to explain a scientific term or a new concept. This agrees with Farid's comments in his interview – that using Malay is the easiest way for him to explain difficult concepts to his students.

As for Su Ling, within her very minimal CS, her switches in the episode of instruction are primarily for getting the students' attention and for emphasising a point made. These functions belong to two different main categories – classroom management and constructing and transmitting academic knowledge. However, through observations, I noticed that most of Su Ling's switches within this episode were either single word or short phrases and not translation of a full sentence as claimed by her during the interview.

The main aim for CS found within 2 observed teachers are different in the sense that Farid switches from English to Malay principally for constructing and transmitting academic knowledge, whereas Su Ling does so mainly for classroom management. This shows that teachers do not generally code-switch for the same reason even if the outcome and objective of the episode is the same i.e. objective of an episode of instruction is to impart new knowledge on students.

B) Episode of Assessment

If we refer back to Table 6.1, it is shown that the amount of Farid's CS in episode of assessment shows a decrease (less than 1%) from the amount found in his episode of instruction. This is different to Su Ling's data as she shows an increase of 2% in her CS found within the episode of assessment as compared to her episode of instruction. My hypothesis is for a teacher's CS to increase in proportional to the amount of his/her interaction with the students.

As discussed in Section 4.5.1, I mentioned that all the observed teachers have different ways of conducting classroom-based assessment during their lessons. Some teachers treat the continuous assessment as a proper examination where students have to remain silent and no discussion is allowed while completing the test. There are also some teachers who pace around the classroom to monitor the students' progress and answer any questions the students may have. The teachers who belong to the latter group are very often also seen giving hints

and help to students who request it. Hence, the latter group of teachers are said to have more interactions with their students as compared to those who take the assessment more seriously.

For this occasion, I noticed during the observation that although both Farid and Su Ling do pace around the classroom while students complete the test, Su Ling mostly interacts with her students, whereas the students under Farid were found to be less vocal during this episode. Therefore, the amount of CS for these teachers is different as compared to their CS in episode of instruction and is affected most likely by the amount of interactions they have with their students.

Despite the difference in the amount of their CS, Farid and Su Ling seem to have the same CS patterns within the episode of assessment as compared to the episode of instruction. Table 6.3 below shows the Top 2 functions of their CS in this episode:

Table 6.3 Top 2 Functions of CS in Farid's and Su Ling's episode of assessment

Farid	Su Ling
To facilitate students' understanding	To get attention
To seek confirmation, to admonish, to negotiate different teacher identities	To emphasise

When taking a first look at Table 6.3, it seems that Farid and Su Ling code-switch in the episode of assessment primarily for the same reason as what they do in the episode of instruction i.e Farid switches mostly for constructing and transmitting academic knowledge, whereas Su Ling switches mostly for classroom management. However, there are three CS functions which tie in the second place for Farid's assessment episode. These functions are – to seek confirmation, to admonish and to negotiate different teacher identities. All of these functions belong to the same functional category i.e. classroom management. Therefore, by looking at the broad functional categorisation, Farid actually switches principally for classroom management during his episode of assessment, while Su Ling remains the same as her episode of instruction.

C) Episode of Experiment

Comparing Farid's and Fatimah's episodes of experiment, Table 6.4 given below shows their Top 2 CS functions in the episode of experiment.

Table 6.4 Top 2 Functions of CS in Farid's and Fatimah's episode of experiment

Farid	Fatimah
To seek confirmation	To give instructions
To facilitate students' understanding, to negotiate different teacher identities, to show disapproval	To facilitate students' understanding

The difference between the ways Farid and Fatimah conduct experiments with their students is that Farid seems to be rather relaxed during the episode, whereas Fatimah seems to be more uptight during the lesson as she keeps raising her voice when talking to her students.

The difference between Farid's and Fatimah's main reason for switching from English to Malay during their episode of experiment can be explained by the way they execute the lessons. During this episode, Farid only briefly explains the procedure of the experiment at the beginning of the episode. Then, students are required to work in groups and carry out their own work. As Farid walks around the class, he is only checking the progress of his students and sometimes, he even chit-chats with his students. As for Fatimah, she is seen constantly reminding the students what they should or should not do. As she joins different groups, she is sometimes required to help the students with their experiments. Nonetheless, they are still both using CS principally for classroom management.

To summarise this section, the discussion of episode of instruction seems to be contradicting the discussion of episode of experiment a little where even though the teachers might teach the same episode, i.e. have the same objectives for their lessons, they may or may not code-switch primarily for the same reason. As seen in the episode of instruction, Farid switches mainly for constructing and transmitting academic knowledge, whereas Su Ling switches mainly for classroom management. However, both Farid and Fatimah have the same principal reason for switching during the episode of experiment, which is to manage the classroom. The discussion of episode of assessment also shows that teachers are switching mainly for classroom management.

6.3 Code-Switching in Bilingual (BMI) Science Classrooms

This Section is split into 2 sub-sections. Section 6.3.1 will throw light on the BMI teachers' view on classroom CS and their actual behaviour as observed during this research. Section

6.3.2 will bring together the three episodes: episode of instruction, episode of assessment and episode of experiment and compare how each BMI teacher code-switches within these episodes.

6.3.1 BMI Teachers' Language Use in Science Classroom

All the BMI teachers agree in their interview that bilingual science education should be strongly encouraged because of its benefit. Marina says that adopting bilingual teaching is very practical since it suits the different language needs of the students. Amina also emphasises her views by expressing strongly that bilingual education is much better than teaching science monolingually, either in English or in Malay.

The Table 6.5 given below shows the amount of English and Malay used by the BMI teachers during their lessons.

Table 6.5 Amount of English and Malay used by BMI teachers

Teacher	Episode	Approximate % of languages used in class (based on word count)	
		English	Malay
Marina	Instructional	36.52	63.48
Shahrul	Instructional	35.63	64.37
Amina	Experiment	43.62	56.38
	Assessment	24.92	75.08

I had initially treated all instances of switch from English to Malay as the main focus of this research and this was how I analysed data from EMI classes. However, as seen from the above Table, BMI teachers tend to use much more Malay than English in their lessons. With such intense switching between English and Malay during the lessons, it raises the issue of whether such heavy utility of CS still has the same function or meaning as it has in EMI classrooms.

This confusion confirms what Lewis, Jones and Baker's (2013) comment on how very little we know about "the actual use of two languages, their distribution, balance and explicit or implicit purpose in lessons" (p.107). Perhaps it is time to delve deeper into 'translanguaging' at this point. As cited in Baker (2011:288), Cen Williams who coined the term

‘translanguaging’ for the planned and systematic use of two languages inside the same lesson, where the input (reading and/or listening) tends to be in one language and the output (speaking and/or writing) in the other language and this is systematically varied. This seems to be a better way of explaining the way BMI teachers shift language during their teaching because their shifts are done more systematically as compared to EMI teachers. Take the example of Shahrul who constantly reads the text in English and then translates it into Malay before explaining it to his students in Malay again. This pattern certainly fits into the definition of ‘translanguaging’ better than ‘code-switching’.

6.3.2 Comparison of CS across Episodes of Instruction in BMI Classrooms

In this sub-section, the only comparison within the BMI classroom that can be done is the episode of instruction by Marina and Shahrul as their 1-hour lessons consist only this episode. Within Amina’s lesson there are 2 episodes – episode of assessment and episode of experiment. As both Marina’s and Shahrul’s lessons do not have these episodes, I will compare Amina’s episodes to those in the EMI classrooms. This will be done in the next section. For now, we will look at the comparison between Marina’s and Shahrul’s episode of instruction. Table 6.6 shows the Top 2 functions for both English and Malay used in classrooms.

Table 6.6: Top 2 Functions for both English and Malay used in Marina's and Shahrul's episode of instruction

Marina		Shahrul	
Malay	English	Malay	English
To facilitate students’ understanding	To use content-related words	To facilitate students’ understanding	To read from text
To elicit response	To get attention	To encourage students = to elicit response = to shift attention from whole class to individual student	To get attention

Table 6.6 above indicates that Marina and Shahrul follow similar patterns during their switch from one language to the other. Both of them switch primarily to English whenever they use content-related words or read from the text such as - the textbook or slides. Then they switch

principally to Malay whenever they need to explain terminology or a concept to the students in order to help them understand it better.

6.4 Comparison of CS across EMI and BMI Classrooms

A) Episode of Instruction

Among the 4 teachers who have an episode of instruction in their lessons, Farid, Marina and Shahrul switch their language from English to Malay mainly to facilitate the students' understanding. On the other hand, Su Ling switches from English to Malay mostly for classroom management. It can be seen from here that despite assigning different MOI's to the classrooms i.e. Farid's and Su Ling's were in English, whilst Marina's and Shahrul's in Malay, teachers generally provided an explanation in Malay in an attempt to help their students grasp lessons better. One possible reason for this is that Malay is the national language of Malaysia and is taught in all levels of school. Hence, regardless of what everyone's first language at home is, they are assumed to have a good command of Malay as they have had more opportunities to learn the language. This is in direct contrast to the situation regarding English, which is the second language in Malaysia, and so most students only start learning it as a subject in school when they are 9 years old. Hence, different students may have different levels of proficiency with the language. Therefore, as Shahrul expresses in his interview, providing explanation in Malay not only ensures that students are able to understand their lessons productively, but it also proves to be time effective. Nonetheless, if a teacher constantly translates everything he/she reads in English to Malay, this will instead be time-consuming and prolong the time needed to complete the syllabus.

B) Episode of Assessment

Both Farid and Su Ling switch from English to Malay in the episode of assessment primarily for classroom management, whereas, Amina switches mainly for constructing and transmitting academic knowledge (to emphasise and to elicit response). During the episode of assessment, Amina tells her students the topic that the test will include and then gives them a few minutes to revise their chapters before taking the test. During the period where the students are revising, Amina also tends to pick some important points and emphasises that the students should pay attention to such content as it will be asked during the test. While the

students complete their test, Amina would sit in front of the class and have very minimal interaction with them. This highlights that the main function of Amina's language switch is to transmit knowledge to her students and not for classroom management, just like Farid and Su Ling. Such scenarios show us that the functions of CS within a class may get affected by the different teaching styles that each teacher chooses to follow.

C) Episode of Experiment

As for the episode of experiment, Farid and Fatimah's code-switch is mainly for classroom management e.g. to give instruction. However, Amina switches from English to Malay mainly to emphasise and get the students' attention. It has also been observed that the number of instances of her giving instruction in English is the same as when she gives instruction in Malay. Once again, it is shown here that teachers do not generally code-switch for the same reasons even during the same episode. Further research will need to be carried out in order to obtain enough data for generalisation.

6.5 Students' Attitudes Towards Classroom Code-switching

A total of 166 students completed the questionnaire, of these 92 students were from the EMI classes and 74 students from the BMI classes. The important point here is to discuss the students' views on using more than one language during their science lessons.

Out of the 92 students, a total of 55 students (59.8%) did not get confused with their teacher's CS during the class. Twenty Four students expressed that they got slightly confused and only 13 students (14.1%) thought that the current CS in their EMI science lesson class was confusing. The following chart shows the students opinions on the balance of languages used in the science classroom.

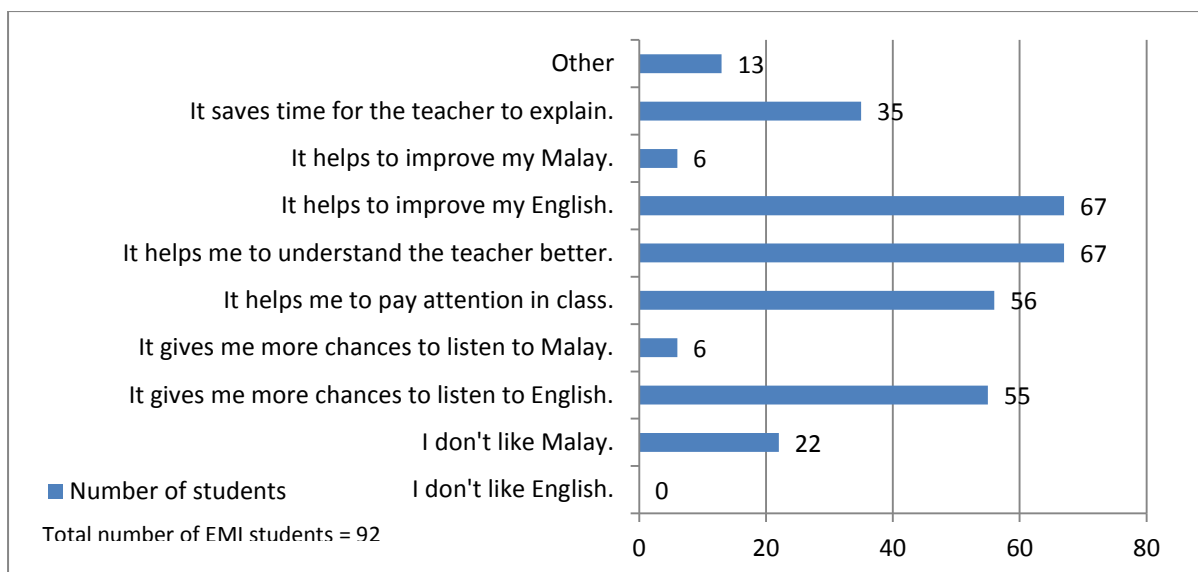


Figure 6.1 Students' views on CS in EMI science classroom

From Figure 6.1, we learn that the majority of students in the observed EMI science classes not only think that classroom CS helps them to understand the teacher better, but it can also be seen as a way to improve their English. This result reflects one of the main functions of CS that we discussed earlier i.e. to facilitate the understanding of students. In other words, as discussed earlier, I commented that “to facilitate students’ understanding” is one of the primary reason why teachers CS in their science lessons. Now that the students express that the teachers’ CS is helping them to understand better, it is likely that the teachers’ CS is acceptable and beneficial to the students.

It is also quite interesting to see that most of the students think that classroom CS helps them to improve their English. This is a point that perhaps most of the teachers have not foreseen, that their students would think that English being used in the science classroom is also a way for them to improve their own language skill. Such result calls for a detailed study of ‘translanguaging’ in Malaysian classrooms.

As for the BMI students, their opinions remain the same as those in the EMI classrooms, whereby 54.1% (40 out of 74) of the students are of the opinion that the mix of English and Malay used by their teachers confuses them. Twenty nine students think that they were somewhat confused, but only 5 students (6.76%) felt that such a mix of language confused them during the lessons. The following chart shows students’ opinions on the mix of languages used in the BMI science classroom.

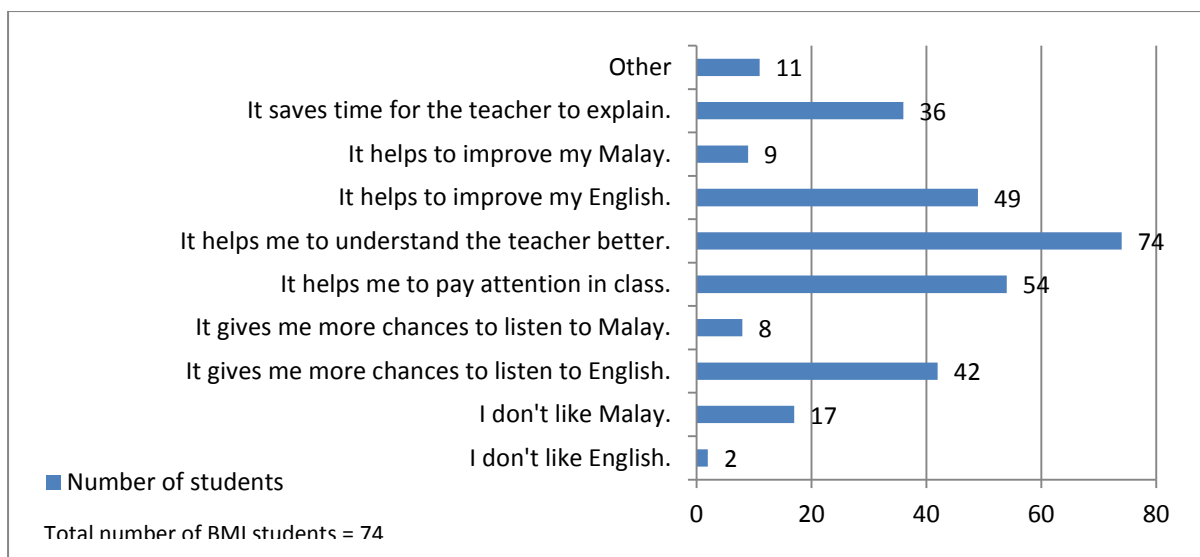


Figure 6.2 Students' views on CS in BMI science classroom

It is very surprising to see that all students expressed that bilingual science classroom helped them understand their teachers better. With the teachers switching between English and Malay frequently in the classroom, the students expressed that they did not get confused by the switches and also thought that the switches were beneficial for them. Perhaps when both English and Malay are used in the class, students are able to follow the teacher's teaching better, hence, students think that bilingual classes helps them pay attention in the classroom as well.

6.6 Summary

This chapter reiterates and interprets further the findings from previous chapter. In general, although EMI teachers and BMI teachers share some similarities in the principal functions of classroom CS, generalisations still cannot be made. Further and more detailed research will need to be carried out with bigger pool of subjects and discourse data. Also, with such high intensity of CS found in the bilingual classroom, it raises the issue of labelling switches in bilingual classroom as 'code-switching'. Perhaps 'translanguaging' may be a better way to explain such phenomenon in Malaysia as this also ties into students' expectation towards a mixed-language classroom. It is interesting to reveal that students tend to see EMI or BMI science lessons as a way for them gain exposure to English language and improve their language skill. This fits into the definition of 'translanguaging' where students not only gain

scientific knowledge during the lessons but also opportunities to develop their language (Baker, 2011).

In the next chapter, the major findings of this research will once again be presented, following by the implications of these findings in Malaysian science classrooms. Some strengths and limitations of the research will also be discussed before some possible direction for future research is given.

Chapter 7 Conclusion

7.1 Introduction

This chapter is divided into 5 sections. Section 7.2 details the major findings of this research by answering the research questions formulated for this study. Section 7.3 describes the theoretical and practical implications which emerge from the study. Section 7.4 reviews the strengths and limitations of this research and finally, section 7.5 provides some suggestions for future research.

7.2 Major Findings

This study investigates the languages used to teach science in Malaysian classroom. I have observed and recorded the actual science teaching in both EMI and BMI classrooms. More specifically, I analysed the pragmatic functions of CS in these classrooms in order to compare the act of CS which differs in EMI and BMI classrooms. Moreover, I have also requested students to complete a questionnaire in order to study their views on classroom CS. There are four research questions for this study and the major findings are summarised as below:

(1) Do science teachers CS in class?

Yes. Teachers do generally CS in science lessons whether it is an EMI or a BMI classroom. The main difference between these classrooms is the intensity of the switch where BMI classrooms have more dense instances of CS as compared to EMI classrooms.

(2) How often do science teachers CS in class?

As mentioned in (1), BMI science teachers tend to have more intense CS in their teaching as compared to those in the EMI classrooms. Teachers also generally switch more when the lesson requires more interaction with the students e.g. during the episode of experiment.

(3) In what context and for what purpose do science teachers CS in class?

Upon analysing the transcriptions, it is found that the functions of CS found in a science classroom are similar to those found in an English language classroom. The macro functions of classroom CS found here also agrees with Ferguson's categorisation of classroom CS (see

more detail in section 4.5.2). This study looks into teachers' CS in three different episodes: episodes of instruction, episodes of assessment and episodes of experiment. Although no two teachers have the same intensity of CS or the same functions for their switches, EMI teachers generally switch from English to Malay primarily for constructing and transmitting academic knowledge during the episode of instruction and for classroom management (to give instruction) during the episode of experiment. As for BMI teachers, they tend to switch from Malay to English whenever they read from the English-medium text or use content-related words. They then switch back to Malay to give explanation to facilitate students' understanding. This can also be seen as a process to construct and transmit academic knowledge.

(4) What are students' views towards classroom CS?

Students generally accept the idea that their science teachers would code-switch between English and Malay during lessons. Most of the students feel that their teachers' CS has helped them follow and understand lessons better. This supports Kamisah and Misyana's (2011) study (see section 3.4.4.4B). It is also interesting to find that many students think that the use of two languages, especially English in science classroom, can be looked at as a way of increasing their exposure to the language and consequently improve their English skills.

7.3 Implications of Findings

This research provides four main theoretical and practical implications in the research of classroom CS. Firstly, the analytical framework of this study integrates the pragmatic functions of classroom CS into genre study of science classroom, i.e. splitting science classroom into episodes of instruction, assessment and experiment. The research results show that teachers switch language primarily for two reasons, namely to fulfil the different functions of speech according to the different types of activities carried out during lessons and different styles of teaching. This combined approach provides a systematic way to examine the functions of CS in science classroom and the analytic framework can hence be applied to study other discourses and content-subjects for pragmatic studies. For example, although history and geography lessons may not have an episode of experiment, by analysing the topics and organisation of these lessons, a particular set of subject-centred episodes might be discerned.

Secondly, the functions of CS revealed in this study of science classroom (see Table 4.4) are consistent with most functions found in previous studies of classroom CS (see section 3.4.4.2). Although most of these previous studies were conducted in English language classrooms, there are similarities in the functions of CS and the main similarity is shown by Ferguson's categorisation. This finding may imply that classroom CS has 3 main functions: (i) to construct and transmit academic knowledge (ii) to manage classroom and (iii) to improve interpersonal relations.

Thirdly, with the majority of students expressing their preference of secondary science education to be in the same MOI as what they are taught during primary school, it is implied that the Malaysian primary and secondary school students who are currently affected by the policy to revert the MOI for science from English to Malay will experience difficulty when they eventually enter Form 6 (pre-university level) as the MOI for science in Form 6 would be in English. This also implies that Form 6 teachers will need to be equipped with the communicative tools to help facilitate students' understanding during the transition period. Therefore, there should be an awareness among the teachers on the good practices and benefits of classroom CS so as to increase their understanding of classroom CS and how it can help them in developing the students' understanding of scientific knowledge. The existing Jacobson's concurrent approach (Faltis, 1989), which later developed into 'translanguaging' in Welsh classrooms (Baker, 2011) and New York communities (Garcia, 2009), provides training for bilingual teachers to be able to maintain a balanced use of two languages in their teaching. Similar training could be designed for Malaysian teachers but before that, enough evidence should be collected in order to know the particular forms of CS which are pedagogically detrimental or helpful to the students (Ferguson, 2009).

Last but not least, as the findings reveal, most students view CS in EMI and BMI classrooms as an opportunity to be exposed to English language and consequently help them improve their language skills. This has an implication for studying the role of content-subject teachers as English language models in the classroom. This would help us gain better understanding of the functions of classroom CS and explore the possibilities of imparting scientific knowledge while at the same time, improving students' language skills.

7.4 Strengths and Limitations of the Research

There are strengths, as well as limitations to this study. The strengths of this research lie in the four aspects: the subjects chosen, the execution of post-observation interview, the three episodes of a science lesson and the study of students' views on classroom CS.

Firstly, the decision to carry out this research in both EMI and BMI science classrooms has enabled comparisons to be made between these two types of classroom setting. With the authentic classroom discourse recorded and transcribed, I am able to analyse the data and reveal the different level of intensity of switches found in both EMI and BMI classrooms.

Secondly, the adoption of post-observation interviews in this study helps us understand the functions of CS from teachers' point of view. Many of the previous studies have relied solely on the discourse-analytic approach to identify and describe the pedagogic functions of classroom CS. However, through post-observation interviews, or what Ferguson (2009: 232) calls 'stimulated recall utilising lesson transcript', teachers are able to read transcript of their speech during the lessons and provide input on why they code-switch at that particular point of time. This provides a good supplement to my pragmatic analysis of the functions of classroom CS.

Thirdly, the splitting of science lessons into three main episodes: the episode of instruction, the episode of assessment and the episode of experiment, acknowledges that there are different activities and objectives within a science lesson. This implies that teachers may have different discourses during these episodes and consequently, they may switch their language differently according to the current activity and objectives of the lesson.

Fourthly, the study of students' views on classroom CS provides useful insights into the benefits of classroom CS. As these students are the ultimate stakeholders of classroom CS, it is vital to investigate if they do prefer their teachers to code-switch during science lessons. Fortunately, the students in this study have revealed that their teachers' CS does help them understand their science lessons better. This suggests that classroom CS in a content-based lesson does help develop students' understanding of a subject content.

However, there are also some limitations to this study. A number of points need to be listed so as to warrant attention for future research. The first limitation concerns the school profile. The six schools chosen for this research are all based in the urban area and hence, it is important to be aware that the findings in this current study may not be generalised and taken as representative of all schools in Malaysia. The reason being, students in urban area have more exposure to English language as compared to students in rural area. Under such circumstances, using English-medium science textbook and switching between English and Malay may be more acceptable for the students in this study but may not be so for students living in the rural area who have limited or reduced opportunities to be exposed to English language.

The second limitation concerns the lack of data from video-recording and students' discourse within classroom. Had video-recording been allowed and more students' discourse was included in this research, I believe that the pragmatic functions of classroom CS could be further enhanced as we are then able to see the body language that accompanies teacher's CS and also study the immediate effect of teacher's CS on the students.

Thirdly, although the science lesson is split into three episodes in this study, not all teachers have all the three episodes within the 1-hour lesson that is chosen for a detailed analysis. Due to this limitation, comparison between EMI and BMI classrooms and across all three episodes cannot be made in full and limit this research to draw conclusive results.

7.5 Suggestions for Future Research

Not only does this research study CS in EMI and BMI science classroom, it also opens up further research dimensions which could extend the scope of this study. Some of these new dimensions could also address the limitations of this research described earlier.

Firstly, this research could be extended by including schools within rural area. With students who have less exposure to English language in rural area, the intensities of switching and the pragmatic functions of CS made by teachers may be different. Expanding this study to also include science classroom teaching in rural schools may shed light on different patterns of classroom CS.

Secondly, other dimensions such as age and classroom subject could be explored in future research in order to provide comparison to the findings obtained in this study. This research focuses on Form 1 (secondary school year 1) science classrooms in Malaysia. Further research on different age group such as primary or tertiary education, in other subjects such as History, Mathematics and English language could provide a well-rounded picture on the languages used in classroom teaching and offer a more comprehensive understanding of classroom CS.

Thirdly, the CS patterns portrayed by BMI teachers in this study reveal that the switching of language in bilingual classroom may have more depth than to being just ‘code-switching’. One of the teachers even showed the traces of ‘translanguaging’ in his use of two languages during lesson. Furthermore, students in this study have expressed the view that they also see EMI and BMI classrooms as an opportunity where they could increase their exposure to English language and consequently improve their language skills. Therefore, conducting research based on ‘translanguaging’ in Malaysia could help us understand CS and bilingual education better.

Fourthly, as this research has taken a discourse analytic approach, it could be useful if these results can be complemented with experimental or quasi-experimental paradigms that study the effects of CS. For example, using a group of mixed ability students as the subject, teachers are requested to consciously switch language for different purposes while teaching these students, e.g. only for explaining scientific terminology, only for classroom management or no switching at all. At the end of the experiment, students will be asked for their views regarding the different switches used by the teachers and which would they find most easy to understand. A longitudinal research could also potentially show us how CS would help facilitate students’ understanding of the content-subject and at the same time, improve students’ language skills.

As a final note, classroom CS is indeed widespread and uncontrollable especially in multilingual post-colonial societies like Malaysia. Therefore, educational authorities should encourage further investigation of the phenomenon and realise the potential of CS as a communicative resource in classroom teaching.

References

- 2012 deadline on Science and Maths to cushion impact. (2009). *The Star*. Retrieved from <http://thestar.com.my/news/story.asp?file=/2009/7/9/nation/20090709161532&sec=nation>
- Abello-Contesse, C. (2013). Bilingual and multilingual education: an overview of the field. In A.C. Christian, M.C. Paul, D. L.J. Maria & C.B. Ruben (Eds.), *Bilingual and multilingual education in the 21st century: building on experience*. (pp. 3-23). Bristol: Multilingual Matters.
- Adendorff, R. (1993). Codeswitching amongst Zulu-speaking teachers and their pupils: Its functions and implications for teacher education. *Language and Education*, 7(3), 141-162.
- Arthur, J. & Martin, P. (2006). Accomplishing lessons in postcolonial classrooms: Comparative perspectives from Botswana and Brunei Darussalam. *Comparative Education*, 42(2), 177-202.
- Asmah H. O. (1979). *Language planning for unity and efficiency: A study of the language status and corpus planning of Malaysia*. Kuala Lumpur: Penerbit Univeristi Malaya.
- Asmah H. O. (2003). *Language and language situation in South East Asia: with a focus on Malaysia*. Kuala Lumpur: Akademi Pengajian Melayu, Universiti Malaya.
- Auer, P. (1984). *Bilingual conversation*. Amsterdam: John Benjamins.
- Auer, P. (1998). (Ed.) *Code-switching in conversation: language, interaction and identity*. London: Routledge.
- Badrul H. A. & Kamaruzaman J. (2009). Teachers' code-switching in classroom instructions for low English proficient learners. *English Language Teaching*, 2(2), 49–55.
- Baker, C. (2010). Bilingual education. In R. Kaplan (Ed.). *The Oxford Handbook of Applied Linguistics* (2nd ed.). Oxford: Oxford University Press.
- Baker, C. (2011). *Foundations of bilingual education and bilingualism* (5th ed.). Bristol: Multilingual Matters.
- Blom, J. P. & Gumperz, J. J. (1972). Social meaning in linguistic structures. In J. J. Gumperz & D. Hymes (Eds.). *Direction in sociolinguistics* (pp. 407-434). New York: Holt, Rinehart & Winston.

- Blom, J. P. & Gumperz, J. J. (2007). Social meaning in linguistic structure: code-switching in Norway. In L. Wei (Eds.). *The bilingualism reader* (2nd ed., pp. 75-96). London: Routledge.
- Brisk, M. E. (1998). *Bilingual education: From compensatory to quality schooling*. Mahwah, NY: Lawrence Erlbaum.
- Brock-Utne, B. (2005). Language-in-education policies and practices in Africa with a special focus on Tanzania and South Africa – Insights from research in progress. In A. M. Y. Lin & P. W. Martin (Eds.). *Decolonisation, Globalisation: Language-in-education Policy and Practice* (pp. 173-193). Clevedon: Multilingual Matters.
- Canagarajah, S. (1995). Functions of code-switching in ESL classrooms: socialising bilingualism in Jaffna. *Journal of Multilingual and Multicultural Development*, 6(3), 173-195.
- Cazden, C. B. (1986). Classroom discourse. In M. C. Wittrock (Ed.), *Handbook of research on teaching* (pp. 432-463). New York: Macmillan.
- Chan, S. H. & Tan, H. (2006). English for Mathematics and Science: current Malaysian language-in-education policies and practices. *Language and Education*, 20(4), 306-321.
- Clegg, J. (2001). Can English-medium education work? Why we should be honest about its failures and courageous about change. In R. Trewby & S. Fichat (Eds.), *Language and Development in Southern Africa: Making the Right Choices*, (pp. 210-226). Windhoek : Gamsberg Macmillan.
- Clegg, J., & Afitska, O. (2011). Teaching and learning in two languages in African classrooms. *Comparative Education*, 47(1), 61-77. <http://dx.doi.org/10.1080/03050068.2011.541677>.
- Clemente, I. (2008). Recording audio and video. In Li Wei & M. G. Moyer (Eds.), *The Blackwell guide to research methods in bilingualism and multilingualism*. Oxford: Blackwell Publishing Ltd.
- Cohen, L. & Holliday, M. (1996). *Practical statistics for students*. London: Paul Chapman Publishing Ltd.
- Cohen, L., Manion, L., & Morrison, K. (2000). *Research methods in education* (5th ed.). London: Routledge Falmer.
- Creswell, J. W., & Miller, D. L. (2000). Determining validity in qualitative inquiry. *Theory into Practice*, 39(3), 124-131.

- Creswell, J. W., Plano Clark, V. L., Gutmann, M. L., and Hanson, W. E. (2003). Advanced mixed methods research designs. In A. Tashakkori & C. Teddlie (Eds.), *Handbook of mixed methods in social and behavioural research*. Thousand Oaks, Calif.: Sage Publication.
- Dabène, L. & Billiez, J. (1986). Code-switching in the speech of adolescents born of immigrant parents. *Studies in Second Language Acquisition*, 8(3), 309-325.
- David, M. K. & Govindasamy, S. (2005). Negotiating a language policy for Malaysia: Local demand for affirmative action versus challenges from globalisation. In A. Suresh Canagarajah (Ed.), *Reclaiming the local in language policy and practice*, (pp. 123-245). Mahwah, NJ: Lawrence Erlbaum Associates, Inc. Publishers.
- Davies, K. A. (1995). Qualitative theory and methods in applied linguistics research. *TESOL Quarterly*, 29, 427-53.
- De Klerk, V. (2006). Codeswitching, borrowing and mixing in a corpus of Xhosa English. *International Journal of Bilingual Education and Bilingualism*, 9(5), 597-614.
- Denzin, N. K. (1978). *The research act: a theoretical introduction to sociological methods*. New York: McGraw-Hill.
- Denzin, N. K. (1989). *The Research Act* (3rd ed.). Englewood Cliffs, N. J.: Prentice-Hall. Inc.
- Dixon, L. Q. (2009). Assumptions behind Singapore's language-in-education policy: Implications for language planning and second language acquisition. *Language Policy*, 8, 117-137.
- Dore, J. (1977). Children's illocutionary acts. In R. Freedle (Ed.), *Discourse production and comprehension I*. Norwood, NJ: Ablex.
- Dore, J. (1977). Children's illocutionary acts. In R. Freedle (Ed.), *Discourse production and comprehension I*. Norwood, NJ: Ablex.
- Dörnyei, Z. (2007). *Research methods in applied linguistics*. Oxford: Oxford University Press.
- Drew, P & Heritage, J. (1992). *Talk at work: Interaction in institutional settings*. Cambridge: Cambridge University Press.
- Duranti, A. (1997). *Linguistic anthropology*. Cambridge: Cambridge University Press.

- Edwards, A. D. & Westgate, D. P. G. (1994). *Investigating classroom talk* (2nd ed.). London: The Falmer Press.
- Eldridge, J. (1996). Code-switching in a Turkish secondary school. *ELT Journal*, 50(4), 303-311.
- Faltis, C. J. (1989). Code-switching and bilingual schooling: an examination of Jacobson's new concurrent approach. *Journal of Multilingual and Multicultural Development*, 10(2), 117-127.
- Ferguson, C. A., Houghton, C., & Wells, M. H. (1977). Bilingual education: an international perspective. In B. Spolsky & R. Cooper (Eds.), *Frontiers of Bilingual Education*. Rowley, MA: Newbury House.
- Ferguson, G. (2003). Classroom code-switching in post-colonial contexts. In S. Makoni and U. H. Meinhof (Eds.), *AILA review: Africa and applied linguistics* (pp. 38-51). Amsterdam; Philadelphia: John Benjamins Publishing Company.
- Ferguson, G. (2006). *Language planning and education*. Edinburgh: Edinburgh University Press.
- Ferguson, G. (2009). What next? Towards an agenda for classroom code-switching research. *International Journal of Bilingual Education and Bilingualism*, 12(2), 231-241.
- Ferguson, G. (2013). English, development and education: Charting the tensions. In E. J. Erling & P. Seargeant (Eds.), *English and development: Policy, pedagogy and globalization* (pp. 21-44). Bristol: Multilingual Matters.
- Fishman, J. A., & Fishman, S. G. (2000). Rethinking language defense. In R. Phillipson (Ed.), *Rights to language: Equity, power and education* (pp. 23-27). Mahwah, NJ: Lawrence Erlbaum Associates.
- Flanders, N. A. (1970). *Analysing teaching behaviour*. Boston: Addison-Wesley Educational Publishers Inc.
- García, O. (2009). *Bilingual Education in the 21st Century: A Global Perspective*. Oxford: Blackwell.
- Garcia, O. and Li W. (2014) *Translanguaging: Language, bilingualism and education*. Basingstoke: Palgrave Macmillan.
- Gardner-Chloros, P. (2009). *Code-switching*. Cambridge, UK: Cambridge University Press..
- Gauci, H. & Camilleri Grima, A. (2012). Codeswitching as a tool in teaching Italian in Malta. *International Journal of Bilingual Education and Bilingualism*, 1-17.

- Gaudart, H. (1987). A typology of bilingual education in Malaysia. *Journal of Multilingual and Multicultural Development*, 8(6), 529-552.
- Genesee, F. & Gándara, P. (1999). Bilingual education programs: Across notional perspective. *Journal of Social Issues* 55(4), 665-685.
- Gill, S. K. (2004). Medium-of-instruction policy in higher education in Malaysia: Nationalism versus internationalisation. In J. W. Tollefson & A. B. M. Tsui (Eds.), *Medium of instruction policies: Which agenda? Whose Agenda?* (pp. 135-152). Mahwah, NJ: Lawrence Erlbaum Associates, Inc. Publishers.
- Gill, S. K. (2005). Language policy in Malaysia: Reversing direction. *Language Policy*, 4(3), 241-260.
- Gill, S. K. (2006). Change in language policy in Malaysia: the reality of implementation in public universities. *Current Issues in Language Planning*, 7(1), 82-94.
- Gill, S. K., Nambiar, R. M. K., Ibrahim, N. & Tan, K. H. (2010). Globalization and language-in-education policy shift in Malaysia: Challenges of implementation. In V. Vinita (ed.), *Globalization of language and culture in Asia: The impact of globalization processes on language* (pp. 180-205). London: Continuum International Publishing Group.
- Goffman, E. (1974). *Frame analysis: An essay on the organization of experience*. Boston, MA: Northeastern University Press.
- Goffman, E. (1981). *Forms of talk*. Philadelphia, PA: University of Pennsylvania Press.
- Goon, J. (2012, November 4). Parent groups vow to fight on for PPSMI. *The Star*. Retrieved 5 February, 2013, from <http://thestar.com.my/news/story.asp?file=/2012/11/4/nation/20121104175512&sec=nation>.
- Grosjean, F. (1982). *Life with two languages: An introduction to bilingualism*. Cambridge, Mass: Harvard University Press.
- Gumperz, J. J. (1982). *Discourse strategies*. Cambridge, UK: Cambridge University Press.
- Guthrie, L. E. (1984). Contrasts in teachers' language use in a Chinese-English bilingual classroom. In J. Handscombe, R. A. Orem & B. P. Taylor (Eds.), *On TESOL 1983: The question of control*. Washington, DC: TESOL.
- Hassan, A. (2005). Language planning in Malaysia: the first hundred years. *English Today* 84, 21(4), 3-12.
- Heller, M. (2008). Doing ethnography. In Li Wei & M. G. Moyer (Eds.), *The Blackwell guide to research methods in bilingualism and multilingualism* (pp. 249-262). Oxford: Blackwell Publishing Ltd.

- Hesse-Biber, N. S. & Leavy, P. (2006). *The practice of qualitative research*. Thousand Oaks, Calif.: Sage.
- Hornberger, N. H. (1991). Extending enrichment bilingual education: Revisiting typologies and redirecting policy. In O. García (Ed.), *Bilingual Education: Focusschrift in Honor of Joshua A. Fishman* (Vol. 1). Amsterdam/Philadelphia: John Benjamins.
- Howard, E. R. & Christian, D. (2002). *Two-way immersion 101: Designing and implementing a two-way immersion education program at the elementary level*. University of California at Santa Cruz: CREDA.
- Hunter, A. & Brewer, J. (2003). Multi-method research in sociology. In A. Tashakkori & C. Teddlie (Eds.), *Handbook of mixed methods in social and behavioural research*. Thousand Oaks, Calif.: Sage Publication.
- Johnson, K. E. (1995). *Understanding communication in second language classrooms*. Cambridge: Cambridge University Press.
- k, C. (2011). *Education - News | The Star Online. Thestar.com.my*. Retrieved 8 January, 2012, from <http://thestar.com.my/education/story.asp?file=/2011/11/13/education/9878350&sec=education>
- Cheng, N. L. (2004). Hong Kong SAR. In H. W. Kam, & R. Wong (Eds.), *Language policies and language education: The impact in East Asian countries in the next decade* (2nd ed., pp. 100-114). Singapore: Eastern University Press.
- Kachru, B. (1978). Code-mixing as a communicative strategy in India. In J. Alatis (Ed.). *International dimension of bilingual education* (pp.25-52). Washington, DC: Georgetown University Press.
- Kamisah A. & Misyana S. H. (2011). Code-switching and code-mixing of English and Bahasa Malaysia in content-based classroom: frequency and attitudes. *The Linguistics Journal*, 5(1), 220-247.
- Kamsiah A. (2004). Brunei Darussalam. In H. W. Kam, & R. Wong (Eds.), *Language policies and language education: The impact in East Asian countries in the next decade* (2nd ed., pp. 43-64). Singapore: Eastern University Press.
- Kementerian Pendidikan Malaysia. (n.d.). *Sekolah Kluster Kecemerlangan*. Retrieved 28 October, 2013, from <http://www.moe.gov.my/bpsbpsk/index.php/skk>.
- Kow, Y. C. (2003). Code-switching for a purpose: focus on pre-school Malaysian children. *Multilingua*, 22, 59-77.

- Legarreta, D. (1979). The effect of program models on language acquisition by Spanish speaking children. *TESOL Quarterly*, 13, 521-534.
- Lewis, G., Jones, B. & Baker, C. (2012) 'Translanguaging: Origins and Development from School to Street and Beyond'. *Educational Research and Evaluation*, 18(7), 641-654.
- Lewis, G., Jones, B. & Baker, C. (2013) '100 Bilingual Lessons: Distributing Two Languages in Classrooms'. In C. Abello-Contesse, P. Chandler, M. D. Lopez-Jimenez, M. M. Torreblanca-Lopez & R. Chacon-Beltran (Eds.) *Bilingualism and Multilingualism in School Settings*. Bristol: Multilingual Matters.
- Li W. (1998). The 'why' and 'how' questions in the analysis of conversational code-switching. In P. Auer (Ed.), *Code-switching in conversation: Language, interaction and identity* (pp. 156-176). London: Routledge.
- Li W. (2005). "How can you tell?" Towards a common sense explanation of conversational code-switching. *Journal of Pragmatics*, 37, 375-389.
- Lillis, T. & Curry, M. J. (2013). English, scientific publishing and participation in the global knowledge economy. In E. J. Erling & P. Seargeant (Eds.), *English and development: Policy, pedagogy and globalization* (pp. 220-242). Bristol: Multilingual Matters.
- Lim, A. L. (2003, December). *Problems faced by JUs on the ETeMS program*. Paper presented in the ELTC ETeMS Conference: Managing curricular change, Pearl Point International Hotel, Kuala Lumpur..
- Lin, A. (1996). Bilingualism or linguistic segregation? Symbolic domination, resistance and code-switching in Hong Kong schools. *Linguistics and Education*, 8, 49-84.
- Lin, A. M. Y. (2005). Critical, transdisciplinary perspectives on language-in-education policy and practice in postcolonial contexts: The case of Hong Kong. In A. M. Y. Lin & P. W. Martin (Eds.). *Decolonisation, globalisation: Language-in-education policy and practice* (pp. 38-54). Clevedon, UK: Multilingual Matters.
- Lindholm-Leary, K. J. (2001). *Dual language education*. Clevedon: Multilingual Matters.
- Liong, K. C. (2012, October 16). Why PPSMI should continue. *The Star*. Retrieved 5 February, 2013, from <http://thestar.com.my/news/story.asp?file=/2012/10/16/focus/12175869&sec=focus>.
- Macaro, E. (1997). *Target language, collaborative learning, and autonomy*. Clevedon: Multilingual Matters.
- Mackey, W. F. (1970). A typology of bilingual education. *Foreign Language Annals*, 3, 596-608.

- Mahathir, M. (2002, May 11). Maths, Science to be in English. *New Straits Times*. Retrieved 7 February, 2013, from <http://www.accessmylibrary.com/article-1G1-88615736/maths-science-english-hl.html>.
- Maillat, D. & Serra, C. (2009). Immersion education and cognitive strategies: Can the obstacle be the advantage in a multilingual society? *International Journal of Multilingualism*, 6(2), 186-206.
- Mangubhai, F. (2002). Language-in-education policies in the South Pacific: Some possibilities for consideration. *Journal of Multilingual and Multicultural Development* 23(6), 490-511.
- Marsh, H. W., Hau, K. T., & Kong, C. K. (2000). Late immersion and language instruction (English vs. Chinese) in Hong Kong high schools: Achievement growth in language and non-language subjects. *Harvard Educational Review*, 70 (3), 302-346.
- Martin, P. (1999). Bilingual unpacking of monolingual texts in two primary classrooms in Brunei Darussalam. *Language and Education*, 13(1), 38-58.
- Martin, P. (2005). 'Safe' language practices in two rural schools in Malaysia: tension between policy and practice. In A. M. Y. Lin & P. W. Martin (Eds.), *Decolonisation, globalisation: Language-in-education policy and practice* (pp. 74-97). Clevedon: Multilingual Matters Ltd.
- Martin, P. W. (1996). Code-switching in the primary classroom: One response to the planned and the unplanned language environment in Brunei. *Journal of Multilingual and Multicultural Development*, 17(2-4), 128-144.
- Martin-Jones, M. (1995). Code-switching in the classroom: Two decades of research. In L. Milroy & P. Muysken (Eds.), *One speaker, two languages: Cross disciplinary perspectives on code-switching* (pp. 90-111). Cambridge: Cambridge University Press.
- Martin-Jones, M. (2000). Bilingual classroom interaction: a review of recent research. *Language Teaching*, 33(1), 1-9.
- Math and Science back to Bahasa, mother tongue (Updated). (2009, July 8). *The Star*. Retrieved from <http://thestar.com.my/news/story.asp?file=/2009/7/8/nation/20090708144354&sec=nation>
- Maya Khemlani, D., McLellan, J., Shameem R.-G. & Ain N. A. (2009). (Eds.). *Code Switching in Malaysia*. Frankfurt: Peter Lang.
- Mehan, H. (1979). *Learning lessons-social organization in the classroom*. Cambridge, Mass: Harvard University Press.

- Mejía, A-M. De. (2002). *Power, prestige and bilingualism: International perspectives on elite bilingual education*. Clevedon: Multilingual Matters.
- Milk, R. (1981). An analysis of the functional allocation of Spanish and English in a bilingual classroom. *California Association for Bilingual Education: Research Journal*, 2(2), 11-26.
- Milroy, L. & Muysken, P. (1995). (Eds.). *One speaker two languages: Cross disciplinary perspectives on code-switching*. Cambridge: Cambridge University Press.
- Ministry of Education Brunei. (2008). *Primary Education*. Retrieved December 6, 2012, from Ministry of Education: <http://www.moe.edu.bn/web/moe/edusys/priedu>.
- Ministry of Education Malaysia. (2010). *To uphold Bahasa Malaysia and to strengthen the English Language*. Retrieved, 12 February, 2013, from http://www.moe.gov.my/mbmmbi/moe_mbmmbi_03.htm.
- Ministry of Education Singapore. (2012a). *Primary Education*. Retrieved December 5, 2012, from <http://www.moe.gov.sg/education/primary/>
- Moyer, M. G. (2008). Research as practice: Linking theory, method and data. In Li Wei & M. G. Moyer (Eds.), *The Blackwell guide to research methods in bilingualism and multilingualism*. Oxford: Blackwell Publishing Ltd.
- Muysken, P. (2000). *Bilingual speech: typology of code-mixing*. Cambridge, UK: Cambridge University Press.
- Myers-Scotton, C. & Bolonyai, A. (2001). Calculating speakers: Codeswitching in a rational choice model. *Language in Society*, 30, 1-28.
- Myers-Scotton, C. (1983). The negotiation of identities in conversation: A theory of markedness and code choice. *International Journal of the Sociology of Language*, 44, 115-136.
- Myers-Scotton, C. (1992). Comparing codeswitching and borrowing. *Journal of Multicultural and Multilingual Development*, 13, 19-40.
- Myers-Scotton, C. (1993). *Social motivations for code-switching: Evidence from Africa*. Oxford: Clarendon Press.
- Myers-Scotton, C. (1999). Explaining the role of norms and rationality in codeswitching. *Journal of Pragmatics*, 32, 1259-1271.
- Myers-Scotton, C. (2007). Code-switching as indexical of social negotiations. In L. Wei (Ed.). (2nd ed). *The bilingualism reader* (pp. 97-122). Oxon: Routledge.

- Nunan, D. (2003). The impact of English as a global language on educational policies and practices in the Asia-Pacific region. *TESOL Quarterly*, 37(4), 589-613.
- Otheguy, R. & Otto, R. (1980). The myth of static maintenance in bilingual education. *Modern Language Journal* 64(3), 350-356.
- Pakir, A. (2004). Medium-of-instruction policy in Singapore. In J. W. Tollefson & A. B. M. Tsui (Eds.), *Medium of instruction policies: Which agenda? Whose Agenda?* (pp. 117-133). Mahwah, NJ: Lawrence Erlbaum Associates, Inc. Publishers.
- Pandian, A. & Ramiah, R. (2003, December). *Mathematics and Science in English—teacher voices*. Paper presented in the ELTC ETeMS Conference: Managing curricular change, Pearl Point International Hotel, Kuala Lumpur.
- Patton, M. Q. (1980). *Qualitative evaluation methods*. Beverly Hills: Sage Publications.
- Patton, M. Q. (1990). *Qualitative evaluation and research methods* (2nd ed.). London: Sage Publications.
- Payawal-Gabriel, J. & Reyes-Otero, M. (2006). Comprehensible input strategies and pedagogical moves using Filipino/English as medium of instruction in secondary Mathematics. *Education Quarterly*, 83-97.
- Payne, U. & Cuff, E. (Eds.) (1982). *Doing teaching: the practical management of classrooms*. London: Batsford.
- Poplack, S. (1982). Bilingualism and the vernacular. In B. Hartford, A. Valdman, & C. Foster, *Issues in International bilingual education: The role of the vernacular*, pp. 1-23. New York: Plenum Press.
- Probyn, M. (2001). Teacher's voices: Teachers' reflections on learning and teaching through the medium of English as a second language. *International Journal of Bilingual Education and Bilingualism*, 4(4), 249-266.
- Probyn, M. (2005). Language and the struggle to learn: the intersection of classroom realities, language policy, and neo-colonial and globalisation discourses in South African schools. In A. Lin and P. Martin (Eds.). *Decolonisation, Globalisation: Language-in-Education Policy and Practice* (pp. 153-172). Clevedon: Multilingual Matters.
- Richards, L. (2005). *Handling qualitative data: A practical guide*. London: Sage.
- Rollnick, M. & Rutherford, M. (1996). The use of mother tongue and English in the learning and expression of science concepts: a classroom-based study. *International Journal of Science Education*, 18(1), 91-103.

- Schermerhorn, R. A. (1970). *Comparative ethnic relations*. New York: Random House.
- Seedhouse, P. (2004). *The interactional architecture of the language classroom: a conversational analysis perspective*. Oxford: Blackwell Publishing.
- Setati, M., Adler, J., Reed, Y., & Bapoo, A. (2002). Incomplete journeys: code-switching and other language practices in mathematics, science and English language classrooms in South Africa. *Language and Education*, 16(2), 128-149.
- Sinclair, J. M. & Coulthard, R. M. (1975). *Towards an analysis of discourse: The English used by teachers and pupils*. Oxford: Oxford University Press.
- Skutnabb-Kangas, T. (1981). *Bilingualism or not: the education of minorities*. Clevedon: Multilingual Matters.
- Skutnabb-Kangas, T. (2000). *Linguistics genocide in education – or worldwide diversity and human rights?* Mahwah, NJ: Erlbaum.
- SMK Cochrane.(2013). *Anugerah dan pencapaian PMR 2012*. Retrieved 28 October, 2013 from <http://www.smkcochrane.net/2013/04/anugerah-dan-pencapaian-pmr-2012.html>.
- ten Have, P. (1990). Methodological issues in conversation analysis. *Bulletin de Methodologie Sociologique*, (27), 23-51.
- Then, D. C. O., & Ting, S. H. (2009). Preliminary study of code-switching in English and science secondary school classrooms in Malaysia. *Teaching English as a Second or Foreign Language (TESL-Electronic Journal)*, 13(1). Retrieved 9 November, 2012, from <http://www.tesl-ej.org/ej49/a3.html>.
- Then, D. C. O., & Ting, S. H. (2011). Code-switching in English and science classrooms: More than translation. *International Journal of Multilingualism*, 8(4), 299-323.
- Tollefson, J. W., & Tsui, A. (2004). *Medium of instruction policies: Which agenda? Whose agenda?* In J. W. Tollefson, & A. B. Tsui (Eds.) Mahwah, NJ: Lawrence Erlbaum Associates.
- Trudell, B. (2007). Local community perspectives and language of education in Sub-Saharan African communities. *International Journal of Educational Development*, 27(5), 552-563.
- Tse, S. K., Shum, M. S., Ki, W. W., & Wong, C. P. (2001). The transition from English to mother-tongue Chinese as medium of instruction: Issues and problems as seen by Hong Kong teachers. *L1 – Educational Studies in Language and Literature* , 1, 9-36.
- Tse, S. K., Shum, M., Ki, W. W., & Chan, Y. M. (2007). The medium dilemma for Hong Kong secondary schools. *Language Policy* , 6, 135-162.

- Tsui, A. (2004). Medium of instruction in Hong Kong: One country, two systems, whose language? In J. W. Tollefson, & A. Tsui, *Medium of instruction policies: Which agenda? Whose agenda?* (pp. 97-116). Mahwah, NJ: Lawrence Erlbaum Associates.
- Unesco. (1953). *The use of vernacular languages in education*. Paris: Unesco.
- Villarreal, A. (1999). Rethinking the education of English language learners: Transitional bilingual education programs. *Bilingual Research Journal*, 23(1), 11-45.
- Walsh, S. (2006). *Investigating classroom discourse*. New York: Routledge.
- Williams, E. (2006). *Barriers and bridges: Language in African education and development*. Manchester, UK ; Kinderhook, NY : St. Jerome Pub.
- Wong, F. & Ee, T. H. (1975). *Education in Malaysia* (2nd ed.). Kuala Lumpur: Heinemann Educational.
- Woolard, K. A. (2004). Codeswitching. In A. Duranti (Ed.). *A companion to linguistic anthropology* pp73-94. Oxford: Blackwell Publishing.
- Yong, F. L. (2010). A study on the learning approaches of Malaysian students in relation to English language acquisition. *American Journal of Scientific Research*, 9, 5-11.

Appendix A

Figure 1*: Trend of Students Scoring Grade A, B and C in UPSR** Science Subject According to Location 2001-2008

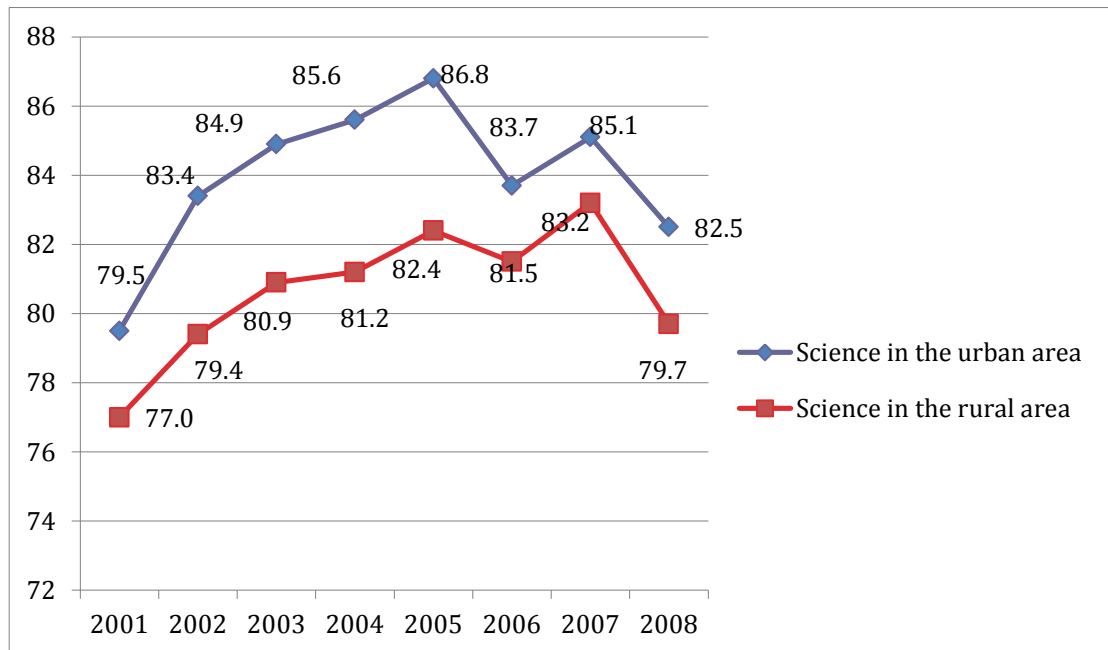
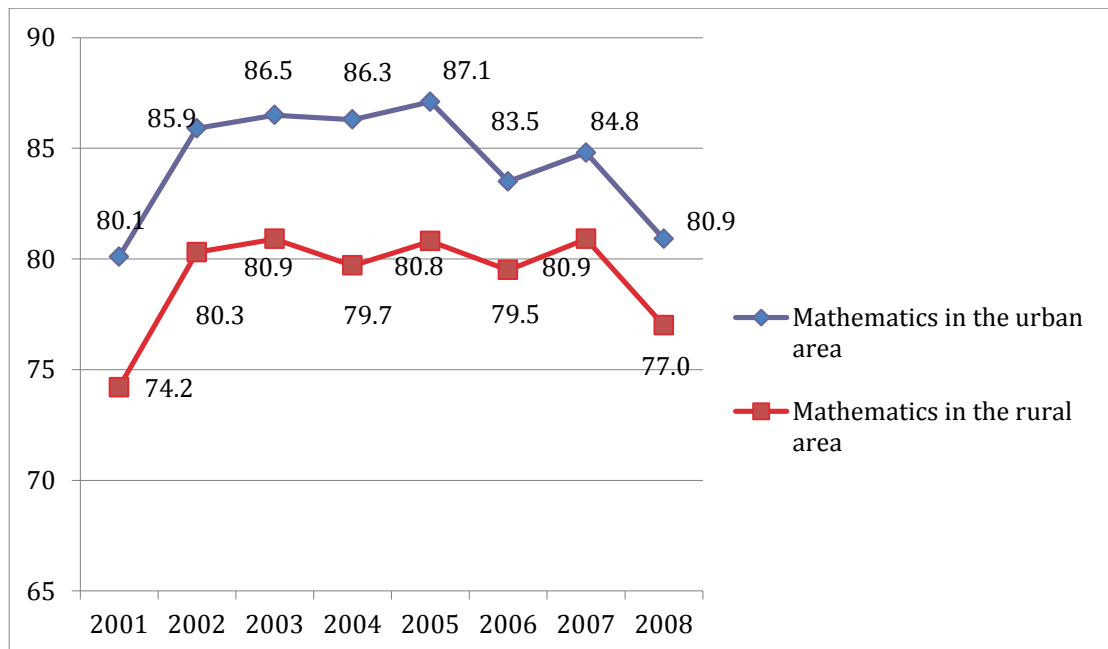


Figure 2*: Trend of Students Scoring Grade A, B and C in UPSR** Mathematics Subject According to Location 2001-2008



* Taken and translated from

<http://thestar.com.my/archives/2009/7/8/nation/20090708144354.pdf> on 17 May 2010

**UPSR stands for *Ujian Penilaian Sekolah Rendah* (Assessment Test for Primary Schools)

Appendix B

	Secondary schools		Primary schools	
	Number	(%)	Number	(%)
Level 5 (89-100)	53	0.29	32	0.06
Level 4 (67-88)	3,423	18.91	5,092	9.90
Total of Level 4 & 5	3,476	19.20	5,124	9.96
Level 3 (45-66)	10,521	58.11	24,987	48.57
Level 2 (21-44)	3,949	21.81	19,807	38.50
Level 1 (00-22)	158	0.87	1,526	2.97
Total of Level 1, 2 & 3	14,628	80.80	46,320	90.04
Total of participants	18,104	100.00	51,444	100.00

Table 1*: Results of English Proficiency Assessment Test for Teachers of Mathematics and Science Subjects, 2008

* Taken and translated from

<http://thestar.com.my/archives/2009/7/8/nation/20090708144354.pdf> on 17 May 2010

Appendix C

Sample questions for interviews with all science teachers.

1. How do you feel about the decision of using (Malay, English or both) as the MOI for science?
2. If you were given the choice, would you abolish or continue with *PPSMI*? Why?
3. Do you think students will benefit from *MBMMBI*?
4. Now that your school teaches science in (Malay, English or both), do you think your students will cope well when they enter Form 6, of which the subject will be taught in English?
5. If you think they will struggle, what kind of problems do you think they will face?
6. Do you think Form 6 teachers will face any problems in teaching students under the *MBMMBI* policy? If yes, what are the problems that you foresee?
7. What do you understand about code-switching?
8. Are you aware if you code-switch in class?
9. Under what circumstances do you usually code-switch i.e. why do you code-switch?
10. What do you think about classroom code-switching? Do you think it should be encouraged or discouraged?
11. Do you think teachers will benefit from a formal training on classroom code-switching?

Sample questions for pre and post observation interview with chosen science teachers.

Pre-observation interview:

The same questions asked to all science teachers (Appendix A) with extra questions on their personal and teaching background.

1. How long have you been teaching?
2. What training did you receive before becoming a teacher?
3. What language(s) do you speak?
4. What age group have you been teaching?

Post-observation interview:

1. I notice that you code-switched at this instance (allowing teacher to listen to the tape or read the transcript), can you please explain the reason?

Appendix D

Observed Teachers Portfolio

Farid

Teaching experience: 3 years

First language: Malay

MOI during undergraduate: English

View on using more than one language in class:

“My personal view on mixed languages in class, it's actually good if the English language is not the mother tongue of the (students) of the. For example in Malaysia our mother tongue is in Malay so there's a few, for example, lot more umm, explanation, further explanation, if the kids don't really understand, so we need to find easy way for them, easier language, sometimes we use Malay. Normally we use Malay in order to ahh, explain something that's quite difficult for them to understand.”

Su Ling

Teaching experience: 3 years

First language: Mandarin

MOI during undergraduate: Mostly Malay

View on using more than one language in class:

“Actually I prefer English in science and maths teaching. Because the terms, it is more efficient, if the students want to understand a certain theory and formula...So sometimes in an exam they answer in English but they have grammar mistakes but I just give them correct cos I know they understand the concept. And sometimes it's bilingual, they can answer in both BM or BI so for me, actually their achievement is not based on their language but their mindset whether they want to study or not...I don't encourage mix language you know. Students will get confused cos I tried that before, for the middle achievement classes. They said confuse. This is sometimes you switch you know BI then you switch to BM, they'll get confused even though you may think it's good but then actually it's confusing for them. After we discussed right, all the teachers agreed with that...Or one sentence English and then I translate or explain again in BM, full sentence. But not mix the language in between, of course we can do that, but not most of the time.”

Fatimah

Teaching experience: 10 years

First language: Malay

MOI during undergraduate: English

View on using more than one language in class:

“We have to like bilingual in our teaching, especially the class like not, A class, A class I still have BM and BI I have to but in my other class D, I have to mix the language (more) cos they don't understand...sometimes I lose words, a better words, sometimes we, sometimes what we have in mind is not appropriate to say it to the children you know, so **dalam kepala** (*in your mind*) when you say ah I have something but when we want to phrase it we go, oh no no, OK, I just what I can know is **kosong** (*empty*). Haha...There's no particular reason for that. Sometimes when ahh, we speak a lot of English, sometimes we lose, we lost words of what I want to say, finish my vocabulary...I just like, err it's like because we are native, we like speak native words with students, something like this "**apa dia masalah** (*what is the problem*)" sometimes the students know that when I speak in Malay sometimes it's not like err,

it's like **penegasan** (*emphasis*), I want to stress something or it's just I want to try to make jokes. I'm not very good in making jokes in English. They feel more comfortable for some...But but they realise that if I speak fully in Malay, it means that I'm so angry. Ah..so they really understand. haha..but luckily when you were around, they were very good.”

Marina

Teaching experience: 15 years

First language: Malay

MOI during undergraduate: Malay

View on using more than one language in class:

(Comment translated from Malay) “Practical la. Ah because giving them chance, to not pick side for them, because there are some who rely on Malay a lot, some rely extensively on English. So, bilingual allows them option for as both are balance...My factual information is all in English. Err try to explain in English so they will be able to read in English unless they do not understand, they need further explanation err, I explain in Malay, that I will use bilingual. But for now, for students in the controlled class, indeed the right-hand teacher asks all to favour English more. If it is not a controlled class, the majority of them use Malay.”

Amina

Teaching experience: 23 years

First language: Malay

MOI during undergraduate: Malay

View on using more than one language in class:

(Comment translated from Malay) “If for me, I would prefer bilingual la. For me la. I feel it is really good to use bilingual than from using totally Malay or totally English.”

Shahrul

Teaching experience: 6 years

First language: Malay

MOI during undergraduate: Malay

View on using more than one language in class:

(Comment translated from Malay) “I think it needs reform. Because its meaning can be confusing to students too. When we change the policy it could confuse students to learn either in English or Malay...Because the feedback from majority students is less what do we call, like difficult la, for example there are students who can understand English like what I am doing I am using English powerpoint and English textbook but for students who are not fluent in English they find it difficult to catch up in English. But when we teach in Malay, students who are not Malays especially would face difficulty understanding in Malay.”

Appendix E

Questionnaire for students

Dear student, thank you for agreeing to participate in my study. I am a PhD student currently collecting data for my research. Please complete the following questionnaire by choosing the best answer that represents you. You do not need to provide your name for this.

Please **CIRCLE** your answer:

For example: How old are you?

- A) 12 years old **(B)** 13 years old C) 14 years old

1) What language do you use most often at home?

- A) Malay B) Mandarin C) Tamil D) English
E) Other: _____

2) Which type of primary school did you go to?

- A) Sekolah Kebangsaan B) Sekolah Jenis Kebangsaan (Cina)
C) Sekolah Jenis Kebangsaan (Tamil) D) International School
E) Other: _____

3) When you were in primary school, what was the language most often used by your science teacher?

- A) Malay B) Mandarin C) Tamil D) English

4) Now, in your Form 1 science class, how much Malay and English does your teacher use?

- A) More Malay less English B) More English less Malay
C) Both languages are used equally D) Only Malay E) Only English

(Please turn over)

- 5) Please circle the number to show how much English and/or Malay you wish your science teacher would use in class. The smaller the number, the more Malay you prefer and the higher the number, the more English you prefer. Number 1 means only Malay and number 10 means only English.

For example, if you prefer more Malay and less English, do this:

(More Malay) (More

1	2	3	4	5	6	7	8	9	10
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 English)

Your answer:

(More Malay) (More

1	2	3	4	5	6	7	8	9	10
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 English)

- 6) Please explain your answer in question 5 by ticking (✓) one or more of the following reasons:

- It helps me to understand the teacher better.
- It saves time for the teacher to explain.
- It helps me to pay attention in class.
- I don't like English.
- I don't like Malay.
- It gives me more chances to listen to English.
- It gives me more chances to listen to Malay.
- It helps to improve my English.
- It helps to improve my Malay.
- Other: _____

- 7) Do you get confused when your teacher uses two languages in class?

A) Yes B) A little C) No

-----The end-----

Appendix F

Data from Students' Questionnaire

1. Farid' s students

No.	Language used at home	Primary school attended	Science MOI in primary school	Science MOI now	Preferred MOI	Why?	Do you get confused?
1	Mandarin	Sekolah Jenis Kebangsaan (Cina)	Mandarin	More English less Malay	10	It gives me more chances to listen to English., It helps to improve my English.	No
2	English	Sekolah Kebangsaan	English	More English less Malay	7	It helps me to understand the teacher better., It gives me more chances to listen to English., It gives me more chances to listen to Malay., It helps to improve my English., It helps to improve my Malay.	No
3	Malay	Sekolah Kebangsaan	Malay	More English less Malay	6	It helps me to understand the teacher better., It gives me more chances to listen to English., It helps to improve my English.	No
4	Malay	Sekolah Kebangsaan	English	More English less Malay	6	It helps me to understand the teacher better., It gives me more chances to listen to English., It helps to improve my English.	No
5	Malay	Sekolah Kebangsaan	English	More English less Malay	6	It helps me to understand the teacher better., It gives me more chances to listen to English., It helps to improve my English.	No
6	Malay	Sekolah Kebangsaan	English	More English less Malay	6	It helps me to understand the teacher better., It helps me to pay attention in class., It gives me more chances to listen to English., It helps to improve my English.	No
7	English	Sekolah Jenis Kebangsaan (Tamil)	English	More English less Malay	10	It saves time for the teacher to explain., I don't like Malay., It gives me more chances to listen to English., It helps to improve my English.	A little
8	Malay	Sekolah Kebangsaan	Malay	More English less Malay	5	It helps me to understand the teacher better., It helps me to pay attention in class.	No
9	English	Sekolah Kebangsaan	English	More English less Malay	10	It helps me to understand the teacher better., It saves time for the teacher to explain., It helps me to pay attention in class., I don't like Malay., It helps to improve my English.	No

10	Malay	Sekolah Kebangsaan (also went to International sch)	English	More English less Malay	9	It helps me to understand the teacher better., It saves time for the teacher to explain., It helps me to pay attention in class., I don't like Malay., It gives me more chances to listen to English., It helps to improve my English.	No
11	Malay	Sekolah Kebangsaan	English	More English less Malay	6	It helps me to understand the teacher better., It saves time for the teacher to explain., It helps me to pay attention in class., It gives me more chances to listen to English., It helps to improve my English., It helps me to communicate better.	No
12	English	Sekolah Kebangsaan	Malay	More English less Malay	6	It gives me more chances to listen to English., It gives me more chances to listen to Malay., It helps to improve my Malay.	A little
13	Malay	Sekolah Kebangsaan	English	More English less Malay	9	It helps me to understand the teacher better., It helps me to pay attention in class., It gives me more chances to listen to English., It helps to improve my English., I can understand much more in English.	No
14	Malay	Sekolah Kebangsaan	English	More English less Malay	7	It helps me to understand the teacher better., It helps me to pay attention in class., It gives me more chances to listen to English., It helps to improve my English.	No
15	English	Sekolah Kebangsaan	English	More English less Malay	10	It saves time for the teacher to explain., It helps me to pay attention in class., I prefer learning in English.	No
16	Malay	Sekolah Kebangsaan	English	More English less Malay	9	It helps me to understand the teacher better., It helps me to pay attention in class., It gives me more chances to listen to English., It helps to improve my English.	No
17	Tamil	Sekolah Jenis Kebangsaan (Tamil)	English	More English less Malay	10	It helps me to understand the teacher better., It helps me to pay attention in class., I don't like Malay., It gives me more chances to listen to English., It helps to improve my English.	A little
18	English	Sekolah Kebangsaan	Malay	More English less Malay	6	It helps me to understand the teacher better., It helps me to pay attention in class., It gives me more chances to listen to English., It helps to improve my English.	No
19	Malay	Sekolah Kebangsaan	English	More English less Malay	10	It helps me to understand the teacher better., It helps me to pay attention in class., I don't like Malay., It helps to improve my English.	No
20	Malay	Sekolah Kebangsaan	English	More English less Malay	7	It helps me to understand the teacher better., It gives me more chances to listen to English., It helps to improve my English.	No
21	English	Sekolah Jenis Kebangsaan (Cina)	Mandarin	More English less Malay	9	It gives me more chances to listen to English., It helps to improve my English.	A little

22	English	Sekolah Jenis Kebangsaan (Cina)	Mandarin	More English less Malay	9	It helps me to understand the teacher better., It helps me to pay attention in class., I don't like Malay., It gives me more chances to listen to English., It helps to improve my English.	No
23	Malay	Sekolah Kebangsaan	English	More English less Malay	5	It helps me to understand the teacher better.	A little
24	Malay	Sekolah Kebangsaan	Malay	More English less Malay	5	It helps me to understand the teacher better., It helps me to pay attention in class., It gives me more chances to listen to English., It gives me more chances to listen to Malay., It helps to improve my English.	A little

2. Su Ling's students

No.	Language used at home	Primary school attended	Science MOI in primary school	Science MOI now	Preferred MOI	Why?	Do you get confused?
1	English	Sekolah Kebangsaan	Malay	More English less Malay	10	It helps me to understand the teacher better., It saves time for the teacher to explain., It helps me to pay attention in class., I don't like Malay., It gives me more chances to listen to English., It helps to improve my English.	No
2	Tamil	Sekolah Kebangsaan	English	More English less Malay	10	It helps me to understand the teacher better., I don't like Malay., It gives me more chances to listen to English., It helps to improve my English.	A little
3	English	Sekolah Jenis Kebangsaan (Cina)	Mandarin	More English less Malay	8	It helps me to understand the teacher better., It saves time for the teacher to explain., It helps me to pay attention in class., It gives me more chances to listen to English., It helps to improve my English.	A little
4	Mandarin	Sekolah Kebangsaan	English	More English less Malay	8	It helps me to understand the teacher better., It saves time for the teacher to explain., It helps me to pay attention in class., It gives me more chances to listen to English., It helps to improve my English.	A little

5	English	Sekolah Kebangsaan	Malay	More English less Malay	10	It helps me to understand the teacher better., It saves time for the teacher to explain., It helps me to pay attention in class., I don't like Malay., It gives me more chances to listen to English., It helps to improve my English., I feel weird when teacher explains in Malay.	Yes
6	Mandarin	Sekolah Jenis Kebangsaan (Cina)	Mandarin	More English less Malay	9	It helps me to understand the teacher better., I don't like Malay., It helps to improve my English.	A little
7	Mandarin	Sekolah Kebangsaan	English	More English less Malay	9	It helps me to understand the teacher better., It helps me to pay attention in class., I don't like Malay., It gives me more chances to listen to English., It helps to improve my English.	No
8	English	Sekolah Jenis Kebangsaan (Cina)	Mandarin	More English less Malay	9	It helps me to understand the teacher better., I don't like Malay., I am not good in Malay.	No
9	English	Sekolah Kebangsaan	English	More English less Malay	9	It helps me to understand the teacher better., It helps me to pay attention in class., It gives me more chances to listen to English., It helps to improve my English.	No
10	English	Sekolah Kebangsaan	English	Both languages are used equally	9	It helps me to understand the teacher better., It helps me to pay attention in class., It gives me more chances to listen to English., It helps to improve my English.	No
11	Malay	Sekolah Kebangsaan	English	More English less Malay	8	It gives me more chances to listen to English.	No
12	Mandarin	Sekolah Jenis Kebangsaan (Cina)	Mandarin	More English less Malay	10	It helps me to understand the teacher better., I don't like Malay., It gives me more chances to listen to English., It helps to improve my English., I don't understand Malay very much.	A little
13	Mandarin	Sekolah Jenis Kebangsaan (Cina)	Mandarin	More English less Malay	8	It helps me to understand the teacher better., I don't like Malay., It gives me more chances to listen to English., It helps to improve my English., English is easier to understand.	Yes
14	Malay	Sekolah Kebangsaan	English	More English less Malay	8	It saves time for the teacher to explain., It helps me to pay attention in class., It gives me more chances to listen to Malay., It helps to improve my English.	No
15	English	Sekolah Kebangsaan	English	More English less Malay	8	It helps me to understand the teacher better., It helps me to pay attention in class., It gives me more chances to listen to English., It helps to improve my English.	No

16	Malay	Sekolah Kebangsaan	English	More English less Malay	8	It helps me to understand the teacher better., It saves time for the teacher to explain., It helps to improve my English.	No
17	Malay	Sekolah Kebangsaan	Malay	More English less Malay	2	It helps me to understand the teacher better.	A little
18	Malay	Sekolah Kebangsaan	English	More English less Malay	9	It helps me to understand the teacher better., It helps me to pay attention in class., It gives me more chances to listen to English., It helps to improve my English.	A little
19	English	Sekolah Kebangsaan	English	More English less Malay	9	It helps me to understand the teacher better., It helps me to pay attention in class., It helps to improve my English.	A little
20	English	Sekolah Kebangsaan	English	More English less Malay	10	It saves time for the teacher to explain., It helps me to pay attention in class., It helps to improve my English.	No
21	Mandarin	Sekolah Kebangsaan	English	More English less Malay	8	It helps me to understand the teacher better., It saves time for the teacher to explain., It helps to improve my English.	No
22	English	Sekolah Jenis Kebangsaan (Cina)	Mandarin	Only English	10	It saves time for the teacher to explain., It helps me to pay attention in class., I don't like Malay.	A little
23	English	Sekolah Jenis Kebangsaan (Cina)	Mandarin	Only English	10	It saves time for the teacher to explain., It helps me to pay attention in class., I don't like Malay., It gives me more chances to listen to English., It helps to improve my English.	A little
24	Malay	Sekolah Kebangsaan	English	More English less Malay	8	It helps me to understand the teacher better., It saves time for the teacher to explain., It helps me to pay attention in class., It gives me more chances to listen to English., It helps to improve my English.	No
25	Malay	Sekolah Kebangsaan	English	More English less Malay	8	It saves time for the teacher to explain., It helps me to pay attention in class., It gives me more chances to listen to English., It helps to improve my English.	No
26	Mandarin	Sekolah Jenis Kebangsaan (Cina)	Mandarin	Both languages are used equally	9	It helps me to understand the teacher better., It saves time for the teacher to explain., It helps me to pay attention in class., It gives me more chances to listen to English., It gives me more chances to listen to Malay., It helps to improve my English., It helps to improve my Malay.	No
27	Malay	Sekolah Jenis Kebangsaan (Cina)	Mandarin	More English less Malay	10	It helps me to understand the teacher better., It gives me more chances to listen to English., It helps to improve my English.	No

28	Mandarin	Sekolah Jenis Kebangsaan (Cina)	Mandarin	Only English	10	It helps me to understand the teacher better., It saves time for the teacher to explain., It gives me more chances to listen to English., It helps to improve my English.	No
29	Mandarin	Sekolah Jenis Kebangsaan (Cina)	Mandarin	More English less Malay	9	I don't like Malay.	No
30	English	Sekolah Kebangsaan	English	More English less Malay	10	It saves time for the teacher to explain., It helps me to pay attention in class., It helps to improve my English.	No

3. Fatimah's students

No.	Language used at home	Primary school attended	Science MOI in primary school	Science MOI now	Preferred MOI	Why?	Do you get confused?
1	Mandarin	Sekolah Kebangsaan	English	More English less Malay	10	It helps me to understand the teacher better., It saves time for the teacher to explain., It helps me to pay attention in class., It gives me more chances to listen to English., It helps to improve my English.	No
2	Tamil	Sekolah Kebangsaan	English	More English less Malay	10	It helps me to understand the teacher better., It saves time for the teacher to explain., It helps me to pay attention in class., It gives me more chances to listen to English., It gives me more chances to listen to Malay., It helps to improve my English., It helps to improve my Malay.	No
3	Malay	Sekolah Kebangsaan	English	More English less Malay	9	It helps me to understand the teacher better., It saves time for the teacher to explain., It helps me to pay attention in class., It helps to improve my English.	No
4	English	Sekolah Kebangsaan	English	Both languages are used equally	8	It helps me to understand the teacher better., It saves time for the teacher to explain., It helps me to pay attention in class., It helps to improve my English.	No
5	English	Sekolah Kebangsaan	English	Both languages are used equally	5	It saves time for the teacher to explain., It helps me to pay attention in class.	A little

6	Malay	Sekolah Kebangsaan	English	More English less Malay	7	It helps me to understand the teacher better., It gives me more chances to listen to English., It helps to improve my English.	A little
7	English	Sekolah Jenis Kebangsaan (Cina)	Mandarin	Both languages are used equally	10	It helps me to understand the teacher better., It helps me to pay attention in class., I understand better of what my science teacher teaches in class using English.	No
8	Mandarin	Sekolah Jenis Kebangsaan (Cina)	Mandarin	More Malay less English	9	It helps me to understand the teacher better., It saves time for the teacher to explain., It helps me to pay attention in class., It gives me more chances to listen to English., It helps to improve my English.	A little
9	Mandarin	Sekolah Jenis Kebangsaan (Cina)	Mandarin	More Malay less English	9	It saves time for the teacher to explain., It helps me to pay attention in class., It gives me more chances to listen to English., It helps to improve my English.	A little
10	Malay	Sekolah Kebangsaan	English	Both languages are used equally	7	It helps me to understand the teacher better., It helps me to pay attention in class.	No
11	English	Sekolah Kebangsaan	English	Both languages are used equally	10	It helps me to understand the teacher better., It gives me more chances to listen to English., It is because I am used to using English in science so it will be confusing when teacher change to all Malay language.	No
12	Malay	Sekolah Kebangsaan	English	More English less Malay	8	It helps me to understand the teacher better., It saves time for the teacher to explain., It helps me to pay attention in class., It gives me more chances to listen to English., It helps to improve my English.	No
13	Malay	Sekolah Kebangsaan	English	Both languages are used equally	9	It helps me to understand the teacher better., It helps me to pay attention in class., It gives me more chances to listen to English., It helps to improve my English.	No
14	Mandarin	Sekolah Kebangsaan	English	More English less Malay	10	It helps me to understand the teacher better., It saves time for the teacher to explain., I don't like Malay., It gives me more chances to listen to English., It helps to improve my English.	Yes
15	Mandarin	Sekolah Jenis Kebangsaan (Cina)	Mandarin	More English less Malay	10	It helps me to understand the teacher better., It saves time for the teacher to explain., I don't like Malay., It gives me more chances to listen to English., It helps to improve my English.	Yes
16	English	Sekolah Kebangsaan	Malay	Both languages are used equally	8	It saves time for the teacher to explain., It helps me to pay attention in class., It helps to improve my English., It helps to improve my Malay.	No

17	Malay	Sekolah Kebangsaan	English	Both languages are used equally	10	It helps me to pay attention in class., It gives me more chances to listen to English., It helps to improve my English.	No
18	English	Sekolah Kebangsaan	English	More English less Malay	9	It helps me to understand the teacher better., It helps me to pay attention in class., I understand English more compared to Malay.	No
19	Malay	Sekolah Kebangsaan	Malay	More English less Malay	6	It helps me to understand the teacher better., It helps me to pay attention in class., It helps to improve my English.	No
20	English	Sekolah Kebangsaan	English	More English less Malay	10	It helps me to understand the teacher better., It saves time for the teacher to explain., It helps me to pay attention in class., I don't like Malay., It gives me more chances to listen to English., It helps to improve my English.	No
21	English	Sekolah Kebangsaan	English	More English less Malay	10	It helps me to understand the teacher better., It saves time for the teacher to explain., It helps me to pay attention in class., I don't like Malay., It gives me more chances to listen to English., It helps to improve my English.	No
22	English	Sekolah Kebangsaan	English	Both languages are used equally	6	It helps me to understand the teacher better., It saves time for the teacher to explain., It helps me to pay attention in class., It helps to improve my English., It helps to improve my Malay.	No
23	Malay	Sekolah Kebangsaan	English	More Malay less English	8	It helps me to understand the teacher better., It helps me to pay attention in class., It gives me more chances to listen to English., It helps to improve my English.	A little
24	Malay	Sekolah Kebangsaan	Malay	Both languages are used equally	6	It helps me to understand the teacher better., It helps to improve my English.	No
25	Mandarin	Sekolah Kebangsaan and SJK (Cina)	English	More English less Malay	7	It helps me to understand the teacher better., It helps me to pay attention in class., It gives me more chances to listen to English., I prefer English to Malay as English is my mother tongue.	No
26	Malay	Sekolah Kebangsaan	English	Both languages are used equally	9	It helps me to understand the teacher better., It helps me to pay attention in class., It gives me more chances to listen to English., It helps to improve my English.	A little
27	Malay	Sekolah Kebangsaan	English	Both languages are used equally	10	It helps me to understand the teacher better., It helps me to pay attention in class., It gives me more chances to listen to English., It helps to improve my English.	A little

28	English	Sekolah Swasta	English	Both languages are used equally	10	It helps me to understand the teacher better., It helps me to pay attention in class., I'm more comfortable/fluent in English.	No
29	Malay	Sekolah Kebangsaan	English	More English less Malay	8	It helps me to understand the teacher better., It helps to improve my English.	A little
30	Mandarin	Sekolah Jenis Kebangsaan (Cina)	Mandarin	More English less Malay	10	It helps me to understand the teacher better., It saves time for the teacher to explain., It helps me to pay attention in class., I don't like Malay., Malay is difficult to understand.	Yes

4. Marina's students

No.	Language used at home	Primary school attended	Science MOI in primary school	Science MOI now	Preferred MOI	Why?	Do you get confused?
1	English	Sekolah Kebangsaan	English	More Malay less English	10	It helps me to understand the teacher better., It saves time for the teacher to explain., It gives me more chances to listen to English., It helps to improve my English., I don't fully understand Malay.	A little
2	English	Sekolah Kebangsaan	English	More English less Malay	9	It helps me to understand the teacher better., It helps me to pay attention in class., It gives me more chances to listen to English., It helps to improve my English.	A little
3	English	Sekolah Kebangsaan	English	More English less Malay	9	It helps me to understand the teacher better., It saves time for the teacher to explain., It helps me to pay attention in class., It gives me more chances to listen to English., It helps to improve my English.	A little
4	English	Sekolah Kebangsaan	English	More English less Malay	9	It helps me to understand the teacher better., It helps me to pay attention in class., It gives me more chances to listen to English., It helps to improve my English.	A little
5	Malay	Sekolah Kebangsaan	English	Both languages are used equally	5	It helps me to understand the teacher better., It saves time for the teacher to explain., It helps me to pay attention in class.	A little

6	Malay	Sekolah Kebangsaan	English	Both languages are used equally	5	It helps me to understand the teacher better., It saves time for the teacher to explain., It helps me to pay attention in class., I don't like English., It gives me more chances to listen to Malay., It helps to improve my English., It helps to improve my Malay.	A little
7	English	Sekolah Kebangsaan	English	More Malay less English	10	It helps me to understand the teacher better., It saves time for the teacher to explain., I don't like Malay., It gives me more chances to listen to English.	Yes
8	Malay	Sekolah Kebangsaan	English	More English less Malay	3	It helps me to understand the teacher better., It helps me to pay attention in class.	A little
9	English	Sekolah Kebangsaan	English	Both languages are used equally	10	It helps me to understand the teacher better., It saves time for the teacher to explain., It helps me to pay attention in class., I don't like Malay., It gives me more chances to listen to English., It helps to improve my English.	A little
10	English	Sekolah Kebangsaan	English	Both languages are used equally	9	It helps me to understand the teacher better., It helps me to pay attention in class., It helps to improve my English., It feels easy for me to learn science in English.	A little
11	Mandarin	Sekolah Jenis Kebangsaan (Cina)	Mandarin	Both languages are used equally	7	It helps me to understand the teacher better., It helps me to pay attention in class., It helps to improve my English.	A little
12	Cantonese	Sekolah Jenis Kebangsaan (Cina)	Mandarin	Both languages are used equally	10	It helps me to understand the teacher better., It saves time for the teacher to explain., I don't like Malay.	A little
13	Malay	Sekolah Kebangsaan	Malay	Both languages are used equally	4	It helps me to understand the teacher better., It saves time for the teacher to explain., It helps me to pay attention in class., It gives me more chances to listen to Malay., It helps to improve my Malay.	No
14	Tamil	Sekolah Jenis Kebangsaan (Tamil)	Tamil	Both languages are used equally	5	It helps me to understand the teacher better., It helps me to pay attention in class., It gives me more chances to listen to English., It helps to improve my English.	No
15	Cantonese	Sekolah Kebangsaan	English	Both languages are used equally	9	It helps me to understand the teacher better., It saves time for the teacher to explain., It helps me to pay attention in class., It gives me more chances to listen to English., It helps to improve my English.	A little

16	Malay	Sekolah Kebangsaan	English	Both languages are used equally	6	It helps me to understand the teacher better., It helps me to pay attention in class.	No
17	Malay	Sekolah Kebangsaan	Malay	Both languages are used equally	3	It helps me to understand the teacher better., It saves time for the teacher to explain.	No
18	Mandarin	Sekolah Jenis Kebangsaan (Cina)	Mandarin	Both languages are used equally	10	It helps me to understand the teacher better., It helps me to pay attention in class., I don't like Malay., It gives me more chances to listen to English., It helps to improve my English.	A little
19	English	Sekolah Kebangsaan	English	More English less Malay	10	It helps me to understand the teacher better., It saves time for the teacher to explain., It helps me to pay attention in class., I don't like Malay., It gives me more chances to listen to English., It helps to improve my English., It is easier to interact with the teacher.	Yes
20	English	Sekolah Kebangsaan	English	More English less Malay	10	It helps me to understand the teacher better., It saves time for the teacher to explain., It helps me to pay attention in class., I don't like Malay., It gives me more chances to listen to English., It helps to improve my English., It is easier to interact or answer.	Yes
21	English	Sekolah Kebangsaan	English	More English less Malay	10	It helps me to understand the teacher better., It helps me to pay attention in class., I don't like Malay., It gives me more chances to listen to English., It helps to improve my English., It is easier to understand English.	Yes
22	Cantonese	Sekolah Kebangsaan	English	More English less Malay	6	It helps me to understand the teacher better., It saves time for the teacher to explain., It helps me to pay attention in class., It helps to improve my English.	A little
23	Cantonese	Sekolah Kebangsaan	English	Both languages are used equally	7	It helps me to understand the teacher better., It gives me more chances to listen to English., It helps to improve my English.	No
24	English	Sekolah Kebangsaan	English	Both languages are used equally	10	It helps me to understand the teacher better., It helps me to pay attention in class., It gives me more chances to listen to English., It helps to improve my English.	No
25	English	Sekolah Kebangsaan	English	Both languages are used equally	10	It helps me to understand the teacher better., It helps me to pay attention in class., It gives me more chances to listen to English., It helps to improve my English.	No

26	English	Sekolah Kebangsaan	English	More English less Malay	10	It helps me to understand the teacher better., It saves time for the teacher to explain., It helps me to pay attention in class.	Yes
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5. Shahrul's students

No.	Language used at home	Primary school attended	Science MOI in primary school	Science MOI now	Preferred MOI	Why?	Do you get confused?
1	Mandarin	Sekolah Jenis Kebangsaan (Cina)	Mandarin	Both languages are used equally	10	It helps me to understand the teacher better., It saves time for the teacher to explain., It helps me to pay attention in class., It gives me more chances to listen to English., It helps to improve my English.	A little
2	Malay	Sekolah Kebangsaan	Malay	Both languages are used equally	5	It helps me to understand the teacher better., It saves time for the teacher to explain., It helps me to pay attention in class.	No
3	Malay	Sekolah Kebangsaan	Malay	Both languages are used equally	6	It helps me to understand the teacher better., It helps me to pay attention in class.	No
4	Mandarin	Sekolah Jenis Kebangsaan (Cina)	Mandarin	Both languages are used equally	6	It helps me to understand the teacher better., It helps me to pay attention in class., It gives me more chances to listen to English., It helps to improve my English., I learned science in Malay before I changed school	A little
5	Mandarin	Sekolah Jenis Kebangsaan (Cina)	Mandarin	Both languages are used equally	10	It helps me to understand the teacher better., It helps me to pay attention in class., It gives me more chances to listen to English., It helps to improve my English.	No
6	Mandarin	Sekolah Jenis Kebangsaan (Cina)	Mandarin	Both languages are used equally	10	It helps me to understand the teacher better., It helps me to pay attention in class., It gives me more chances to listen to English., It helps to improve my English.	No
7	Mandarin	Sekolah Jenis Kebangsaan (Cina)	Mandarin	Both languages are used equally	5	It helps me to understand the teacher better., It helps me to pay attention in class., It helps to improve my English., It helps to improve my Malay.	No

8	Mandarin	Sekolah Jenis Kebangsaan (Cina)	Mandarin	Both languages are used equally	5	It helps me to understand the teacher better., It helps me to pay attention in class., It gives me more chances to listen to English., It helps to improve my English.	No
9	English	Sekolah Jenis Kebangsaan (Cina)	Mandarin	Both languages are used equally	6	It helps me to understand the teacher better., It gives me more chances to listen to English.	No
10	Mandarin	Sekolah Jenis Kebangsaan (Cina)	Mandarin	Both languages are used equally	6	It helps me to understand the teacher better., It helps me to pay attention in class., It helps to improve my English.	No
11	English	Sekolah Jenis Kebangsaan (Cina)	Mandarin	Both languages are used equally	9	It helps me to understand the teacher better., It saves time for the teacher to explain., It helps me to pay attention in class., It gives me more chances to listen to English., It helps to improve my English.	No
12	Mandarin	Sekolah Jenis Kebangsaan (Cina)	Mandarin	Both languages are used equally	9	It saves time for the teacher to explain., It helps me to pay attention in class., It gives me more chances to listen to English., It helps to improve my English.	No
13	Mandarin	Sekolah Jenis Kebangsaan (Cina)	Mandarin	More English less Malay	10	It helps me to understand the teacher better., It saves time for the teacher to explain., I don't like Malay., It gives me more chances to listen to English., It helps to improve my English.	No
14	Malay	Sekolah Kebangsaan	Malay	Both languages are used equally	5	It helps me to understand the teacher better.	No
15	Mandarin	Sekolah Jenis Kebangsaan (Cina)	English	Both languages are used equally	10	It helps me to understand the teacher better., It saves time for the teacher to explain., It helps me to pay attention in class., It gives me more chances to listen to English., It helps to improve my English.	A little
16	English and Tamil	Sekolah Kebangsaan	English	More English less Malay	9	It helps me to understand the teacher better., It helps me to pay attention in class., It gives me more chances to listen to English., It helps to improve my English.	A little
17	English	Sekolah Kebangsaan	English	More English less Malay	7	It helps me to understand the teacher better., It helps me to pay attention in class., It gives me more chances to listen to English.	No
18	Malay	Sekolah Kebangsaan	Malay	Both languages are used equally	7	It helps me to understand the teacher better., It helps me to pay attention in class., It gives me more chances to listen to English., It helps to improve my English.	No

19	Malay	Sekolah Kebangsaan	Malay	More English less Malay	5	It helps me to understand the teacher better., It saves time for the teacher to explain., It gives me more chances to listen to English., It helps to improve my English., It helps to improve my Malay.	A little
20	Malay	Sekolah Kebangsaan	Malay	More English less Malay	5	It helps me to understand the teacher better., It saves time for the teacher to explain., It helps to improve my English., It helps to improve my Malay.	No
21	English	Sekolah Kebangsaan	Malay	More Malay less English	10	It helps me to understand the teacher better., It saves time for the teacher to explain., It helps me to pay attention in class., I don't like Malay., It gives me more chances to listen to English., It helps to improve my English.	A little
22	Mandarin	Sekolah Jenis Kebangsaan (Cina)	English	More English less Malay	7	It gives me more chances to listen to English., It helps to improve my English.	No
23	Malay	Sekolah Kebangsaan	English	Both languages are used equally	6	It helps me to understand the teacher better., It helps me to pay attention in class.	No
24	Tamil	Sekolah Jenis Kebangsaan (Tamil)	English	More English less Malay	8	It helps me to understand the teacher better., It gives me more chances to listen to English., It helps to improve my English.	No

6. Amina's students

No.	Language used at home	Primary school attended	Science MOI in primary school	Science MOI now	Preferred MOI	Why?	Do you get confused?
1	Malay	Sekolah Kebangsaan	English	More Malay less English	4	It helps me to understand the teacher better., It gives me more chances to listen to Malay., It helps to improve my Malay.	No
2	Tamil	Sekolah Jenis Kebangsaan (Tamil)	Tamil	More Malay less English	9	It helps me to understand the teacher better., It helps me to pay attention in class., I don't like Malay., It gives me more chances to listen to English.	A little
3	Malay	Sekolah Kebangsaan	Malay	Both languages are used equally	6	It helps me to understand the teacher better., It saves time for the teacher to explain., It helps me to pay attention in class.	A little

4	Malay	Sekolah Kebangsaan	Malay	Both languages are used equally	6	It helps me to understand the teacher better., It gives me more chances to listen to Malay.	No
5	Malay	International School	English	Both languages are used equally	5	It helps me to understand the teacher better., It helps me to pay attention in class.	No
6	Malay	Sekolah Kebangsaan	Malay	Both languages are used equally	9	It helps me to understand the teacher better., It gives me more chances to listen to English., It helps to improve my English.	No
7	English	Sekolah Kebangsaan	Malay	Both languages are used equally	7	It helps me to understand the teacher better., It gives me more chances to listen to English., It gives me more chances to listen to Malay., It helps to improve my English., It helps to improve my Malay.	No
8	Malay	Sekolah Kebangsaan	English	Both languages are used equally	7	It helps me to understand the teacher better., It saves time for the teacher to explain., It helps me to pay attention in class., It helps to improve my English.	No
9	English	Sekolah Kebangsaan	English	Both languages are used equally	6	It helps me to understand the teacher better., It gives me more chances to listen to English.	No
10	Malay	Sekolah Kebangsaan	English	Both languages are used equally	8	It helps me to understand the teacher better., It gives me more chances to listen to English., It helps to improve my English.	No
11	Malay	Sekolah Kebangsaan	English	Both languages are used equally	8	It helps me to understand the teacher better., It gives me more chances to listen to English., It helps to improve my English.	A little
12	Mandarin	Sekolah Jenis Kebangsaan (Cina)	Mandarin	More Malay less English	8	It helps me to understand the teacher better.	A little
13	Malay	Sekolah Kebangsaan	Malay	Both languages are used equally	5	It helps me to understand the teacher better., It gives me more chances to listen to English., It gives me more chances to listen to Malay., It helps to improve my English.	No
14	Malay	Sekolah Kebangsaan	Malay	Both languages are used equally	5	It helps me to understand the teacher better., It helps me to pay attention in class., It gives me more chances to listen to English., It helps to improve my English., It helps to improve my Malay.	No

15	Mandarin	Sekolah Jenis Kebangsaan (Cina)	Mandarin	More Malay less English	9	It helps me to understand the teacher better., It saves time for the teacher to explain., It helps me to pay attention in class., I don't like Malay., It gives me more chances to listen to English., It helps to improve my English.	A little
16	Mandarin	Sekolah Jenis Kebangsaan (Cina)	Mandarin	More Malay less English	10	It helps me to understand the teacher better., I don't like Malay., It gives me more chances to listen to English., It helps to improve my English.	A little
17	Malay	Sekolah Kebangsaan	English	Both languages are used equally	7	It helps me to understand the teacher better., It saves time for the teacher to explain., It helps me to pay attention in class.	No
18	Malay	Sekolah Kebangsaan	English	Both languages are used equally	7	It helps me to understand the teacher better., It saves time for the teacher to explain., It helps me to pay attention in class., It helps to improve my English., It helps to improve my Malay.	No
19	English	Sekolah Kebangsaan	English	Both languages are used equally	9	It helps me to understand the teacher better., It gives me more chances to listen to English., It helps to improve my English.	No
20	English	Sekolah Kebangsaan	English	Both languages are used equally	8	It helps me to understand the teacher better., It saves time for the teacher to explain.	No
21	English	Sekolah Kebangsaan	Malay	Both languages are used equally	6	It helps me to understand the teacher better., It helps me to pay attention in class., It helps to improve my English., It helps to improve my Malay., It can make me understand in detail.	A little
22	Malay	Sekolah Kebangsaan	English	Both languages are used equally	5	It helps me to understand the teacher better., It saves time for the teacher to explain., It helps me to pay attention in class.	A little
23	Malay	Sekolah Kebangsaan	English	Both languages are used equally	5	It helps me to understand the teacher better., It saves time for the teacher to explain., It helps me to pay attention in class.	A little
24	English	Sekolah Kebangsaan	English	Both languages are used equally	5	It helps me to understand the teacher better., It helps me to pay attention in class., It gives me more chances to listen to English., It helps to improve my English.	No

Appendix G

Farid's lesson transcript

Episode of Instruction			
Turn No.	Role	Transcriptions	Function
1.	T:	OK, so, erm, continuing from yesterday, ok, I need you to get back your files (.) from yesterday. Come make it quick, go go, now. ((ss getting out from their seats to get the files.)) (...) And can I have a (?) please? Distribute. (...) So err, each person should get at least two, no no no, two, they have err, two pieces for each person. So, do a round, class, thank you, yup, everyone. Everyone should have two pieces la, per set. (...) Err, who's still have the problem with their file? Oh Aisyah, Aisyah din have any file, so never mind, so in the meantime, just staple it together. (...) Yes, Fiquan, why are you late?	
2.	S:	(??)	
3.	T:	Why? You ¹ kena (<i>got</i>) (??) Where's your file? Go to your seat k? Alright so, everyone got their files, ok arr, today we're gonna go into a new topic, we finish chapter four, we finish talking about metal, err last time we talk about metal and non-metal, ok, so today we're gonna go into a new topic which is chapter number 5, air around us. K, please look at your textbook. (.) K, we start with page forty-nine, and Jia Jit is surrounding the class with a, sorry, why you have only one? Alright, k k, you should get two piece of paper, ok two piece of handout, come in front, Fiquan. Ok, (...) yes thank you. And please refer to the last handout that I give you yesterday. Last handout yesterday. (...) Right, ready? Where's my handout? Where's Nazia? Is Nazia absent? Ok. Never mind. Ok. So today we're gonna learn about air around us. What did you know about air around us? (.) ² Apa you tau pasal air? (<i>what do you know about air</i>) Yes, Jonathan.	1. To seek confirmation 2. To elicit response
4.	S:	We breathe it.	
5.	T:	We breathe?	
6.	S:	It.	
7.	T:	We breathe it. Ok. Air we breathe the air. What else? ³ Siapa lagi? (<i>Who else?</i>) Hanim? ((S replies but voice unheard)) Air has mass. Good. ⁴ Betul. (<i>Correct.</i>) Air is a matter so it should have mass. What else?	3 - To encourage students - To elicit response 4 - To emphasise
8.	S:	Air is a mixture.	
9.	T:	Air is a mixture, good. Yes Lasi?	

10.	S:	They also have types of err air, a lot of types of air.	
11.	T:	A lot of types of air? Umm, ok la. Yes? Aiman, why are you so nervous? Yes, Fiquan.	
12.	S:	Air cannot be seen.	
13.	T:	Air?	
14.	S:	Cannot be seen.	
15.	T:	Air cannot be seen.	
16.	S:	It's needed to sustain life.	
17.	T:	Air is needed to sustain life, ok. What else?	
18.	S:	Air can be compressed.	
19.	T:	Air can be compressed. Very good. What else? (.) ⁵ Siapa lagi nak tambah? (<i>Who else wants to add?</i>) Yes Fiquan?	5 - To encourage students - To elicit response
20.	S:	Air occupies space.	
21.	T:	Air occupies space, good. (.) Oh, you know a lot about air already. No need to learn la. Yes Jonathan.	
22.	S:	(??)	
23.	T:	Ok, air is all around us, good, what else? ⁶ Apa lagi Lasi? (<i>What else Lasi?</i>) Ok, so actually you have err, quite good ideas about air. K, this is just err, we are trying to making sense of all the knowledge that you have, you already have. You learn it, you don't need to learn it, it's common, it's a general knowledge. But now, we try to make it a little bit clearer for you. Ok. So, what is around us? K, recently we are talking about A.P.I. A.P.I. What is A.P.I.?	6 - To encourage students - To elicit response - To shift attention from whole class to individual student
24.	SS:	Air pollution index.	
25.	T:	Air Pollution Index. This is the current issue, just happened last week, is it?	
26.	SS:	Yes.	
27.	T:	Ok, why do we need this A.P.I.? (.) Why do we need this A.P.I.? (.) Ah, can someone tell me. In Malay we call it ⁷ IPU .	7 – To facilitate understanding
28.	S:	So that we know how polluted our air is.	
29.	T:	Yes, very good, this is an indicator for us to measure the amount of pollutant in the air. K. ⁸ Pencemaran udara. (<i>Air pollution</i>) So what are the recent cases, recent tragedy happen to Malaysia?	8 – To facilitate understanding
30.	SS:	Haze.	
31.	T:	Haze. K, is this the first time?	
32.	SS:	No.	
33.	T:	Do you know when is the last time the haze? ((Students try to make guesses.)) Was it 2005? 2004? 2008? Every year? Umm. (.) I think there's a documentary, I think in the history channel last time "Haze over Hell" I think it's about 1990 (.) ah, I'm not sure whether it's 1998, 1997.	
34.	S:	1997.	

35.	T:	1997. Ok thank you Aiman. OK because 1998 we have Commonwealth, ah, I don't think we have this problem during the commonwealth. So I think it's 1997. Ok the same tragedy, k err, there's open burning. Open forest fire in Indonesia, so the haze came all the way from Indonesia, and covering our atmosphere la. Ok. So, what are the precautions that you need to do? What are the precaution step that you need to take? in order to avoid these problem?	
36.	S:	Wear a mask.	
37.	T:	Ok good, wear a mask, what else?	
38.	S:	Drink water.	
39.	S:	Avoid outdoor activity.	
40.	T:	Sorry?	
41.	S:	Avoid outdoor activity.	
42.	T:	Ok good, avoid outdoor activities.	
43.	SS:	Drink a lot of water.	
44.	T:	Drink more water, do not come to school ya? Last time, ⁹ kan? (<i>right?</i>) ((Students laugh.)) No one come to school. Good.	9 - To lighten the mood
45.	S:	Stay at home.	
46.	T:	Ah sorry?	
47.	SS:	Stay at home.	
48.	T:	Stay at home yes.	
49.	S:	Take a rest.	
50.	T:	Take a rest, ¹⁰ apa lagi? (<i>what else?</i>) Oh ah, recent research shows that when you are wearing the, remember the mask? Ok, is not effective at all. ((unintelligible response from S)) No, because arr, they said the haze particle is much more smaller and it can penetrate the mask. So the only mask is suitable during the haze arr, our air is not that polluted la, so don't worry too much k. What we, the best mask for you is N95. And I'm not sure where to get it. N95. N 95. ((S may have asked a question but it's unheard)) Umm, not sure the symbol is N95. This is the best one for you ah. Just in case of emergency. Not to frighten you. No. k? but, it's advisable to wear mask all the time. Ok. So arr, anything else you want to, did anyone else get the side effect from the haze? Yes Azhar? What happened to you?	10 - To encourage students - To elicit response
51.	S:	Actually I had a fever.	
52.	T:	You get a fever?	
53.	S:	Sore throat.	
54.	T:	Sore throat. Ok good. Eh eh, not good. No no no, I mean, those are the symptoms commonly occur la when you exposed to haze. What else, err Fiquan, ¹¹ kenapa? (<i>why?</i>)	11 - To shift attention from whole class to individual student
55.	S:	Asthmatic attack.	

56.	T:	Oh, you ¹² kena asthmatic attack? (<i>oh, you had asthmatic attack?</i>) So is it that bad? ((S response can't be heard)) So so la. You need to use the, what do you call that, nebuliser is it? Nebuliser. Anyone else? Affected by the haze.	12 - To seek confirmation
57.	S:	Flu.	
58.	T:	Flu? Umm flu, ok, same thing. No wonder la, all of you missing classes last week ah. How many days? We give you one holiday, how many days leave you all take?	
59.	S:	Just one.	
60.	T:	Two? Three?	
61.	SS:	Just one!	
62.	T:	Eh la, really ah? Ok so, that is the current issue about our air, recently happen. K, arr, fortunately now is raining, so the haze is started to disappear la, slowly. Right, this is the latest picture, we can't really see the KLCC, he's actually in the, what do you call the park down there, outside the KLCC?	
63.	SS:	(?)	
64.	T:	I think he's just outside the Dome, the coffee shop. K, but we can't really see the err KLCC. This is how the, err this is how bad is the haze last time. (.) Ok. So umm, we're gonna talk a little bit on the atmosphere, right. (.) Ok, so, our atmosphere, what did you know about atmosphere?	
65.	S:	It (?) us from (?)	
66.	T:	¹³ Ah, kechap, Khairul, Khairul, apa? Pusing, pusing. (<i>Ah, wait, Khairul, Khairul, what? Turning, turning.</i>) What are you working a circle? What is atmosphere? (.) Anything?	13 - To shift attention from whole class to individual student - To elicit response - To encourage students
67.	S1:	Ah.	
68.	T:	Ah, you ¹⁴ apa buat tadi circle? (<i>Why did you do a circle?</i>)	14 - To encourage students - To elicit response
69.	S1:	I circle je (<i>only</i>).	
70.	T:	Yes, atmosphere in a circular form. ¹⁵ Bentuk dia bulat, tak ada atmosphere, (<i>Its shape is round, there's no atmosphere</i>) you don't have a flat atmosphere, ¹⁶ tak ada. (<i>don't have</i>) ((Students laugh.)) You don't have a box. What else? Yes.	15 - To emphasis 16 - To emphasis
71.	S:	It protects us from sunlight.	
72.	T:	Arr, it protects us from the?	
73.	S:	Sunlight.	
74.	T:	Sunlight. Um, yes. It does. It filters the sunlight yes, UV. Yes, what else?	
75.	S:	It has seven layers.	
76.	T:	It has seven layers. Can you name all seven?	
77.	SS:	No.	

78.	T:	Why?	
79.	S:	All I can remember is the last one.	
80.	T:	Arr..ok, you learn this in geography before right?	
81.	SS:	No.	
82.	T:	Troposphere, stratosphere.	
83.	SS:	No.	
84.	T:	Not yet? Form 2, form 1? I don't know. I left geography for about 15 or 10 years ago. I don't really remember. But umm, that's a layer, I don't think ah, it's not seven, 5-6? But thank you Shakil. Anyone else want to add? (.) ¹⁷ Siapa lagi? (<i>who else?</i>) (.) ((S mumbles something)) ¹⁸ Ah, kenapa? (<i>Ah, why?</i>) Aunty Fazira? ((Student giggles.))	17 - To encourage students - To elicit response 18 - To shift attention from whole class to individual student
85.	S:	Teacher.	
86.	T:	Yes yes.	
87.	S:	Is it colourless?	
88.	T:	Atmosphere, colourless, do we see the atmosphere? Do we, do atmosphere got colour?	
89.	SS:	Blue.	
90.	T:	It's more like a blue, ok, it's a mixture of white, pale blue, something like that.	
91.	S:	Nitrogen, nitrogen.	
92.	T:	Nitrogen, ok good, what else?	
93.	S:	Spaceships burn when it starts entering it.	
94.	T:	Spaceship burn? (S) Ah ok, so when something fall from the sky, from the space, entering our atmosphere, they start to burn. Why? Can someone tell me why?	
95.	SS:	Friction.	
96.	T:	Good, friction. OK, Friction between what?	
97.	S:	Particle.	
98.	T:	Particles with?	
99.	SS:	Air.	
100.	T	K, the air. Actually air is a mixture. There's a lot of things going on in the air. So when something moving very fast, k, there's a friction. So the friction creates a spark. That's why you saw a comet, k, when we saw something falls down, they start to burn up and so on. Why? Anything went up? No. ok, so did you know, how, how, deep, how tall is the atmosphere?	
101.	S:	How high.	
102.	T:	Sorry, ah yes, how high is our atmosphere? (S) Eleven kilometres? Nah. So, if eleven kilometres means Everest is just outside the atmosphere. ((Students laugh.)) So if we have for example, say, 10 kilometres, this is our earth, so if you have a Mount Everest over here, so the atmosphere ((teacher draws on white board, students giggles.)) So if	19 - To facilitate understanding - To lighten the mood

		you say la, 10 kilometres so the atmosphere should be here so if somebody go on top of the Everest, he's out of atmosphere. ¹⁹ Dia orang keluar kat sini ah. (<i>These people are out here</i>). ((Students laugh.)) Wah, so the moon is here. Wow, yes can I help? ((A student comes into the class asking for some distilled water.)) (S) Distilled water? I don't have, I don't think we have the supply here. Sorry class ya. Ah, you need to check downstairs, in the chemistry lab. Ok, so atmosphere, 10 kilometres, nope. Sorry, but a good try. Anyone else? 20 kilometre? No. 100 kilometre? Nope. It's actually approximately 10,000 kilometre high. K, it's about 10,000 kilometre high so from here, you can lah, count, use your ruler, k, 10000 kilometre then you'll, you don't have anymore atmosphere. K, yes, Aiman.	
103.	S:	Isn't there a carbon line (??)?	
104.	T:	Yes, so, approximately, the carbon line should be err 10000 kilometre above the sea level.	
105.	S:	(??)	
106.	T:	Ya so you need to travel at least 10000 kilometre. (.) Why am I? It's not a mystery you know. It's a normal thing. So you can travel upward, no problem, we can fight the gravity. Yes, we can defy the gravity. Is it true? Ok, so, ah, what's ok, atmosphere ok, as we go up, as we go higher, k, that atmosphere become thinner (.) k, why? For example la, if you go ah from (.) have any of you went to Kinabalu? Mount Kinabalu, on top, (S) oh ²⁰ tak sampai atas lagi. (<i>haven't reached the top yet</i>) else where in? in Limbao? Where's Limbao?	20 - To shift attention from whole class to individual student
107.	S:	I went half way and came down.	
108.	T:	Oh, you only half way, why you quit half way? (S) Oh ok., Anyone else? Yes, Shengkil? Top. So what, what did you feel up there? How do you feel?	
109.	S:	(??)	
110.	T:	It's hard to breathe. Good. Hey, it's not good. ((Students laugh.)) Means, ah, that's the, what do you call this? That's the reason why you hardly, you cannot really breathe up there. Anyone else? ²¹ Siapa yang pernah pergi? (<i>Who've been before</i>) who went to top of the KLCC before? Are you sure? How? (S) Half way. I thought like somebody went out to KLCC ²² panjat yang, the lightning punya conductor tu. (<i>climb the, the lightning's conductor that</i>) (S) The what?	21 - To elicit response - To link to students' experiences 22 - To lighten the mood
111.	SS:	Spiderman.	
112.	T:	Oh the spiderman yes. The real spiderman or the spiderman guy? I'm confused now, which one?	
113.	SS:	(??)	
114.	T:	The real guy la, ok. So ah, what happen ok, if we go to high place ok.	
115.	S:	Air is heavier.	
116.	T:	Air is heavier? For example, I would like, using the example of Everest, k, so when you are here, it's really hard to breathe ok, ah, people need ah, oxygen supply ok, if you look at the movies, k if you look at the documentaries recently, yes we need to carry our own oxygen supply.	
117.	S:	Teacher, what if (??)	
118.	T:	Sorry?	

119.	S:	When you climb up, won't that be so heavy?	
120.	T:	Ah, it's better to carry heavy stuff than you cannot breathe at all. So, that's are the precaution la. K. (S) Sorry? No no no, don't be afraid, ²³ kenapa malu-malu hari ini? (<i>Why so shy today?</i>) ((SS giggles)) K, so, ah if we go to the top of Everest, ok, normally we need to bring our own oxygen supply, ok, because, it's hard to breathe, why it's hard to breathe, because ah, there's not much oxygen over there.	23 - To negotiate different teacher identities - To elicit response
121.	SS:	(??)	
122.	T:	No, eh, oxygen should be lower because most of the stuff, ok, in atmosphere there's a lot of things going on, (S) yes, sorry? Suitable temperature? No, in not just Everest, anywhere, yes?	
123.	S:	(??)	
124.	T:	Heat? Hmm, gravity, yes, very good. K so it involves around gravity, why? Still remember what's matter? (S)What is matter? Something substances that has mass, occupy space. So anything that has mass will be effected by gravity. So the heavier the thing is, the heavier the matter is, it fall down near to the centre of the earth. They'll pull down by the gravity. So most of the stuff, most of the air, most of the things in the atmosphere, are located maybe about half way here. (.) Maybe around,10 kilometre or 20 kilometre radius all the air, all the oxygen, nitrogen, gases, they will be at the bottom of the atmosphere, k, here it's quite empty, not much particles, yes we do have oxygen but not much, most of it went down, most of the oxygen gas went down due to the gravity. Because, ok, oxygen have mass, ²⁴ dia berat , (<i>it's heavy</i>) so when it's heavy, it'll pull down by the gravity.	24 - To facilitate understanding
125.	S:	(??)	
126.	T:	Ah, not really vacuum, no, we do have particles, but not as much as near to the surface level, k, so here we can breathe normally, ²⁵ tak ada masalah, k kita boleh bernafas , (<i>no problem, we can breathe</i>) but when we go up, to higher, when we ah, travelling with aeroplane, k, ²⁶ kalau terbang naik (<i>if fly by</i>) aeroplane, do we open the window? ((Students giggles.)) We don't need to open the window to breathe, no. You ²⁷ buka (<i>open</i>) fuuuuu, superman, ah tu (<i>that's</i>) pressure, k, pressure pun sama (<i>also same</i>), k due to the number of content in the air. So as we go up, as we go higher, the atmosphere become thinner, k less particles inside. So you, if you want to breathe normally, stay down, k if you go high, it's harder to breathe. K, not much oxygen over there. OK, any question? ²⁸ Ada apa-apa nak tanya (<i>Anything to ask regarding</i>) atmosphere? Any question? Any mystery you'll be, yes, any mystery before, yang ²⁹ tak boleh (<i>cannot</i>) solve regarding atmosphere? ³⁰ Tak ada ya? (<i>Don't have right?</i>) Sure? Really sure? Yes, Fiquan.	25 - To emphasise 26 - To facilitate understanding 27 - To lighten the mood - To facilitate understanding 28 - To check understanding - To elicit response - To encourage students 29 - To emphasise 30 - To seek confirmation
127.	S:	Dia tak pernah keluar? (<i>It has never been out?</i>)	
128.	T:	³¹ Tak pernah keluar? (<i>Never been out</i>) How? Oxygen. Ah, yes it can escape but don't worry, oh, recently ah, I did some research on this, ok, it says that about 500 millions no, 500 millions yes, 500 million years ago, before the dinosaurs ok, before the dinosaurs, the whole world is covered with carbon dioxide.	31 - To seek confirmation
129.	S:	(??)	
130.	T:	Hmm? Yes, it's sort of, ah we are quite similiar to Mars. Mars mars is actually covered with carbon dioxide, we	

		are like Mars about 500 million years ago, before the existence of plants.	
131.	S:	(??)	
132.	T:	Hmm? It was, sorry Aiman? (S) Oh no no no, I've never been there so I don't know la which is worse or what but 500 million years ago, we don't have any oxygen and the whole world is covered with carbon dioxide. Can anyone live?	
133.	SS:	No.	
134.	T:	No. Ok. However after that there's a, ah, they started the I don't know who started la, but suddenly there's a plant, when the plant start to spread, ah, and start to ah, what we call that, reproduce, ³² membiaak, makin banyak , (<i>reproduce, getting more</i>) when the plant is growing, yes.	32 - To facilitate understanding
135.	S:	(??)	
136.	T:	Yes, very good, they do photosynthesis, they take out all the carbon dioxide, they change it to oxygen. K, so with the help of plant, k, during before the dinosaurs time, k with the help of plant, the changing the carbon dioxide to oxygen in order for us to live, so it's suitable for us to live, all the animal all the ah plants can live now. Sorry?	
137.	S:	(??)	
138.	T:	³³ Nabi Adam. Hmm, selepas tu Nabi Adam bila bumi ni dah sesuai dihidup. (<i>Prophet Adam, hmm, after that Prophet Adam when the earth was suitable to be inhabited.</i>) (S) Yes, how does the plant grow? Err, it's a natural phenomena, so we need to have food, water, aha, so err, and also sunlight la. So these are the things need to, ah need by plants to grow up, to grow, sorry. So, after 5, it takes about millions of years to change la, to change carbon dioxide to oxygen, maybe k, just for you to ponder la, maybe one day, Mars can be like earth. But now we are sensing, we just discovered there's a form of life over there. There's a slight err, I think they found a formation of water, is it? (S) They found water over there, is it true Aiman? (S) Ice? Ah they found ice in Mars. So if there's a water, there's probability there's a living organism over there.	33 - To link to students' experiences
139.	S:	Is it alien?	
140.	T:	Alien? Not sure. How how how how do, how we define alien, Fiquan?	
141.	S:	Ah human like.	
142.	T:	Human like? What is alien? What does alien mean? (SS) Extra terrestrial? What does it mean by extra terrestrial? So, we are saying alien to the things we never encountered before, right? Alien is mean something is new for us la, ³⁴ makhluk asing , (<i>extra terrestrial</i>) k, maybe we are alien to them as well. So ³⁵ janganlah you rasa macam (<i>don't you feel that</i>) oh everything out there is alien. We are alien as well. ³⁶ Dia orang pun tak kenal kita. (<i>They also don't know us</i>) So, ah, yes Aiman.	34 - To facilitate understanding 35 - To lighten the mood 36 - To facilitate understanding
143.	S:	(??)	
144.	T:	(??) Hmm never heard of this before (S) that's how the moon was created, (S) Oh, ok, but we're talking about living organisms, (S) oh, the organism is a part to the moon? To earth? ohhh, ok k k. So ok, there's a lot of, you can go and Google, internet find information, so maybe later we can discuss this more on this particular topic. (S) ³⁷ Tak nak lah? Pening dah? (<i>Don't want? Dizzy already?</i>) Alien alien ni. Ok, so back to our syllabus. ³⁸ Ah dah	37 - To lighten then mood 38 - To shift attention from whole

		jauh pergi dah. (<i>Ah already gone far away.</i>) Right, air, what is air? OK, air are the particles that is inside our atmosphere, ok, so atmosphere is the mixture of gases called air. Why do I highlight the word mixture?	class to individual student
145.	S:	Because air contains a lot of (?)	
146.	T:	OK, lots of composition, (S) population? Composition. OK, so mixture, remember mixture ah, Nadia, ³⁹ apa (<i>what is</i>) mixture? What is mixture?	39 - To shift attention from whole class to individual student
147.	S1:	Ah. (...)	
148.	S2:	((replies in English))	
149.	T:	K, can you help Nadia? Nadia, ⁴⁰ malu-malu ni, biasa tak malu je. (<i>being shy, usually you're not shy at all</i>) (.) You know what is mixture Nadia? You should know right? OK. So, ⁴¹ apa (<i>what</i>) Syazah?	40 - To negotiate different teacher identities 41 - To shift attention from whole class to individual student
150.	S2:	It's more than one type of particle which is not chemically bonded.	
151.	T:	OK, they are not chemical, good, more than that, more than one type of particles, so they are not chemically bonded so how they bonded?	
152.	SS:	Physically.	
153.	T:	Physically. OK. ⁴² Janganlah cakap (<i>don't say</i>) not chemically bonded, it's physically bonded and easily to separate. ⁴³ Apa dia (<i>what is it</i>) Fiquan?	42 - To emphasise 43 - To shift attention from whole class to individual student
154.	S:	(??)	
155.	T:	What's the difference between physical and chemical? I thought we've done this before? ⁴⁴ Tak ingat la? (<i>Don't remember?</i>)	44 - To admonish
156.	S:	Tak (<i>no</i>)	
157.	T:	Chemical bonded, you need a more longer process, ok, you need a chemical process to separate, however, physical ah bonded or physical bond, you only need to use a small amount of energy, very easy to separate. (S) Ok, so, umm, air is a mixture, so they are lot of particles inside the air, ok, they are not chemically bonded, they are only physically bonded, so you can separate it k. Ah, and, also somebody say about proportion. Yes, it can be in many kinds of any proportions la. K, you can put oxygen more as well. OK, what did you know inside air? What are the things inside air? ⁴⁵ Siapa tau? (<i>Who knows?</i>)	45 - To elicit response - To encourage students
158.	SS:	Nitrogen.	
159.	T:	Nitrogen.	
160.	SS:	Carbon dioxide.	
161.	T:	Carbon dioxide.	
162.	SS:	Oxygen.	
163.	T:	Oxygen.	

164.	SS:	Inert gases.	
165.	T:	Inert gases. (.) What is inert gases?	
166.	S:	Inert.	
167.	T:	Inert. What is inert? Who knows what does it mean by inert?	
168.	S:	⁴⁶ Nadir. (<i>Inactive</i>)	46 - To seek confirmation
169.	T:	⁴⁷ Nadir? (<i>Inactive?</i>) OK in Malay we call it nadir (<i>inactive</i>). What is inert? (SS) Gas? (SS) No no no, the word inert, what does it mean? Inertia? No. It's a gas? Ah, not really. K, there's a word, there's an English word, inert, was it the, never heard of it before? (SS) ⁴⁸ Seorang pun tak pernah dengar? (<i>Not even one of you heard of it before?</i>) Inert.	47 - To facilitate understanding 48 - To seek confirmation
170.	SS:	(??)	
171.	T:	What? Ah ⁴⁹ apa? (<i>what?</i>) K, it's in your glossary. Was it? In page 1? 139. ⁵⁰ Tengok sendiri, (<i>look at it yourself</i>) don't be lazy. Aisyah, check. (SS) What? OK, ah, k, chemically inactive gas or people, some people not some people la, all people call it noble gases. Other name for inert gases are noble gases. OK, inert, what it's inert? Inert means, (...) so our class until? 9? No.	49 - To shift attention from whole class to individual student 50 - To give instruction
172.	SS:	10:10.	
173.	T:	10:10, we have about an hour to go. So inert means k, the word inert k, normally we use this in chemistry. ((Teacher writes on the board)) Inert means it's chemically inactive, or ⁵¹ kita boleh cakap pemalas, siapa yang inert ni macam orang yang pemalas, (<i>we can say idler, whoever that's inert is like a idler</i>) It does not, it doesn't want to do anything, ok, this thing, yes, they are not, they don't want any changes.	51 - To link to students' experiences
174.	S:	(??)	
175.	T:	Noble? OK. Why some people call it noble gases? (SS) Innocent? No, ok, during the old times ok, we have err, we we do have err like, what do you call that, umm, " ⁵² kasta " (<i>caste</i>).	52 - To facilitate understanding
176.	SS:	Kasta? (<i>caste?</i>)	
177.	T:	Like, we have a noble people and the slave, eh no, the commoners, and the slaves. OK? (SS) Noble, commoners, slave. K, noble, commoner, farmer, slave and so on la. K noble people means, this is ah, in Malay we call it ⁵³ bangsawan la, golongan bangsawan, (<i>the nobles, group of nobles</i>) so they don't want to mix with others. They stick among themselves. They are so proud of themselves, they ⁵⁴ berlagak (<i>show off</i>) ah, arrogant, k, so it stands on its own, yes, ⁵⁵ siapa dia? (<i>who is he?</i>) (??) No, k, noble cause, eh, noble causes, ah noble gases are inactive, they prefer to be among themselves, they don't want to react with anything, they don't want to talk to anyone, no la, they don't want to cooperate with anyone, they won't do any reaction yes, Fiquan, (S) ⁵⁶ apa dia? (<i>what is it?</i>)	53 - To facilitate understanding 54 - To facilitate understanding 55 - To shift attention from whole class to individual student 56 - To shift attention from whole class to individual student
178.	S:	How can it be active?	
179.	T:	How can it be active? No, it can't be. There's no way do any chemical reaction with these noble gases. ⁵⁷ Dia tak akan buat apa-apa (<i>it won't do any</i>) reaction, it's chemically inactive, ⁵⁸ pemalas (<i>idler</i>).	57 - To facilitate understanding 58 - To emphasise

180.	S:	So it will never do anything.	
181.	T:	Nope. (SS) Ah however we do need the inert gases, there are lots of uses of inert gases. But, but they don't react with other things la.	
182.	S:	For example?	
183.	T:	For example, ok, give me example of inert gases that you know.	
184.	SS:	Helium.	
185.	T:	Helium, good, (SS: argon) neon, (S: krypton) krypton, (S: argon) argon, ha superman? It's in the book. Xe, Xe Xe what? Xenon. OK, there are a few umm, very popular noble gases or inert gases, the most popular one is helium. What is the use of helium? (SS) Ok, to make the balloons fly. Why does the helium float?	
186.	SS:	(??)	
187.	T:	Yes, less dense than air. K, helium is less dense than air. We learnt this in density before. So that's why it can fly, oh sorry, it can float.	
188.	S:	Is it the lightest gas?	
189.	T:	Ah helium, no, unfortunately, no, the lightest gas is hydrogen, eh no, hydrogen gas, hydrogen gas and helium is the same weight. Helium the mass is 2 gram per mol, hydrogen gas also 2 gram per mol. Oh, this one slightly, 2.02. Helium and hydrogen gas are the lightest gas on earth, however, k, hydrogen gas is very reactive, is very explosive so we don't use hydrogen gas in balloon. Or else somebody might blow their head. ((Students laugh.)) Ah, (S) huh? (S) Yes (?) use it, so that's why we had the (?) tragedy.	
190.	S:	Teacher (??)	
191.	T:	If we put hydrogen, yes, sort of yes, maybe I never, I never make a balloon out of hydrogen gas yet, so no, no we don't have any idea. Yes, Shiza.	
192.	S1:	Is it dangerous to (??)	
193.	T:	Sorry Shiza, I cannot hear you very well.	
194.	S1:	Is it dangerous if people suck helium gas out of (?)	
195.	T:	OK very good question, ok, what happen, ok you know the game we play with the helium gas right? What happen with you, you, if you inhale the helium gas? Ah ((Teacher squeaks.)) ⁵⁹ Suara macam (<i>sound like</i>) (??) hehe, macam siapa (<i>like who</i>)? Fred? Who's Fred?	59 - To lighten the mood - To elicit response
196.	S:	Chipmunk!	
197.	T:	Chipmunk? Chipmunk ⁶⁰ ada (<i>has</i>) Fred ke? I know Alvin, Theodore, who's the other guy?	60 - To seek confirmation
198.	SS:	Simon.	
199.	T:	Simon, ah.	
200.	S:	No Fred is the annoying oranges, umm (?)	
201.	T:	Oohh, o o, what? What? Annoying orange? (S)Very hyper-active orange. Oh my, what is this? Annoying orange? Kind of heard, hear it before. Where is it ah? Is it Youtube? Hee, get a life people, don't stick with the internet.	

		OK, So helium gas, what happen if we inhale helium gas? (SS) Our voice become, ah, the pitch go high ((teacher squeaks)), like squeaky, yes.	
202.	S:	Sound can vibrate (?)	
203.	T:	Yes. ok, how do we make sound? Do you know how we make sound? Vibration. K, for example, this one vibrate so it make sound. K, why does we inhale helium gas, the sound of our voice become squeaky, or the pitch went very high? Yes Nista.	
204.	S:	Teacher, you said vibration makes sound right. Then how do we talk?	
205.	T:	How do we talk? Can you, can you hold your, ah, what do you call this, trachea? No. Ha ha, yes oh yes, vocal chord, so if you talk, you can feel the vibration, right. That's how we speak. OK? The vocal chord vibrates, it produce sound. (S: it vibrates) Yes, it vibrates. ⁶¹ Tak percaya? (<i>Don't believe</i>) Risda? So that's how we make sound. So now, how does helium make our voice squeaky? Vibrate through it? Not really vibrate through it but faster, yes. (S) Yes because the air is lighter so the movement of the sound part, or wave is faster. So when the vibration is faster, the pitch went up, so ahhhhhhh, your ⁶² suara (<i>voice is</i>) like, ahhhhhhh, become macam (<i>like</i>) Carol la, suara (<i>voice</i>) Carol, Carol, you inhale helium today?	61 - To shift attention from whole class to individual student 62 - To lighten the mood
206.	S:	No!	
207.	S:	(??)	
208.	T:	Sorry?	
209.	S:	It's like a kettle.	
210.	T:	Oh, it's like kettle, so making very annoying sound, ok, that's why we put kettle with the sound, so it'll annoy you to switch it off. Ah, k, so helium, it's very light, it's lighter than the normal air that you breathe in, so when the sound went out, due to the thin air, so it will went up faster, so when went out faster, the vibration wave faster, your pitch will go up. K, that's why the sound after you inhale helium is like that. So what are the side effect? Do we have a side effect? (SS) No. There's no side effect at all, ⁶³ jangan risau, hari-hari inhale helium pun tak ada apa-apa. (<i>Don't worry, even if you inhale helium everyday, you'll be fine</i>) No, ⁶⁴ tak ada (<i>there's no</i>) effect because helium are noble or inert (.) gases. They won't react, it won't react with your body, maybe you'll feel bloated, k, if you put too much helium in your body, you might want, you float la, ok la, you be like helium balloon la maybe. ((SS laugh)) But any other chemical reaction, ah, so far no. Because it's an inert gas, so it's chemically inactive. It won't affect your, ah, system in your body, it won't turn your eye green, no, don't worry, ok. ⁶⁵ Tak ada jadi hulk ke devil, (<i>Won't become hulk or devil</i>) no. K, ⁶⁶ Jangan risau. (<i>don't worry</i>) K, so you can start consume helium today. (S) What? You want to buy it? It's quite expensive last time. Laughing gas, laughing gas, what is laughing gas? (S) Nitrogen oxide. It's not helium. ⁶⁷ Macam benda kita boleh gelak, (<i>It's like something that we can laugh</i>) hmm hmm, yes, can you help your friend, Aiman? It's a what? (S) Soft drug. So means it will stimulate our brain k. Soft drug, drug means it will stimulate your brain. Somewhere la, somehow, it'll stimulate your brain.	63 - To emphasise 64 - To emphasise 65 - To link to students' experiences 66 - To negotiate different teacher identities 67 - To facilitate understanding
211.	S:	It'll make you high.	

212.	T:	Not really high la, it's just laugh, it won't something not funny we laugh, that's what a laughing gas is. K. Do you watch the ice age cartoon I think last time? When they went down from the skeleton lift tu, ah, ⁶⁸ dia kata (<i>he says</i>) you will laugh until you die, ah, that's laughing gas, nitrogen dioxide. OK, so inert gases, so what are the composition again? In air? What are the things in air?	68 - To signal change of speaker
213.	S:	Oxygen.	
214.	T:	Oxygen.	
215.	SS:	Nitrogen.	
216.	T:	Nitrogen.	
217.	SS:	Carbon dioxide.	
218.	T:	Carbon dioxide.	
219.	SS:	Inert gases.	
220.	T:	Inert gases.	
221.	S:	Dust.	
222.	T:	Dust.	
223.	S:	Water vapours.	
224.	T:	And water vapours. (S) Oh, k, microorganisms. So we have, err, what, err the most important thing for you to memorise is seven. K, ⁶⁹ paling penting (<i>the most important</i>) you need to memorise seven ok, first nitrogen, oxygen, carbon dioxide, inert gases, dust, water vapour and microorganism. So, these are the composition of air. K we have nitrogen, we have oxygen, carbon dioxide, inert gases, water vapour, dust and microorganism, so by looking at these, ok, what can you conclude?	69 - To emphasise
225.	S:	Nitrogen has, plays a biggest role in air.	
226.	T:	Yes, very good, nitrogen not biggest role, it consists most air, eh, most air is co occupied by nitrogen gas. So what's the second most abundant gas?	
227.	SS:	Oxygen.	
228.	T:	Oxygen, ah next? (SS) Is there any, where's carbon dioxide? Very very small, very thin line here, ok. So the second one is inert gases, and also we have water vapour, dust and microorganism. So, by percentage, ok, ah, just giving you the numbers, later you need to memorise this. K, Nitrogen consists of 78% of air, by mass, by sorry, by volume, k nitrogen gas 78%, oxygen how many percent?	
229.	SS:	Twenty-one.	
230.	T:	Ok approximately 21%, ah, inert gases and microorganism, both are 1%, 1% only, 0.09, approximately 0.09 ok, we assume one la. And carbon dioxide, (SS) 0.03% only. So remember that I said earlier, 500 million years ago, the whole world is covered with carbon dioxide.	
231.	SS:	(??)	
232.	T:	Ah, not the (?), they were there but mostly is covered by carbon dioxide, k, maybe carbon dioxide covered 78% but now with the help of plant, k, it reduce up until 0.03%. (S) Har? Where come the nitrogen? Nitrogen is	

		actually made by the bacteria. Bacteria inside the soil.	
233.	S1:	Teacher but now the carbon dioxide is more than nitrogen is it?	
234.	T:	Sorry?	
235.	S1:	Now.	
236.	T:	Ah ha.	
237.	S1:	Carbon dioxide is more than nitrogen is it?	
238.	T:	Ah no no no no no, ah, the carbon dioxide it cannot exceed 0.05% or else we'll have global warming, you might suffocate and die. Yes, carbon dioxide, the normal content of carbon, let's say it's only 0.03%, k, ⁷⁰ sikit je , very small amount but it will affect us. If it goes lower it's good, but when it goes lower, ah, (S) yes, plant will die, they don't have any supply of carbon dioxide, they cannot make their food, and also we might freeze to die. Ah, greenhouse effect, have you heard about greenhouse effect, so later on we gonna learn about greenhouse effect, there are uses of carbon dioxide as well, ⁷¹ jangan la benci dia , (<i>don't hate it</i>) no. ((Students giggle.)) We do have use of carbon dioxide. So we have about 40, no no about 50 more minutes, I'm gonna do a simple experiment.	70 - To emphasise 71 - To lighten the mood
239.	SS:	Yay!	
Episode of Assessment			
240.	T:	Ok, please clear your table, oh alright, umm, (.) just look at this paper, everyone should take out this paper and piece of no, this paper and a pen. K, the rest put it inside, (S) yup. (S)Yes, everything should be inside the file, so we gonna do the PBS , (<i>continuous school-based assessment</i>) umm, hopefully next week we'll settle everything, maybe after the Bicara Akademik , (<i>academic talk</i>) oh ah, this morning, there was no briefing about bicara akademik (<i>academic talk</i>), ¹ ada juga kan (<i>there was right</i>)? So your parents, I'll be seeing your parents next week right?	1 - To seek confirmation
241.	SS:	Yes! No! ((shout simultaneously.))	
242.	T:	Nah. (...) So gonna get from me. I'll, I'll try to find your parents la. OK, in a group of 1, 2, 3, 4, 5, 6 k good. So each group ok, you gonna do experiment in a group. K, it's a very simple experiment. What I need you to do now, k, look at your handouts, look at the aim. What's the aim of this experiment? ((SS read)) OK. This experiment is to determine the percentage of oxygen in air, what is the statement of problem? (.) So we have the aim, what is our problem? What's your problem? Hmm no, ah? (S) Your problem is PBS ? ((Teacher chuckles.)) That's my problem as well. ² Tapi (<i>but</i>) there's nothing we can do. OK, so, what's the statement problem, or, sorry, statement of problem in this experiment. How? (S) Ah, how do you manipulate the aim. From the aim we change it to problem statement. Scientific investigation, class. (SS) How many? How many percentage of oxygen in air. How? (S) How much oxygen in air? Anything can be accepted. But make sure your statement of problem must be in question form. Must be in question form. So write your own problem statement. ³ Apa masalah you dengan experiment ni? (<i>What is your problem with this experiment</i>)	2 - Linking word 3 - To facilitate understanding
243.	S1:	Sir.	

244.	T:	Yes?	
245.	S1:	Kan kita tak buat lagi experiment ini macam mana nak tahu masalah? (<i>Since we haven't started the experiment, how do we know the problem?</i>)	
246.	T:	((chuckles)) Scientific investigation, we identify the problem then need to experiment. ⁴ Mana boleh ada dah ada buat eksperimen baru cari masalah? (<i>How could you only look for problems after you conduct the experiment?</i>) No way. The other way round. OK, look at the variables, just leave the variables first. OK, look at the procedures, look at the method, ok, write the instruction form of the method, I need you to convert it into a passive form. K, change to passive form, like doing your report, your normal report, change it to passive form, past tense. (S) Essay? Passive form, class, yes, ah, you ⁵ dah belajar , (<i>have already learnt</i>) you learnt this before, you've done your report last time. Ah, why got gold fish memory? Three seconds only ah? Forgot everything. (S) Remember good. Yes, yo, ah, need ah, but now all you need to do is change the method to passive form.	4 - To facilitate understanding - To lighten the mood 5 - To link to students' experiences
247.	S:	Teacher, passive form tu apa (<i>what is that</i>)?	
248.	T:	We change it to passive form, ⁶ macam buat (<i>just like doing</i>) report.	6 - To facilitate understanding
249.	S:	Ah.	
250.	T:	Oh, ah, yes, good, yes past tense, but passive is more like, passive form, you ⁷ belajar inggeris kan? (<i>learn English right</i>) Hmm, Jar has been divided into five sections using? ⁸ Betul (<i>correct</i>) la . Heh, ⁹ Jangan la cucuk dia, kesian Shafiqah . (<i>Don't poke her, pity Shafiqah</i>) Why are you playing with the thing? Yes. Hmm, yes, I still have, the number of (??) Why why, why Azira your notebook is with you? (S) Ahh, because they hand in earlier, so chop, sign, you late, ¹⁰ orang lain dah siap dah (<i>others have finished</i>). ((Teacher walks around the class)) Aiman, why you took so long to think? Just two, just two sentences. MmmHmm..Mmmhmmm, mmhmm, yes Sara, why? Why with the sulky face. ¹¹ Kenapa muka sedih sangat ni? (<i>Why is the face so sad?</i>) Ah, are divided, eh D, sorry, yes my dear. Aha.	7 - To seek confirmation 8 - To provide confirmation 9 - To admonish - To negotiate different teacher identities 10 - To admonish 11 - To negotiate different teacher identities
251.	S:	Can we start the sentences with 'we'?	
252.	T:	Sorry?	
253.	S:	Can we start the sentence with like 'we'?	
Episode of Experiment			
254.	T:	Ah, we don't use any, we I you me, no. The jar is divided, ahhh, English (...) divided the jar? Okla okla, as long as it's like passive, past tense should be ok la. Why you haven't started anything? OK, so looking at the procedure, done? Finished? Ok, so each group k, please send two representatives to the front, ¹ dua orang sahaja , (<i>two people only</i>) each group. ((students collect apparatus)) So, this is your, water basin, fill up, look at the procedure, fill up with water up until here, k you don't need to plasticine because you stick it with the wire already. So where's your another group member? Jia Jit. (...) Off you go.	1 - To emphasise
255.	S:	Can I do it now?	
256.	T:	Ah no, we need to wait everyone settle then we start. (S) Not really, I'm gonna show you. Why did I bring that	2 - To negotiate different teacher

		thing? Yes? Yes? Wooi! ² Tak dia yang makan. (<i>No he was the one who ate it.</i>)	identities
257.	SS:	((Talks in Malay))	
258.	T:	Yesterday I gave you Snickers right? Who's your group member?	
259.	SS:	(??)	
260.	S:	Dia bawa mancis! (<i>He's holding the matches!</i>)	
261.	T:	Ah don't play with the match ya.	
262.	S:	Ah lah, aku paling tak suka. Aku tak nak bawa kaca tu, tak berani. (<i>Ah, I dislike the most. I don't want to hold the glass, don't dare.</i>)	
263.	T:	³ Ah lah bukan ada apa-apa pun. (<i>Ah, that's nothing also.</i>) ((Teacher tries to open something)) Nah.	3 - To negotiate different teacher identities - To lighten the mood
264.	S:	Cikgu ni tak boleh? (<i>teacher this cannot?</i>)	
265.	T:	⁴ Itu air dah (<i>the waster has been</i>) contaminate la. Yo. It's empty. Ah, take out some, some of it, not too much. Do not take everything!	4 - To facilitate understanding
266.	S:	Sir saya juga (<i>me too</i>).	
267.	T:	Wait la, wait, we have enough, we have enough for everyone.	
268.	S:	Racist.	
269.	T:	Racist? Why am I being racist?	
270.	S:	Tak apa, kita bagi dua special. (<i>Never mind, we give two special</i>).	
271.	T:	Eh?	
272.	S:	Saya dengan dia. (<i>me and him</i>)	
273.	T:	Nadia ⁵ minta apa lagi (<i>asking for what again?</i>)? I thought you have six groups? Oh ⁶ tak boleh (<i>cannot</i>), we only have six. So Fiquan.	5 - To elicit response 6 - To admonish
274.	SS:	((talks in Malay.))	
275.	T:	Ah. Ah ⁷ tak ada (<i>don't have</i>), you stick with your group. Oh, careful Aiman. OK. What's that? EPM? Yes. OK first, right, look at your method carefully, what are the things that you need to do? K? ⁸ Dah baca (<i>read already</i>). I give you two minutes. I'll give you two minutes to read out the procedures before we start. ⁹ Tak siap lagi? Cepat siapkan (<i>Not done yet? finish it quickly</i>). Oh you doing at the back? OK.	7 - To show disapproval 8 - To seek confirmation 9 - To show disapproval - To give instruction
276.	S:	Bolehkan (<i>can right?</i>)	
277.	T:	¹⁰ Boleh. (<i>can</i>)	10 - To provide confirmation
278.	S:	Teacher.	
279.	T:	Yup. Yes, four? Are you sure it's four? One two three four five. (...) K. OK now clear your table. I don't want to see any books, any paper or any pencil case. Put it inside the drawer. ¹¹ Belum hantar lagi (<i>haven't submitted yet</i>). Not now. ¹² Kenapa (<i>why</i>)? Why? OK. You can start do your experiment now. Yes, definitely. OK, so, during the	11 - To facilitate understanding 12 - Unknown

		experiment, please look at what are the manipulated variables, what are the constant variables, what are the responding variables. Hmm? OK K. I'll switch off the fan ya. (S) Half candle? (...) Umm make sure the water level is above the candle, slightly above the candle. (...) So (??) how many hours? Tomorrow we have class is it?	
280.	S:	Sir?	
281.	T:	Hmm, yes? (S) Sorry? That's fine, that's fine. Because the water can. Sure no problem. OK. Err no, no need, because we have the, ok just make sure the water level above the ah glass, so it should be higher than the, candle, it should be fine. Oh too much, ah wait, I ¹³ takut (<i>scare</i>) the water,	13 - To negotiate different teacher identities
282.	SS:	(??)	
283.	T:	Careful I don't want the candle to be spoiled by the water, that's all. (S) What? Ha, that's why la I say. Do not put too much water class. It'll make the candle, where's the match? OK ok, it's fine. Water rise, yes? I think it's fine it's not wet. It's OK Aiman. It is supposed to rise. The water level should rise. Uh Aiman. ((Teacher showing experiment by himself.)) ((S sings Happy birthday to you.)) (SS) Do it yourself. Yo. Can, no worry. Hah. Use you own method. Ha? No. What happened. K so write your observation. Or you can repeat the experiment. Are you sure? I asked you to divide the thing. Divide the gas jar into five sections right? (.) Where's the five section? Five? Is it five? One two three four only.	
284.	S:	Ooohh.	
285.	T:	Aaahh. Redo. Careful you might wet the ah candle. Class, make sure you divide the jar into five sections first. ¹⁴ Dah (<i>done</i>)? Ah tu (<i>that's</i>) five.	14 - To seek confirmation
286.	S1:	Sir, tadi kan, tadi kita nyalakan (<i>just now right, just now we light it</i>).	
287.	T:	Yes?	
288.	S1:	Lepas tu kita letak kat situ. Lepas tu nak buat apa? (<i>After that we place it there. After that what do we do?</i>)	
289.	T:	¹⁵ Tengok la (<i>look at it</i>). Write down your observation.	15 - To give instruction
290.	S1:	Ha, apa dia I tak jumpa? (<i>Ha, what is it I don't see?</i>)	
291.	T:	¹⁶ Apa-apa tak jumpa (<i>See nothing at all</i>)?	16 - To seek confirmation
292.	S1:	Yang kita orang nampak, I (?) (<i>things that we see, I</i>)	
293.	T:	Hmm mm. Yes? ¹⁷ Dah habis (<i>already finished</i>)? Anyone with the extra match? ((Thud sound at the background)) Wow careful! Can I have the match? No no. Ah k. Ah no. Ah ok, there's a problem in your set up of experiment. Apparatus used. The water level should be higher than the candle. So, or else the (??) (SS) Ah, ¹⁸ sikit sangat air (<i>water is too little</i>).	17 - To seek confirmation 18 - To facilitate understanding
294.	S:	Saya ingat nak separuh, separuh la ni. (<i>I thought it needs half, this is half</i>).	
295.	T:	¹⁹ Tak, tak separuh (<i>not, not half</i>). (SS) Ah ah the air should flow inside. (.) So just a little bit more water.	19 - To emphasise

Appendix H

Su Ling's lesson transcript

Episode of Instruction			
Turn No.	Role	Transcriptions	CS Functions
1.	T:	Ok, before we start our lesson, who's absent?	
2.	SS:	Err Hafiz, Hafiz, Yap.	
3.	T:	Who?	
4.	SS:	Hafiz, Yap, Zeng Yap.	
5.	T:	Hafiz, Yap, that's all, two? Farian, three. Yesterday? Who didn't come?	
6.	S:	Yesterday all came.	
7.	T:	OK.	
8.	S:	Teacher I want go back class to take the file.	
9.	T:	K go. K who wants to pay for the yuran PIBG (<i>Parents and Teachers Association fees</i>) can pay now. Right. ((Students queuing to pay fee.)) We'll discuss about it later.	
10.	S:	(??)	
11.	T:	We'll discuss about it later.	
12.	S:	Umm teacher, I'm waiting for the (?), but then the PIBG you want to (??)	
13.	T:	So how much you want to pay?	
14.	S:	Ah how much I have to pay?	
15.	T:	I didn't bring the paper, k after, during recess right, come and see me. I'll show you how much you need to pay.	
16.	S:	Or you just talk to (??)	
17.	T:	Ya can, umm, I can give you my phone number then you can ask him to call me.	
18.	S:	(??)	
19.	T:	Ya sure sure, anything. OK, before we start, let's take out your textbook first, OK chapter five. And as usual, before that, I need you to tell me the interesting science facts. OK, today who's turn? Ahm, Nakib, come, don't tell me you didn't prepare ok. I told you so many weeks ago. Quick.	
20.	S:	(??)	
21.	T:	Yes, can. Quick Nakib, don't waste the time. Put on my table. K come.	

22.	S:	Cat has more bones than (?)	
23.	T:	I cannot hear. Who? Who? A cat. OK. Cat have, has more bones than human. How many bones do they have?	
24.	S:	Two hundred thirty.	
25.	T:	230. Human?	
26.	S:	Two hundred and six.	
27.	T:	206. Are you sure or not? 206 so cat 230. K very interesting, thank you very much Nakib. Yes, you want to ask. Nakib, CZ has a question.	
28.	S:	(??)	
29.	T:	Who? Baby? A baby? How many bones do they have? Three hundred and something?	
30.	SS:	((Students laugh))	
31.	T:	OK this one I don't know. So CZ, go back home and search for it and let me know. OK, next one. YS, where is he? Eh. Ok next, AL. Loud and clear please. Make sure your voice reach at the back. AL I cannot hear you at all.	
32.	S:	A finger nail takes about 6 months to grow.	
33.	T:	A finger nail takes 6 months to grow. To grow until? How long, how long do you mean? Because as I can see, my finger nail is getting longer every day, so what do you mean by take six months to grow? What is the, I mean the limit, the the.	
34.	S:	From base.	
35.	T:	From? Base. I don't quite understand what do you mean by 6 months to grow from base. We have to cut, ya, they have to cut their finger nails each week. So if you say six months I think it's like, so can you tell me what do you mean by six months to grow? AL? Ok, let's say, I don't have a finger nail on my finger, so it takes six months for me to grow a new one, is it? Is that what you mean? Yes. OK, thank you very much. Ok next, HR. Ya, come.	
36.	S:	The word robot comes from the.	
37.	T:	HR, you don't even know how to pronounce. Faster. Can you hear? Cannot hear.	
38.	S:	The word robot comes from the (??)	
39.	T:	The word? Where? Where did the word robot come from? There's a question, where? Then where's your, the word comes from the (?) Robotnique, which means false labour or even slave. So robot means slave actually. So it's not the, it's not what we imagine, robot is like full with metals and all that. OK, quite interesting but not so clear, right. Robot is actually means slave. OK. Thank you very much.	
40.	SS:	(??)	
41.	T:	Can, can get it from me later. It's not language, it's (?) a country. This one is so hard to pronounce. I'll tell you later. OK, next one we have MH. MH loud and clear.	
42.	S:	Seekor siput mempunyai empat belas ribu tujuh ratus empat puluh lima gigi. (<i>a snail has fourteen thousand seven hundred forty-five teeth</i>)	
43.	T:	Again, again?	
44.	S:	Seekor siput mempunyai empat belas ribu tujuh ratus empat puluh lima gigi. (<i>a snail has fourteen thousand</i>	

		<i>seven hundred forty-five teeth</i>	
45.	T:	1Siput. Gigi (<i>Snail. Teeth</i>)? OK I'm sure none of you know about it. OK, again again, loud and clear, 2seekor siput (<i>a + collective noun + snail</i>),	1 - To emphasise - To get attention 2 - To encourage students - To get attention
46.	S:	Seekor siput mempunyai empat belas ribu tujuh ratus empat puluh lima gigi. (<i>a snail has fourteen thousand seven hundred forty-five teeth</i>)	
47.	T:	OK, that's so interesting, ok, 14700 teeth right, a 3siput (<i>snail</i>), a snail, who found out the scientist ya of course. Ya the scientist. OK thank you very much MH, very good. But the teeth must be very small and tiny la. We can't see it. 14 thousand it's not 4 thousand. Ya, must be very tiny and small. OK last we have Izuani.	3 - To emphasise
48.	SS:	(??)	
49.	T:	No. Come.	
50.	S:	The biggest (??)	
51.	T:	OK, the largest organ, ya this one we know that, the largest organ in our body is actually our skin and it takes 50% of our body weight. OK, very good, very interesting, thank you very much. OK so, next, I mean this coming Friday, NR, SX, CZ, S, YH, YP and PT. OK, YS come, quick.	
52.	S:	(??)	
53.	T:	Again? What? What 6 million million? What's that?	
54.	S:	A healthy person has (??)	
55.	T:	There's not such term as million million million. How many zeros? How many zeros?	
56.	S:	(??) ((Students laughing in the background))	
57.	T:	Where did you get it? This is a person himself don't know how to pronounce it. OK, so basically it says about our blood contains billions, it's not million, billions, ok, so it's billions of haemoglobin, the red blood cells. Right. YS, come back home and find out how to pronounce that. It's more than billion actually, it's a lot, zillion, yes, so I think the person himself don't know how to pronounce it, 6000 million million million, ok? Ya, red blood cells. Have to find out. Zillion maybe? Billion zillion, I don't know.	
58.	S:	Teacher got zillion ah?	
59.	T:	Got, got billion got zillion. OK, so let's continue with our lesson, chapter 5.1. So I'll show you the CD-Rom on Chapter 5.1, the air around us. Umm, what is the composition of air? And, why air is a mixture. OK? So have a look. ((Teacher is getting ready the CD and slides)) ((CD starts and plays for about 40 seconds.)) So we know that living things need air in order to live. Air is one of the most important resources that sustain life. So air is all around us. Can you think of one example, can you tell me one example? Yup.	
60.	S:	Because we are breathing.	
61.	T:	Because we are breathing, yes, we need air. We need oxygen ok? Any any other answer?	
62.	S:	Because we are still alive (??)	

63.	T:	What's that? Again, again?	
64.	S:	Because we are still alive after three minutes.	
65.	T:	Re what? Because we are still alive after three minutes? That doesn't make sense to me, I mean ok? So any other examples? Apart from oxygen, any other examples? Carbon dioxide, ok, can you tell me what example?	
66.	SS:	Plants.	
67.	T:	Yes, carbon dioxide is used for plants to make food, undergo photosynthesis, and the plant would release the oxygen for human to breathe. K, these are the examples. Let's see. ((CD continues for 33 seconds.)) OK, so air cannot be seen, as you all know. Because it is colourless, tasteless and without any smell. (??) can feel the movement of air or wind around us. That's why you can feel the fan, the wind, the movement of air. OK, you can feel your own breath. OK, so these are? You can feel air moving in and out of our nose when we breathe. So can you try now. Ya, put your hand in front of you, and then you just breathe, using your mouth, using your nose. Can you feel it? This is what we call air. OK, and we breathe out oxygen, carbon dioxide as well. Right. ((CD continues for 23 seconds.)) Do you know that? The atmosphere. Ya, actually our earth is covered by layers of air, ok, it's what we call atmosphere. Right. ((CD continues for 21 seconds.)) So we learn in chapter 3 matter, we know that gas has mass and occupies space right? So what are the components of air? Can you tell me? The components of air. The first one.	
68.	SS:	Oxygen	
69.	T:	78%, nitrogen, 21%.	
70.	SS:	Oxygen.	
71.	T:	K, 0.03, carbon dioxide and 0.97? Yes, inert gases and other dust, microorganism and water vapour. Right? So let's see one by one. ((CD continues for 26 seconds.)) OK the different gases. So which one you want to look first? Oxygen. You can see oxygen the chemical umm molecule is O ₂ , right? 2 oxygen atoms. ((CD continues for 31 seconds.)) OK so air in the park with lots of trees will contain more oxygen than in an industrial area. That's why we say that air is a mixture. Right? Next one, which one you want to look first? The second, which one? Nitrogen ok. ((CD continues for 20 seconds.)) K even though nitrogen takes about 78% of the air right, but actually it's only used for plants, in a certain, I mean very very small amount, alright, not much. OK next one we look at carbon dioxide. ((CD continues for 25 secs.)) OK, so we know that carbon dioxide is very important for plants to make food through photosynthesis. OK, now my question is, (.) 4kenapa (<i>why</i>), ok, why we are encouraged to plant more trees around our house?	4 - To get attention - To elicit response
72.	SS:	To get more oxygen.	
73.	T:	To get more oxygen. So what is the effect to human if we plant more trees?	
74.	SS:	We can breathe, get (?) oxygen.	
75.	T:	K imagine you are building a house without any trees around you, what is the effect? You'll feel? Yes, you'll feel very very hot. Why?	
76.	SS:	(??)	

77.	T:	Yes, you know that carbon dioxide actually will trap the heat. OK. The heat will not be released into atmosphere. So you'll feel the hot. You'll feel the heat. Right, but if you plant more trees, more carbon dioxide is being absorbed by the plants right, it releases more oxygen to you. So it will not trap the heat, so you'll feel more cold. Right? That's why you'll feel very fresh when you go into a jungle, you go to a forest, because more oxygen, less carbon dioxide, ok? K last one. ((CD continues for 19 secs)) Inert gas. You don't have to remember all these gases ok? You'll be learning this, when you go up to Form 4, you'll be learning Chemistry, you'll learn all this. But now you just have to remember one or two examples of inert gases. Helium, argon, do you know neon? Ya? You know neon ya? ((CD continues for 28 secs)) OK next. How would you show that oxygen exists in air? How? How? HS can you tell me how? How would you show that oxygen exist in air? HS? Don't know the answer? YW? TYW? Umm, HZ? How would you show that oxygen actually exist in air?	
78.	SS:	(??)	
79.	T:	When you breathe in oxygen. OK, so you know that, do you know that one is oxygen? When you breathe in air right, do you know actually that one is oxygen? You don't know right? Because it's colourless, tasteless, odourless. K so how would you know that oxygen actually exists in air? ((CD continues for 37 secs)) OK? So basically actually air can be separated umm by using a what we can, process call distillation. It's a rather complicated process, that's why we can't do it. You must go to a lab and do. OK? So air can be separated into their components by using distillation process. K, so you get oxygen, you get nitrogen, carbon dioxide and helium. Each component. So let's click view and see what happens. You put it inside a lighted candle, K extinguished immediately. Yes, so through this experiment we know that air consists of oxygen. Right? And oxygen is needed for combustion. Ya? ((Teacher talks while playing the CD)) K question number one, CT. What are the components of air? Your answer, can't see the board? In front.	
80.	S:	Gases, dust and microorganism.	
81.	T:	OK, gases, dust and microorganism. ((CD)) Try again. KJ?	
82.	S:	Gases and others.	
83.	T:	Gases and? Others. ((CD)) OK, why the number four is wrong? Gases, dust and, yes, because it doesn't have water vapour. So your answer is wrong, CT. Number two ((CD)) umm, NB. What are the gases of air, in air?	
84.	S:	(??) ((CD))	
85.	T:	What are the gases in air? If you can't see, come to the front.	
86.	SS:	Oxygen, carbon dioxide, nitrogen (??)	
87.	T:	Which mean? The third one, oxygen, carbon dioxide and inert gases ((CD)), ok correct. Number three ((CD)) number three, BT, which are the following inert gases? BT, come.	
88.	S:	D.	
89.	T:	D, helium, argon, neon, xenon, radon and Krypton. K. ((CD)) Number four, ((CD)) Suria. What can you conclude from this. Suria stand up and tell me the answer. A lighted candle burns for a while inside a jar of air. What can you conclude from this?	

90.	S:	There is oxygen.	
91.	T:	Ya? Read the whole thing.	
92.	SS:	Err, there is oxygen in the air.	
93.	T:	Yes, there is oxygen in the air. Let's see. ((CD)) ok, ((CD)) k number five, umm, RY, atmosphere, k this is so easy. ((CD)) ok, so next one. OK, come, who wants to try can come out and try ((using the mouse to answer the question on screen)). JQ, come. Ya. Come and click. So air can be divided to two components, gases and other components. So what are they? JQ come. Don't click anything first, just try, there are two more boxes. ((waiting for student to answer)) Hey, are you sure or not? Sure?	
94.	SS:	Sure, sure.	
95.	T:	JQ if you are wrong, I'll ask you to do pumping ok ten times. ((Students laugh because he answered wrongly)) Ah no, come. Good try. Come who wants to try again. AD. Yes, later I'll come. Make sure you do your pumping ten times. AD come. AD. Quick. OK, if you answer wrongly, tell me one secret.	
96.	SS:	What secret? I'll tell you my secret.	
97.	T:	((waiting for student to answer)) Hey class 1B listen here, you do not know how to differentiate between gases and other components is it? Gas means gas right? ((student answers wrongly and the class cheers)) Come, tell me a secret.	
98.	S:	Umm what secret?	
99.	T:	Anything that I don't know.	
100.	SS:	((students teasing at the back))	
101.	T:	Just tell me, just tell me, I won't tell anybody. OK, I know the secret already. OK next one, umm come, II. OK, 5kalau jawab salah (if answer wrongly), make sure you don't sleep in the class.	5 - To lighten the mood
102.	SS:	((students laugh))	
103.	T:	Eh come on. ((whole class cheers because student answers correctly)). OK, all these are gases, gases mean? Gases mean gas, oxygen, carbon dioxide, hydrogen, inert gases, all these. OK? Water vapour is not a gas, definitely.	
104.	SS:	(??)	
105.	T:	OK ((CD))	
106.	SS:	((??))	
107.	T:	I'll choose, I'll choose, don't worry. See, 1B, listen here, read the question first before you come out and answer it. OK, so next one come, CZ. And the rest of you, help him to check his answer. Why so fast? Yes, it's easy basically. Helium, argon, neon, xenon, radon and krypton. All these are inert gases. ((CD)) Ya, the usage of inert gases. ((CD)) OK, so basically helium is used to pump I mean the balloon, k so basically, the balloon, inside there is helium gas. That's why it's very, it's very very what we call density is very very low, that's why it can float to the air, helium. And, neon, you know, the the, this one is neon, ya, the lamp, this one and also, what is this, the third one is what?	
108.	SS:	(?)	

109.	T:	What's that? Ya, in the umm, operation room, operation room in hospital and this one you know that, the neon, the light, the effect. K?	
110.	S:	Teacher teacher.	
111.	T:	Yup.	
112.	SS:	(??)	
113.	T:	I cannot hear, I cannot hear you. When you blow the balloon, carbon dioxide is coming out, so if you pump the balloon using helium right, it will float to the air. But if you pump using, I mean you just blow it, it will not float. It's not that light. No. So there's there's difference. ((CD)) OK done. Now we go to the next one, last one. Percentage. SN SN go there and help me to click. ((School bell rings)) Wait ah, wait wait wait. SN. Ya, go back go back. Name the different types of gases in the air. Umm YH, can you name the different types of gases in the air?	
114.	S:	Oxygen	
115.	T:	Oxygen.	
116.	SS:	Oxygen, carbon dioxide, inert gases and nitrogen.	
117.	T:	OK, very good. SN click gases. ((CD)) K click next. ((CD)) Umm, SN click next. ((CD)) Click next. ((CD)) K, so this one you all know that. K so, nitrogen 78, oxygen 21, inert gases actually is 0.97, k so around 1% and carbon dioxide is 0.03%. This one you all know that. That day you all also present in class already.	
118.	SS:	(??)	
119.	T:	((CD)) Textbook 0.97. Click next, SN, next. OK, question number one. Number one, ah, MH, the pie chart shows the percentage of gases and which of the following...P?	
120.	S:	Nitrogen, oxygen.	
121.	T:	Yes, nitrogen, oxygen. Let's see. OK, correct. Next number 2 AL. Oh, this one, come and drag. SN can come back here. Thank you very much. K if you answer wrongly, sing a song.	
122.	SS:	((Students laugh))	
123.	T:	Are you sure or not?	
124.	SS:	Teacher teacher what if he's wrong?	
125.	T:	Sing a song. No secret, no. OK, well done! OK, so did you all know that? This one is very easy. ((CD)) OK, question number 3, ah, CL. CL.	
126.	S:	Teacher somebody is outside.	
127.	T:	Who is outside? ((teacher walks outside to speak to a student))	
128.	S:	Teacher teacher, (??)	
129.	T:	Sing a song. OK, both the candles extinguished after some time. What happens to water level? Oxygen how many percentage? Oxygen how many percentage? 21. OK, 21 means? One fifth, yes, so what's the answer?	
130.	S:	Teacher is it both?	
131.	T:	You choose, you choose the closer one, the closer answer, just choose one, just choose one. ((Class cheers because CL answers wrongly and they want him to sing a song.)) OK, CL, second chance, try one more time, one more	

		time, one more time. Different, gas jar A and B different size but then actually percentage of the air is still the same, 21%. It's one fifth. So what do you think CL? OK.	
132.	SS:	((Students are unhappy because CL answers correctly))	
133.	T:	OK, well done. So the water level rises to one fifth of the height, on both. Number four, number four, FR. Yes, 0.03, this is easy. ((CD)) This one, this one no need. It's ok. This one is ok. ((CD)) OK umm, DN, in what kind of situation will the percentage change? Can you tell us? In what kind of situation the percentage will change. Stand up and share with the class.	
134.	S:	When oxygen becomes more than nitrogen.	
135.	T:	What do you mean? In what kind of situation? You don't know. CX, in what kind of situation will the percentage change? Crowded place? What about? Can you explain more? What do you mean by crowded place?	
136.	S:	Ahh, oxygen will be less.	
137.	T:	Yes, in crowded places right, the oxygen will be lesser, and what about carbon dioxide?	
138.	S:	(??)	
139.	T:	Yes, carbon dioxide will be more. OK. Very good, sit down. Next one, umm, PT. In kind of situation will the percentage change. Just now she said crowded place, less oxygen, more carbon dioxide. So what about others. Other situation or environment? In the jungle?	
140.	S:	(??)	
141.	T:	There's more oxygen.	
142.	S:	(??)	
143.	T:	Than carbon dioxide. K, very good. OK done. That's all. So 5.1 you know about the composition of air and you know about the percentage of each component right? And you know why air is a mixture because the composition is not fixed, it changes according to the environment and situations. OK, so that's all and now I want you to do some exercise.	
144.	SS:	No.	
Episode of Assessment			
145.	T:	Why? To show that you really understand.	
146.	S:	Teacher what exercise?	
147.	T:	What exercise, very simple exercise. I think you can answer it within 10 minutes. AK, this one is the ¹ jadual peperiksaan (<i>exam timetable</i>), you paste it in the class, right.	1 - To emphasise - To get attention
148.	S:	Teacher everybody same one ah?	
149.		Ya, same one. and 1 Berdikari (<i>independent [name of class]</i>), this is the timetable for your coming ² penilaian (<i>assessment</i>) 2. So make sure you go and ³ fotostat , ask the ⁴ bendahari (<i>treasurer</i>) to fotostat for you, each and every one of you. And this one paste it on the board in the class. One one, just one, take one. OK, take one. And I'll give you maybe 15 minutes to do it, and then we'll discuss together. What?	2 - To emphasise - To get attention 3 - To emphasise - To get attention 4 - To emphasise

			- To get attention
150.	S:	Teacher got French exam?	
151.	T:	Some people they have. Some people take French.	
152.	S:	I take French but (??)	
153.	T:	Got exam ah? I don't know that. Just go and have fun. I think it's very simple one. And exercise 4.1, who else didn't hand it? Exercise 4.1. OK, who else? K extra? Extra paper give it back to me. SS. ((Teacher checks homework while the students complete their exercise in class)) SR faster. You still want to record until the end?	
154.	R:	Just let it run.	
155.	T:	Beatrice, faster.	
156.	S:	Teacher.	
157.	T:	Yes, write down your name, your class and write down today's date. Today is seventeen July.	
158.	S:	Seven is missing.	
159.	T:	Seven is missing? Ah, just write, just write inside. Because it's usually 0.971 like that. Sshh sshh.	
160.	SS:	Teacher, teacher.	
161.	T:	Yes?	
162.	S:	I tell you a secret.	
163.	T:	Aha. Oh what quick tell me.	
164.	SS:	Actually we have a crush on you, haha.	
165.	T:	What do you mean? What is that mean?	
166.	SS:	Teacher, teacher. ((Different students calling out to teacher at the back.))	
167.	T:	Beatrice can you do your work?	
168.	S:	Teacher, teacher.	
169.	T:	I don't have. And Suria, stop talking.	
170.	S:	(??)	
171.	T:	Done.	
172.	S:	Teacher why is 0.9?	
173.	T:	Wait.	
174.	S:	I thought it's 0.97.	
175.	T:	0.97, 0.9 it's around there la, that range.	
176.	S:	(??)	

177.	T:	Hmm?	
178.	S:	What's proportion?	
179.	T:	Proportion? Proportion means umm components, each component, proportion.	
180.	S:	Teacher.	
181.	T:	Proportion means each components, the component, proportion, part by part. So Haziq, that day presentation who didn't come? Haziq, umm, there's one more, Hashini, you came or not that day? Presentation, Monday. You came or not? No. So Haziq, Hashini, who else ah? One more.	
182.	S:	Suria.	
183.	T:	Suria. Yes, Suria, the three of you. So you have to do umm what we call individual presentation on chapter five point one. That day everybody present already, k their presentation on five point one.	
184.	SS:	(??)	
185.	T:	0.9, 0.97 or one. It's around there.	
186.	SS:	(??)	
187.	T:	You, depends on you. Three of you, you want to do it together? Or want to do individual presentation? So Hashini can decide, you want to do together with them, presentation or you want to do individually?	
188.	S:	On what teacher?	
189.	T:	On five point one.	
190.	S:	What is ah proportion?	
191.	T:	Proportion means the component, each component, part by part. One proportion, proportion. Separated into different components.	
192.	S:	And ah physical method?	
193.	T:	Physical method, physical la, physical method for example filtration, umm evaporation. Proportion means part by part, each part each component.	
194.	S:	(??)	
195.	T:	0.9 0.97 or around 1.	
196.	S:	Can do it (??)	
197.	T:	No presentation means you must come out and present. So it's either you want to use power point presentation or you want to use manila card. And I will record.	
198.	S:	Teacher, teacher mampat ni (<i>this dense</i>)?	

199.	T:	Ya ⁵ mampat (<i>dense</i>), dense. Dense, D E N S E. So umm this coming Saturday, can you come and, can you present? This Saturday. You have ahh school replacement.	5 - To facilitate understanding
200.	SS:	(??)	
201.	T:	Ah? Friday? Coming Friday one period only, cannot do anything. So I, I'll take double period. No No. I will not take other people's.	
202.	S:	This one can I just (??)	
203.	S:	(??)	
204.	T:	Wait ah, depends on you. So if whenever you are free, you come and tell me. But make sure it's within this week la. I'll make it on Saturday. Make sure you come.	
205.	S:	The process (??)	
206.	T:	Which one? Umm the process, ya change to liquid means what process is that? No, not evaporation. It's, ya. Suria faster.	
207.	S:	Teacher is there such word as deburn?	
208.	T:	How to spell?	
209.	S:	D E B U R N	
210.	T:	D E B, deburn? No.	
211.	S:	Eh mana ada? Deburn mana ada? (<i>where has it? Where is deburn?</i>) ((Student talking to another student))	
212.	T:	No. K Done? Never mind, just try, just try. Each component retains its, OK actually we say that mixture, what's the properties of mixture? The composition is not fixed and? Each component still has its own, shows it's what? For example, sands and ion fillings. So sand is still sand, ion filling is still ion fillings. So what does it call? Original? Properties. Ya so we put original properties. So like B right, each component retains its original properties. Oxygen is still oxygen, carbon dioxide is still carbon dioxide. There's no, wait ah, there's no change of energy when the components are mixed together. OK it's like chemical methods right, when we mix it chemically, sometimes it will release heat, sometimes it will absorb heat. K, so this is called the change of energy but when two things mix together right, like the sand and ion fillings, there's no change of energy, you can't fill the heat ok?	
213.	S:	Teacher.	
214.	T:	Yup.	
215.	S:	Why has the (??)	
216.	T:	Why has the, because oxygen has been used up..ya because the oxygen has been used up during the combustion of the candle. So the water, it will replace the place of oxygen.	

217.	S:	Teacher, how to spell condensation?	
218.	T:	Hmm? Con den sa tion, S A T I O N. Suria, I give you the last warning. Next time, the three of you don't sit together I tell you. OK shall we discuss now?	
219.	SS:	(??)	
220.	T:	Ya, can. Hmm. Number two. Ya what is the process? What's the process? Start with C.	
221.	S:	Condensation.	
222.	T:	Yes! When then water vapour, err, they are in contact with the cold surface right, it will change to liquid. So it's called condensation. Haziq, done?	
223.	S:	Tak tau, yang tu. (<i>Don't know, that one.</i>)	
224.	T:	Izra Imran.	
225.	S:	Apa maksudnya? (<i>what is its meaning?</i>)	
226.	T:	⁶Maksudnya, kenapa air tu akan terbentuk di permukaan dinding sana. (<i>Its meaning, why does the water form on the surface of that wall there.</i>)	6 - To facilitate understanding
227.	S:	Oh.	
228.	T:	So we call what kind of process is that? Start with C. Start with C.	
229.	S:	Condensation.	
230.	T:	Yes.	
231.	S:	Oh!	
232.	T:	OK done? So shall we discuss now? OK let's start. Don't use red pen to mark. Use green colour pen to mark.	
233.	S:	Green ah?	
234.	T:	Yes, do not ever use red colour pen to mark. Green colour, green colour.	
235.	S:	No green, can I use purple?	
236.	T:	Don't use, purple can.	
237.	S:	Teacher, blue?	
238.	T:	Ah the colours other than your handwriting.	
239.	SS:	(??)	
240.	T:	Pink is same as red, don't want. Blue. Your handwriting? OK? So we start with, we start with Ally. The rest of you keep quiet and listen.	
241.	S:	((??))	

242.	T:	W is?	
243.	S:	Oxygen.	
244.	T:	Oxygen. X?	
245.	S:	Inert gases.	
246.	T:	Inert gases. Y?	
247.	S:	Y is carbon dioxide.	
248.	T:	Carbon dioxide. Z?	
249.	S:	Z is (?)	
250.	T:	Yes, very good. So you get the answer? OK. Number two. Umm. KW. Number two. Eh stand up and read. 2 A.	
251.	S:	(??)	
252.	T:	Yes, air is classified as a mixture because it's complicated, it's components can be separated by, by physical method. Distillation process. K? So A, can be separated by physical methods. B, Hilar.	
253.	S:	(??)	
254.	T:	Yes, Each component retains its original properties. Means oxygen still oxygen, carbon dioxide is still carbon dioxide. Not like water H ₂ O, you can't see the properties of oxygen and hydrogen anymore. K? It's pure water. So it retains its original properties, C umm, who else ah, Nakib.	
255.	S:	((reads in English))	
256.	T:	There are no changing? Yes, there's no change of energy when the components are mixed. K you know this one is physical method but if chemically combined right, it will somehow release heat or absorb heat, so you'll feel it's more, I mean it is hot or you'll feel it is cold. But if you mix sand, if you mix rocks together right, you can't feel the change of energy, it's still the same. So that's why we call it physical method. No change of energy when the components are mixed together. Right? So when you mix oxygen, carbon dioxide together, there's no release of heat or whatsoever. OK? D, last one. Umm, FH.	
257.	S:	((Reads in English))	
258.	T:	Yes the proportion of components keep changing. Proportion means each part la, parts by parts. K? So keep changing, depends on the environment. Number three, number three, OK you just tell me what's the gas W?	
259.	SS:	Oxygen.	
260.	T:	Oxygen. Percentage?	
261.	SS:	21.	

262.	T:	21. X?	
263.	SS:	Inert gases.	
264.	T:	Inert gases. Zero point? Nine or zero point nine seven or one. It's, I mean within this range. K? So you just write 0.9 according to the answer. Y? Carbon dioxide. Percentage?	
265.	SS:	0.03.	
266.	T:	0.03. Z, nitrogen, 78. Yes, very simple. OK look at question number four. We are not doing this experiment ok? So umm we'll do another experiment on Monday. The oxygen and carbon dioxide. So but basically, this one you must know, how it works. Diagram three shows the experiment to determine the percentage of oxygen in air. You can see, lighted candle and they will mark there, five umm equal parts 1 2 3 4 and 5. K? And lighted candle put inside, in the water k? And why water does not enter the gas jar at the beginning of the activity?	
267.	SS:	Because the air (??)	
268.	T:	Because? Yes, because air occupies space. Because air occupies space. Or we can say because gas jar is filled with air. Air has mass and occupies space. This one you must know. You must know it's matter. Because gas jar is filled with air. Or we can say because air occupies space. B, what happens to the candle flame after a while?	
269.	SS:	Extinguished.	
270.	T:	Yes, extinguished. Know how to spell extinguish?	
271.	SS:	Yes.	
272.	T:	Ex-ting-guish. So I mean in answering structure questions right, you answer short and clear. No need to be like so long. One sentence like that. K, extinguished. Or you can say the candle flame extinguished, like that. C, why has the water level in the gas jar risen at the end of the experiment?	
273.	SS:	(??)	
274.	T:	Because? Because oxygen has been used up.	
275.	S:	No more oxygen can?	
276.	T:	No more oxygen, because there's no more oxygen, ok, can. You must know that combustion umm requires oxygen. Used up, yes, u s e d u p.	
277.	S:	Teacher (??)	
278.	T:	Ya, not saying the percentage of oxygen, you just say oxygen is used up. That's why the water level will rise. D one, what percentage of air is used in burning?	
279.	SS:	21 percent.	
280.	T:	Yes 21 percent, or one fifth. So you can see the water level rises right to the first part, one fifth. Two, what is the	

		gas used in D1?	
281.	SS:	Oxygen.	
282.	T:	Oxygen. Ya, very simple. Number five, diagram four is an experiment to show the air contains water vapour. So it puts the ice cube inside the umm, what we call the boiling tube and you cover it. A colourless liquid form on the outside wall of the boiling tube. This liquid turns the dry cobalt chloride paper from blue to pink colour. And when it dries up, it'll become blue again. A, name the colourless liquid formed on the outside wall of the boiling tube.	
283.	SS:	Water vapour.	
284.	T:	Water or water vapour?	
285.	SS:	Water vapour.	
286.	T:	It's water. You can see the water drops, that one is water. Water vapour you can't see.	
287.	SS:	Where got water vapour can't see? Water vapour cannot see?	
288.	T:	Means water, water. Water droplets, can. Water vapour is a gas you know. Water vapour is gas, it's in gas form.	
289.	S:	(??)	
290.	T:	It will change to liquid, that one is water, it's not water vapour anymore.	
291.	S:	Oh.	
292.	T:	It's either water, can, or water droplets. Either one. B. State the process of matter change that happens to the ice cubes.	
293.	SS:	Melting.	
294.	T:	Yes, melting. Melting process.	
295.	S:	Teacher so the water droplets (??)	
296.	T:	No, the water droplets is not from the ice cubes, the water droplets is from the environment, the water vapour. I'll tell you why later. Number two. The formation of colourless liquid on the outside wall of the boiling tube.	
297.	SS:	Condensation.	
298.	T:	Yes, condensation. Yes, so this is the ice cube basically. So this is the ice cube, so just now someone say that the water droplets come from the ice cube, it's not. When this ice cube melt right, this one the wall of the boiling tube is very cold. Correct or not? Become colder. So when the water vapour in the environment in contact with the cold surface right, it will turn to liquid. So the water droplets actually is from the water vapour in the environment.	
299.	S:	I thought the ice cube will melt and then.	
300.	T:	The melt, melt inside la the water is inside.	

301.	S:	But teacher the water will come out right?	
302.	T:	The water will not come out, will not come out through the wall. No. The water droplets outside on the wall of the boiling tube is from the environment, the water vapour. OK? C. The colourless liquid on the outside wall of boiling tube is originated from?	
303.	SS:	Air.	
304.	T:	Air. Yes, from the air. From the environment? Ahh, the exact answer will be air.	
305.	S:	Teacher can write water vapour ah?	
306.	T:	Can write water vapour, originated from the water vapour in the air. If you want to say water vapour, you add one more, in the air. 5C? The colourless liquid on the outside wall of the boiling tube is originated from the air.	
307.	S:	(??)	
308.	T:	⁷ Betul (<i>correct</i>) ya.	7 - To provide confirmation
309.	S:	((in Malay))	
310.	T:	⁸ Dia tak faham (<i>he doesn't understand</i>), he don't understand. OK, so this one put in your file, and as for your information, I want your file on Friday. And there is school replacement on Saturday so make sure you come. Haziq, Hashini and Suria I want you to present on Saturday. On 5.1 very easy one, simple. Ya? This Saturday school until umm, I think.	8 - Unknown
311.	SS:	Twelve thirty.	
312.	T:	No it's not definite, not 12:30.	
313.	S:	Teacher why every time (??)	
314.	T:	Because we replace Monday's class.	
315.	SS:	(??)	
316.	T:	This one put under chapter five.	
317.	S:	Teacher until what time?	
318.	T:	Until what time? I think it's until one fifty. I don't think it's until two thirty ah but, one thirty? I mean one fifty. OK, listen here everybody, listen to me. Saturday, school replacement will use Monday's timetable. So if according to Monday's timetable, our class end at two thirty. But I think it'll be until one fifty, if not mistaken.	
319.	SS:	Ahh. No.	
320.	T:	One fifty. You just wait for the announcement, ok, just wait for the announcement. This is what I heard. OK, ⁹ koperasi (<i>cooperation</i>) member you can go for your recess.	9 - To get attention

Appendix I

Fatimah's lesson transcript

Episode of Experiment			
Turn No.	Role	Transcript	CS Functions
1.	T:	OK, ah today, what I promised you to do?	
2.	SS:	Experiment!	
3.	T:	OK, have you read your experiment, your procedure everything?	
4.	SS:	Yes.	
5.	T:	No. Natalie says. I can still see you. OK err, today, we gonna do experiment OK? I'll give you some ((pause)) ¹ lembaran kerja ya (<i>worksheets alright</i>). Ya, I know. 1, 2, 3, 4, 5. Why you wearing the mask today?	1 - To get students' attention
6.	S:	Lung infection, bron-sai-tis.	
7.	SS:	Bronchitis.	
8.	S:	(?)	
9.	T:	Yes, everything. Any absence? ² Ada orang (<i>is there anybody</i>) absent today? OK, ahh, look at the paper that I just gave it to you, OK. Ah, straightaway I just give you the ahh, the procedure ya, short-cut ya, sorry for that. OK. Ahh..that is the procedure, actually the procedure to be, to do your experiment, ³ saya (<i>I</i>) short-cut terus (<i>straightaway</i>). OK, first of all, ah, our aim today is to study the properties of oxygen and?	2 - To elicit response 3 - Unknown
10.	SS:	Carbon dioxide.	
11.	T:	Carbon dioxide ok? So oxygen and carbon dioxide, what is it?	
12.	SS:	Gas.	
13.	T:	Yes, type of gas. So can you see the gas?	
14.	SS:	No.	
15.	T:	T: No? Can you? Sarah? Can you see carbon dioxide? Not the letter, the gas. Can you see?	
16.	S:	No.	
17.	T:	No. OK? So As you know that you cannot see carbon dioxide, as well as oxygen, so, can you see anything inside here? ((referring the test tube.)) No, K. So, ahh the one with the black cover, stopper, ⁴ kita panggil (<i>we call</i>) stopper ni (<i>this</i>), this one is carbon dioxide and the red stopper is, oxygen. OK. We have very limited of these gas ok, so ⁵ saya harap (<i>I hope</i>), listen, when you do the experiment, please do it carefully and read the procedure first and then after that you do it. OK? ⁶ Sebab apa (<i>because of what</i>), I don't want you to waste because we have seven experiments so when seven times six (group), OK, come in, ⁷ pergi mana, lampat (<i>where did you go, late</i>)? Where have you been?	4 - To facilitate understanding 5 - To emphasise 6 - To facilitate understanding 7 - To admonish
18.	S:	(?)	

19.	T:	OK, ahh, do you have your textbook with you. OK, open your textbook page, yes, fifty-six. K, ⁸ Saya ulang balik ya, apa yang kamu dah baca , (<i>I repeat alright, what you've read</i>) Ashrin. K, the first experiment, we would like to test about the solubility in water for oxygen and carbon dioxide. K, what you have to do is, k, I don't want you to use the ⁹ bikar (<i>beaker</i>), so instead I give you the basin, ok? So, fill up the basin with water and then ¹⁰ tak payah banyak-banyak (<i>don't need to have too much</i>), sikit je (<i>a bit only</i>), as long as you can make sure that it can immerse, ¹¹ boleh masukkan (<i>can be entered</i>). OK? And then, open up the stopper, ¹² buka (<i>open</i>) stopper ¹³ ini (<i>this</i>), bila (<i>when</i>), listen, Aina, k ¹⁴ pandang sini (<i>look here</i>). Everybody look at me. When you open the stopper, ¹⁵ kamu terbalikkan ia dulu, balikkan macam ini (<i>you make it upside down, reverse like this</i>), there's water inside, ¹⁶ bayangkan (<i>imagine</i>) you got water inside, and then what you do is ¹⁷ masukkan di dalam air (<i>place it in the water</i>), open the stopper inside the water. ¹⁸ Kalau kamu (<i>if you</i>) open as usual, ah, for example, you ¹⁹ sembang-sembang (<i>chit-chat</i>), heh this is very good, I want to see! Ah, and then you just open, what happened to the gas inside?	8 - To recap 9 - To use content-related words 10 - To give further information 11 - To facilitate understanding 12 - To give instruction 13 - Determiner 14 - To get attention - To give instruction 15 - To detail demonstration 16 - To detail demonstration 17 - To detail demonstration 18 - To get attention 19 - To get attention
20.	SS:	Gone!	
21.	T:	Ya, gone! You cannot catch it back. No, I don't say you stupid for instance. OK, example, a sweet example. OK? Ah so, whenever you want to do anything you have to think first because we have very limited, we need seven of these for each group. OK, so ²⁰ kalau tak dapat (<i>if don't get it</i>), I will let you to have another one but the maximum is ahh satu (<i>one</i>) experiment ²¹ tak boleh lebih daripada tiga (<i>cannot be more than three</i>). OK? So, you ²² bahagi-bahagi (<i>divide it</i>), you have seven experiments, so you can ahh divide it among you all, or you want to do it together, it's up to you how you want to manage the experiment, so you have to, ahh group ²³ kamu kena (<i>your (group) have to</i>) wise, manage how you want to do about it. OK? So, remember ya, open it when? Before you put it in the water or outside?	20 - To get attention 21 - To emphasise 22 - To facilitate understanding - To give instruction 23 - Possessive pronoun
22.	S:	After putting into the water.	
23.	T:	Yes, ok. ²⁴ Buka dia ataupun (<i>open it or</i>) there's another way, when you open it, ²⁵ selalunya kalau (<i>as always if</i>) gas, we are advised to open it ²⁶ bila dia terbalik ya (<i>when it's upside down</i>), k open it and ²⁷ cepat-cepat pegang macam ni ya (<i>quickly hold like this</i>). Ada cara pegang (<i>there's a way to hold it</i>) ok? When you hold the test tube like this, and then ²⁸ bila kamu terbalik bukakan stopper dia, cepat-cepat tangan kamu jadi stopper (<i>when you turn it upside down opening its (stopper), quickly use your hand to be (the stopper)</i>). Make sure that those who hold this ²⁹ dia punya (<i>his</i>) fingers are ³⁰ besar, kalau tangan dia comel (<i>big, if his hand is cute</i>), ah, like my little finger, what happen to the gas? Ah, ³¹ keluar (<i>goes out</i>) la. OK? ³² Cari tangan yang besar-besar (<i>look for big hands</i>) to hold it. OK. K, you understand? Don't use your palm. I know that you want to do that. Heh, ³³ budak-budak (<i>kids</i>). K, next, the experiment, we will use carbon hydroxide, sodium hydroxide solution, k the same way	24 - To give instruction 25 - Linking word 26 - To provide further information 27 - To detail demonstration 28 - To emphasise - Possessive pronoun 29 - Possessive pronoun 30 - To facilitate understanding 31 - To facilitate understanding 32 - To give instruction

		also but this one we'll give you ³⁴ bikar (<i>beaker</i>). OK? And then next, page fifty eight. OK, for this experiment, every group please get the bunsen burner. Ah, ok and then ssshhh. OK, you have two types here. One is glowing wooden splinter and the other one is burning wooden splinter. OK. So when's glowing, how you want to do the glowing? OK, make sure that there's no fire ok. You have to, yes, you burn it and then ³⁵ kamu nampak dia macam (<i>you see it becoming like</i>) glowing, reddish like that, ³⁶ kamu masukkannya, dia akan menyala ataupun dia akan padam (<i>you insert it, it will ignite or it will extinguish</i>). OK? You got me? OK, and then page sixty, we have blue litmus and red litmus paper. OK? You have to put both inside the test tube. K. ³⁷ Buka cepat-cepat, masukkan and then tutup balik (<i>open quickly, insert it and then close it back</i>).	33 - To lighten the mood 34 - To use content-related words 35 - To facilitate understanding 36 - To give instruction 37 - To give instruction
24.	S:	Teacher by the time we open all the gas already come out.	
25.	T:	You can do it. Normally we can do it. And then, lastly, use the lime water, this is lime water, not lime juice. You know what is the difference? K lime water is ³⁸ air kapur (<i>lime water</i>), lime juice is? Juice. OK.	38 - To use content-related words
26.	S:	What is that, air kapur (<i>lime water</i>) ah? Ah la (express disappointment).	
27.	T:	Yes. OK any question? And lastly, we gonna do this bicarbonate indicator. K this is the bicarbonate indicator, ok, be careful, ³⁹ nanti kena baju, dia susah hilang (<i>later it contacts with clothes, it'll be difficult to lose</i>). OK? So don't spray to your friend. OK, put the drip inside and then ⁴⁰ cepat-cepat kamu tengok dia punya perubahan (<i>quickly you look at its change of</i>) colour. Any question? No. K wait. K. First, every group must have the what you call the test tube rack. ⁴¹ Ambil satu group satu (<i>each (group) takes one</i>). ((Students go to the front table to collect materials for experiment.))	39 - To provide further information 40 - To give instruction 41 - To give instruction
28.	T:	Seven each.	
29.	S:	How do you get the gas?	
30.	T:	Ah, we do it.	
31.	S:	Take how many each group?	
32.	T:	Seven. K take seven here, seven here. Natalie, ⁴² tak payah berebut (<i>don't need to fight over</i>). K, we use water to get the gas. Why you want? This thing you put here. I put here.	42 - To admonish
33.	S:	Teacher, some more? Need to take this?	
34.	T:	No no. If you want to use that then you come here. You take the bunsen burner for your group. Yes.	
35.	S1:	Teacher.	
36.	T:	Yes?	
37.	S1:	Can we put our textbook here?	
38.	T:	Yes, can. ⁴³ Ambil, ambil (<i>take, take</i>). Nor, nak lagi tiga, empat ((T speaking to lab assistant)) Satu dua tiga,	43 - To give instruction

		takde kecil? Membazir tu, bikarbonat tu. Ah boleh la, bagi satu. Takde yang besar macam ni ka? Yang ni ada banyak dalam kabinet tu. Yang 250 ni take ade. Ah dah dah dah, dah cukup.	
39.	T:	((back to the lab)) K you guys start your experiment now. Put some water inside. Put the thumb, (?) ⁴⁴ tu buka je la (<i>open that only</i>).	44 - To give instruction
40.	S:	Cikgu, yang experiment ni kena pakai bikar ke besen? (<i>Teacher, for this experiment use beaker or basin?</i>)	
41.	T:	Basin basin. ⁴⁵ Tapi yang ini kena guna bikar (<i>but this needs to use beaker</i>). K put away your things. Ah ⁴⁶ ni tinggalkan (<i>leave this</i>) this one only. Put away all your things, use your result paper only. Sorry? Haiya..why you ⁴⁷ ambil tempat lain (<i>take another space</i>)? This is not, k sodium hydroxide you can take from here. Take your beaker with you.	45 - To provide further information 46 - To give instruction 47 - To show disapproval
42.	S:	Teacher, how much to pour?	
43.	T:	Har? Hundred like that. Pour one hundred. Pour 100ml. K, ⁴⁸ dah (<i>done</i>).	48 - To seek confirmation
44.	S:	Teacher the first experiment with the water one, so just put the red one, put inside then open it?	
45.	T:	Yes put inside then open it.	
46.	S:	That's all right?	
47.	T:	Yes.	
48.	S:	OK, thank you.	
49.	T:	⁴⁹ Dah (<i>done</i>), take your beaker. Yes, I put there. Take 100, yes.	49 - To seek confirmation
50.	S:	Teacher can you pour, I scared.	
51.	T:	Why you scared?	
52.	S:	It's a girl's job. What is that teacher, lime water?	
53.	T:	No this is sodium hydroxide. Ya, because it's basically like, ya, it's a alkaline. Ah, honestly, they ask me to record throughout my class. Ah, might be. Sorry? Why?	
54.	S:	Cikgu we wasted three of the things.	
55.	SS:	Two, two. Two only la.	
56.	T:	Why?	
57.	S:	We don't know what to do. The thing for the carbon dioxide the water didn't go in at first.	
58.	T:	OK.	
59.	S:	But the oxygen ada masukkan? Oxygen masuklah teacher.	
60.	T:	Ok. When you put down there, ⁵⁰ kamu bukakan, kamu tengok yang mana yang naik, yang mana yang turun (<i>you open it, you look at which one rises, which one comes down</i>). It doesn't mean everything will fill up. OK?	50 - To give instruction
61.	S:	Dua-dua masuk dalam baldi itu ya, lepas tu saya buat macam ini. (<i>Insert both into the pail right, then I do like this.</i>)	
62.	T:	Yes.	
63.	S:	Lepas tu nak tunggu apa? (<i>after that what are we waiting for?</i>)	

64.	T:	⁵¹ Tengok tengok dia naik atau tidak (<i>Look if it rises or not</i>). Air dia (<i>its water</i>).	51 - To facilitate understanding
65.	SS:	(??)	
66.	T:	⁵² Tak payah tutup la, yang mana yang kalau dah terbuka tu (<i>Don't need to close it, whichever that is opened</i>) is gone. ⁵³ Mulut dia mulut dia (<i>its mouth its mouth</i>). Dia naik sikit atau banyak (<i>it rises a bit or a lot</i>).	52 - To facilitate understanding 53 - To emphasise
67.	S:	Must we tukar air (<i>change water</i>) every time we do?	
68.	T:	No. You only do twice, ah, one for oxygen one for.	
69.	S:	Cikgu after the oxygen must we tukar air atau guna sama air kan (<i>teacher after the oxygen, must we change water or use the same water right</i>).	
70.	T:	Ah ⁵⁴ guna air sama je (<i>just use the same water</i>), no worry. There, over there. Take from there. 100ml. Take you ⁵⁵ bikar (<i>beaker</i>), take your bikar (<i>beaker</i>) here and pour. Yes? Yes. OK. K, ⁵⁶ nanti buat yang lain (<i>later do a different one</i>), and then, ⁵⁷ bila kamu (<i>when you</i>), what you do is, ok, like this ⁵⁸ kan (<i>right</i>)? And then you open, open up, and then close and then ⁵⁹ tegakkan (<i>straighten it</i>), and then you see. And then you see whether the water gone up or rise of the, from the what ⁶⁰ naik daripada tube ni atau tidak (<i>rise from this tube or not</i>). K, and then, for that one, OK, this one dah (<i>already</i>) spoil ⁶¹ ni tak apa, letak tepi (<i>this doesn't matter, put it aside</i>). K, ah, that one, for that one because ⁶² kecil ya bikar tu (<i>the beaker is small</i>), what you do is, you open it first, ⁶³ cepat-cepat tutup tangan kamu (<i>quickly close it with you hand</i>), k and then ⁶⁴ agak-agak dah dekat dengan tu you masukkan dia (<i>roughly when it's near to it (you) insert it</i>). No fire. The sodium hydroxide. Not really, because it's very very diluted. Yes. It's not acid. That is ah, alkaline. (Teacher is walking around the lab and checking students' progress.)	54 - To facilitate understanding - To accommodate students' language needs 55 - To use content-related words 56 - To give instruction 57 - To get attention 58 - To seek confirmation 59 - To give instruction 60 - To facilitate understanding 61 - To facilitate understanding 62 - To facilitate understanding 63 - To give instruction 64 - To give instruction
71.	T:	((T demonstrating at one of the tables)) Yes? ⁶⁵ Itu, sekejap ye (<i>That, wait a while alright</i>). Ah wait, Lee, we don't need that, we only need the bunsen burner. OK, ⁶⁶ naik tak (<i>rise or not</i>)? OK, which one ⁶⁷ yang tak naik langsung (<i>that doesn't rise at all</i>)? It should be like one of it will ⁶⁸ naik (<i>rise</i>) slightly.	65 - Unknown 66 - To elicit response 67 - To elicit response 68 - To emphasise
72.	SS:	(??)	
73.	T:	⁶⁹ Nampak (<i>See</i>)? OK, OK. Tak apa. Tak kisah air dia kotor ke apa. This is from the tank, don't worry.	69 - To seek confirmation
74.	S:	(??)	
75.		No, we just need the bunsen burner. Ya. I don't say you take this one, I said take this one.	
76.	S:	(??)	
77.	T:	Ok good, very good. OK, that one, you take the sodium hydroxide from there, put 100ml inside. K ⁷⁰ dapat (<i>get</i>) result? ((T moves to another table.))	70 - To elicit response
78.	S:	(??)	
79.	T:	K you won't need the basin, now the basin what you do, you put all the test tubes that you have used. Har? ⁷¹ Dah	71 - To elicit response

		dah guna belum (<i>have you used it</i>)?	
80.	S:	(??)	
81.	T:	Ah ⁷² tak apa, buka je la, dah guna tak apa (<i>never mind, just open it, used already nevermind</i>). Ok, ⁷³ cepat-cepat (<i>quick</i>), use that one and then after that litmus paper over there.	72 - Unknown 73 - To emphasise
82.	SS:	(??)	
83.	T:	OK. OK. That's what you get.	
84.	S:	(??)	
85.	T:	Ah, that one the same thing. ⁷⁴ Sama juga, seperti dalam (<i>it's the same, just like</i>) procedure. ⁷⁵ Massukkan juga, terbalikkan, buka tu (<i>insert it as well, turn it upside down, open that</i>), and then ⁷⁶ terbalikkan masuk (<i>insert it upside down</i>). ⁷⁷ Ya, dia soluble atau tak soluble (<i>is it (soluble) or not (soluble)</i>)? K? Ah, ⁷⁸ sekejap ya (<i>wait a while alright</i>). So creative.	74 - To emphasise 75 - To give instruction 76 - To give instruction 77 - Linking word 78 - To give attention
86.	S:	(??)	
87.	T:	Why you put inside? My God. Look at the picture inside. ⁷⁹ Tengok gambar muka surat (<i>look at the picture page</i>), ay!! I ask you to do different thing you did different thing. That one ⁸⁰ tak guna (<i>no use</i>). K this one, ah, ⁸¹ keluarkan yang dah guna, buang air tu (<i>take out those that have been used, throw the water away</i>). OK, ok, basically ⁸² macam ni kan, buka cover dia , and then ⁸³ cepat-cepat tutup (<i>like this, open its (cover), (and then) quickly close it</i>). And then ⁸⁴ masukkan macam ni dan tolak je masuk (<i>insert like this and push in only</i>). OK? OK, ah, ⁸⁵ cepat (<i>quick</i>). Ah, ok. Yes. Ah, don't worry. It's diluted. Yes?	79 - To admonish - To give instruction - To emphasise 80 - To facilitate understanding 81 - To give instruction 82 - To detail demonstration 83 - To detail demonstration 84 - To detail demonstration 85 - To give instruction
88.	S:	(??)	
89.	T:	Yes, slightly. I don't know. No no no. ⁸⁶ Ini masa kami nak dapatkan tu (<i>this time we want to get that</i>), we used something that turn to purple. No this one been used la. Because they already put this one.	86 - To facilitate understanding
90.	SS:	(??)	
91.	T:	Eh, we have some more to go. Yes, slightly rise or no rises.	
92.	SS:	(??)	
93.	T:	No, yes, no. K. ⁸⁷ Ada naik tak (<i>rises or not</i>)? Err, no no, is it slightly rises or no, ⁸⁸ ataupun (<i>or</i>) goes off? Niza, ⁸⁹ buang air tu, yang mana yang guna (<i>throw that water away, whichever that's been used</i>) put inside.	87 - To elicit response 88 - Linking word 89 - To give instruction
94.	S:	(??)	
95.	T:	Yes. OK? ⁹⁰ Ada naik tak (<i>rise or not</i>)? The water slightly rise up or ⁹¹ tak ada langsung (<i>none at all</i>)? You cannot see? OK, try your best. What?	90 - To elicit response 91 - To elicit response

96.	SS:	(??)	
97.	T:	⁹² Macam ni (<i>like this</i>), ok, and then ⁹³ untuk cepat (<i>for quick</i>), ok, and then ⁹⁴ tolak cepat (<i>push quick</i>). Pegang (<i>hold</i>). Ah, tolong buang air ni (<i>please throw this water away</i>) and then put the test tube ⁹⁵ yang dah guna (<i>that's been used</i>), you put inside here. Yes?	92 - To detail demonstration 93 - To detail demonstration 94 - To detail demonstration - To give instruction 95 - To provide further information
98.	S:	(??)	
99.	T:	You haven't done it? Ah, just wait any group have been used. ⁹⁶ Kamu minta dari dia orang (<i>you request from other people</i>). Ya. Kamu group mana (<i>which (group) are you</i>)? Eh after you use, can you give to Natalie's group? Ah, finish this off.	96 - To give instruction
100.	S:	(??)	
101.	T:	⁹⁷ Ya, ada yang naik, ada yang tak (<i>Yes, some rise, some don't</i>). No, just give you the ⁹⁸ bikar (<i>beaker</i>). Har? OK, it's ok, just put your test tube inside, the one that's been used. No no no, what? Har? ⁹⁹ Keluar (<i>come out</i>)? You mean the water? But you have done the experiment? You put the test tube that's been used, ¹⁰⁰ yang kamu dah guna (<i>that you've used</i>) inside here.	97 - To facilitate understanding 98 - To use content-related word 99 - To seek confirmation 100 - To facilitate understanding
102.	SS:	(??)	
103.	T:	By right can la. So, what did you get? Oxygen? The yellow, or the red or the black? Ah yes, yes. Ah. Eh. No the black one. The black stopper is the carbon dioxide. ¹⁰¹ Yang hitam tu (<i>that black one is</i>) carbon dioxide. ¹⁰² Yang merah (<i>that red</i>), umm, oxygen.	101 - To emphasise 102 - To facilitate understanding
104.	SS:	(??)	
105.	T:	I don't know maybe she has missed up k. It's supposed not to be like that kan. OK, just just proceed. I just want to know what happen. Have you tried the other one? Ya. This one is? Ah, ok, ah the rest you can start with the litmus, we have a lot of. ¹⁰³ ah boleh buat ambil litmus tu (<i>ah can do take that (litmus)</i>). Ah, ok. Ah, OK OK class, sshhh, class! Now after the sodium hydroxide, I'd like you to do the indicator first. Because, sshh, because yes, I want to switch off the lights one shot. ¹⁰⁴ Sekali, sama-sama (<i>once, together</i>) when we use this wooden splinter. ¹⁰⁵ Saya tak nak yang ni tutup lampu, yang ni, yang ni tutup api (<i>I don't want switch off this light, this one, this one switch off</i>), ok, I don't want. Yes. Ok, now you do ok. Take. Ok. Ah.. you got litmus some more. ¹⁰⁶ Sikit je sikit (<i>a bit only, a bit</i>). Two drops je. Inside, inside the tube. Yes.	103 - To give instruction 104 - To emphasise 105 - To facilitate understanding 106 - To emphasise
106.	SS:	(??)	
107.	T:	I don't know. Red and blue. That one, who's is that? No, everybody takes blue. No put ¹⁰⁷ serentak (<i>at the same time</i>). One red and one blue. Why? Because the teacher so nice. Heeerrrr! You haven't got the blue colour'? After that the indicator you put back here ok? So that the rest can use. Eer..what, why you waiting for that? The rest can use this one ya. The litmus paper. K ¹⁰⁸ letak serentak ya (<i>put at the same time alright</i>). Eh wait, ¹⁰⁹ nanti kita buat serentak (<i>later we do together</i>). We switch off the light, eh light, the fan. OK. ¹¹⁰ Satu (<i>one</i>) for carbon	107 - To emphasise 108 - To give instruction 109 - To give instruction 110 - To facilitate understanding 111 - To emphasise

		dioxide satu (<i>one</i>) for oxygen, ¹¹¹ serentak (<i>together</i>). Serentak (<i>together</i>) with the red one. K put together. Dah? Have you taken this? ¹¹² Dah ambil (<i>have taken</i>)? K you put it together ok? ¹¹³ Satu (<i>one</i>) blue satu (<i>one</i>) red, together, ¹¹⁴ serentak (<i>together</i>). Jangan (<i>don't</i>)..ay, ¹¹⁵ dah ambil dah (<i>have taken already</i>). Dah (<i>already</i>)? Have you taken this paper? Ah, slightly rise or does not, no water inside or what the answer you want to put? Slightly or there's no water inside ah, ¹¹⁶ macam tu la. (<i>like that</i>) SS. Why? Wait wait, we do it together because I want to switch off the fan together.	112 - To elicit response 113 - To facilitate understanding 114 - To emphasise 115 - To seek confirmation 116 - To give confirmation
108.	S:	Teacher, this one correct ah teacher.	
109.	T:	You just do it first and then we discuss. Nadia. K ¹¹⁷ cepat-cepat (<i>quick quick</i>). After that, after you do the litmus paper, the bicarbonate indicator, after that do the lime water. Faster faster.	117 - To give instruction
110.	S:	Teacher soluble is ah the water can (?) or cannot?	
111.	T:	Go inside, inside go up is soluble. K do everything that we don't have, don't use the fire first ok? Ah? ¹¹⁸ Ambil tu (<i>take that</i>) lime water. From what colour?	118 - To give instruction
112.	S:	From dark blue.	
113.	T:	To? Red, ok. That one? ¹¹⁹ Tak tukar (<i>no change</i>)? Ah K, yellow and then still yellow. K ¹²⁰ betul (<i>that's right</i>).	119 - To elicit response 120 - To give confirmation
114.	SS:	(??) ((In Malay))	
115.	T:	¹²¹ Ni? (<i>this?</i>)	121 - To elicit response
116.	S:	Oxygen.	
117.	T:	Oxygen no change la. How to (?) Now I smell fishy fishy thing happened.	
118.	S:	(??) ((in Malay))	
119.	T:	No no I ¹²² takut yang sana kan yang tersalah tanda (<i>I'm afraid that it's marked wrongly</i>). No no no, it's ok it's ok. You take the lime water. ¹²³ Nanti kita betulkan dari segi teori (<i>later we correct it from the point of theory</i>).	122 - To facilitate understanding 123 - To give instruction
120.	S:	Cikgu (<i>teacher</i>).. (??)	
121.	T:	Fit everything in, really like squish everything. Eh why you put the indicator together with the..no, indicator different. And then after that you put..why don't you read the procedure? Eh don't play please, Ashwin. Eh put down.	
122.	S:	(??) ((in Malay))	
123.	T:	¹²⁴ Janganlah (<i>don't</i>) main. Eh, please do not play.	124 - To admonish
124.	S:	Teacher, sodium can pour or not?	
125.	T:	Inside where?	

126.	S:	Err, can pour away (?)	
127.	T:	Yes, can. OK are you done with the litmus paper?	
128.	S:	Teacher red colour is what?	
129.	T:	Err carbon dioxide.	
130.	S:	Teacher.	
131.	T:	Yes.	
132.	S:	(??) ((in English))	
133.	T:	OK, you just do it first ok? K, after that do the litmus paper. Ah ¹²⁵ buat cepat cepat cepat . (<i>do quick quick quick</i>) Ya put inside. (?) ¹²⁶ Merah merah (<i>red red</i>) and the blue together.	125 - To give instruction 126 - To emphasise
134.	S:	Then cover.	
135.	T:	Yes.	
136.	S:	Faster.	
137.	T:	Yes. Are you OK? And then don't forget to the...the bicarbonate indicator and lime water, yes. Ah do these first. ¹²⁷ Jangan mainlah (<i>don't play</i>) Ashwin. K.	127 - To admonish
138.	S:	Is it the correct colour or is it like some other colour?	
139.	T:	Something fishy, something happen, I don't know.	
140.	S:	(??)	
141.	T:	It should be, oxygen should be no changes and then carbon dioxide should be yellow or red. Ya, so I think ah, I don't know, ¹²⁸ dia tulis (<i>he wrote</i>) carbon dioxide ¹²⁹ kan (<i>right</i>)? I don't know, ¹³⁰ tak apalah (<i>never mind</i>).	128 - Unknown 129 - To seek confirmation 130 - Unknown
142.	S:	Carbon dioxide is because of water.	
143.	T:	Yes, I think the water inside. ((sound of glass being broken)) Ah! ¹³¹ Pecah (<i>broken</i>)! What are you doing?	131 - To admonish
144.	S:	No that thing fell.	
145.	T:	¹³² Kenapa kamu masuk balik (<i>why did you put it back</i>)? Mana yang you letak (<i>where did you put</i>)? Don't put back inside here. This is the gas.	132 - To admonish - To elicit response
146.	S:	No, I thought I thought that was like no wanna pecah (<i>break</i>) then it hit this thing.	
147.	T:	Aiyo, careful. Don't please, that's why I said do not play in lab.	
148.	S:	(??) ((in Malay))	
149.	T:	¹³³ Yang (<i>that</i>) oxygen? Ah try ¹³⁴ dengan (<i>with</i>) oxygen.	133 - Determiner 134 - Linking word

150.	S:	Teacher, see how wrong already.	
151.	T:	Ya, it's supposed not to be like this. This is no change. Ya.	
152.	S:	Teacher there's water inside.	
153.	T:	Ya, the water, there's some (?) ¹³⁵ biasalah, dalam makmal sekolah memang (<i>that's usual, in schools lab really</i>) (??) OK? ¹³⁶ Nanti kita (<i>later we</i>) discuss in the theory. Ya after that you go and ask them. ¹³⁷ Tak apa tak apa, buat dulu apa yang kamu dapat, nanti kita (<i>that's alright, dowhat you get first, later we</i>) discuss. I just scared that ah she wrongly label. OK? Because ¹³⁸ ini dia tulis (<i>this she wrote</i>) carbon dioxide with the black stopper, I just, I don't know what happen ok? Ah?	135 - To facilitate understanding 136 - To give instruction 137 - To give approval 138 - To facilitate understanding
154.	S:	Lepas siap (<i>after finish</i>)?	
155.	T:	Ah lime water. Who got the lime water? Lime water. Ah ¹³⁹ sana sana (<i>there there</i>). K, you just try whatever you can do and then after that we discuss theoretically, ok? Anisa, ¹⁴⁰ sampah ambil (<i>take the rubbish</i>).	139 - Determiner 140 - To give instruction
156.	S:	(??)	
157.	T:	Sorry? What he said just now?	
158.	S:	(??)	
159.	T:	No changes carbon dioxide, ok. Anisa! I ask you to take that (?) from Aina ya. Your dear best friend.	
160.	SS:	(??)	
161.	T:	OK now you do the lime water. ¹⁴¹ Janganlah buang dalam ni (<i>Don't throw in here</i>). Yes, ¹⁴² tapi dia kena kat bawah (<i>but it should be at the bottom</i>). Should be down there.	141 - To admonish 142 - To facilitate understanding
162.	S:	Tu kacau lagi la (<i>that is disturbing again</i>).	
163.	T:	You got your this experiment?	
164.	S:	Teacher what is it it's sort of smelly?	
165.	T:	What smell?	
166.	S:	Everything.	
167.	T:	I think the chemical they use. K ¹⁴³ cepat, dah guna (<i>quick, have you used</i>) lime water?	143 - To elicit response
168.	S:	Teacher why can't change?	
169.	T:	I don't know, I really can't answer it. Ah ¹⁴⁴ goncang-goncang (<i>shake</i>). No, when you ¹⁴⁵ goncang (<i>shake</i>), you close it like this. ¹⁴⁶ Jangan guna jeng jeng macam ni (<i>don't use 'jeng jeng' like this</i>). Apa yang dapat (<i>what you get</i>) cloudy or not. Which one. Ah ¹⁴⁷ warna dia keruh, keruh (<i>its colour is murky, murky</i>).	144 - To give instruction 145 - To detail demonstration 146 - To give instruction 147 - To emphasise
170.	S:	Ooo.	

171.	S:	Teacher is this suppose to change red?	
172.	T:	It should be yellow to red.	
173.	S:	Yes. It should be yellow to red.	
174.	SS:	(??)	
175.	T:	Carbon dioxide is red, this is what?	
176.	S:	Oxygen.	
177.	T:	Hah. K finish? OK ah everybody finish with the lime water? Finish? Ashwin, put the test tube inside the basin. Yes yes, you have to wash it. The one that you have used the indicator, ¹⁴⁸ semua kena basuh ya (<i>everything needs to be washed</i>). Yes. You have to wash the test tubes afterwards ok.	148 - To give instruction
178.	S:	(??)	
179.	T:	Lime water, there.	
180.	S:	Smells funny.	
181.	T:	No no no, this one. Ah. Over there. No no it's just the chemical they use to take, to get the oxygen. Wash your hand first. Ah it should be yellow to red. Ya? That's the last changes you have?	
182.	S:	Last changes?	
183.	T:	Ya, ¹⁴⁹ daripada (<i>from</i>) purple to yellow.	149 - Linking word
184.	S:	Yellow, ya.	
185.	T:	OK.	
186.	S:	Correct la.	
187.	T:	Ya, ah yes.	
188.	S:	Cikgu (<i>teacher</i>) it has to be the oxygen change colour ke (<i>or</i>) carbon dioxide?	
189.	T:	Carbon dioxide.	
190.	S:	So oxygen change colour?	
191.	T:	Your carbon dioxide?	
192.	S:	Ha?	
193.	T:	What happen to your carbon dioxide? I think we ¹⁵⁰ ter (<i>accidentally</i>)-switch the..Ya, I think she, ya. OK. Have you finished with the lime water? ¹⁵¹ Dah (<i>done</i>)? OK ah, ¹⁵² saya akan (<i>I will</i>), I will switch off the fan ok? So that we can do the glowing.	150 - Pre-fix 151 - To seek confirmation 152 - To get attention
194.	S:	Teacher lime water?	

195.	T:	Over there. Ya put inside the.	
196.	S:	(??) ((in Malay))	
197.	T:	Ah ¹⁵³ basahkan tapi sebab kamu punya tu kan dia dah dia bila (<i>make it wet but because your that thing has, when that</i>) you put inside the test tube ¹⁵⁴ tu dia dah (<i>that it has already</i>) moist kan, ¹⁵⁵ tapi you moist ¹⁵⁶ dululah tengok (<i>but (you moist) it first and see</i>), try, ¹⁵⁷ tadi dah try tak dapatkan (<i>just now already (try) don't get it right</i>)? K try moist pula. Ya, I think it's been switched la, I also don't know. It looks like acidic. This one no change. No! This one litmus different thing. Please read the procedure, hello, you got five of you, none of you can read the procedure? How you know cloudy? No, see cloudy means that you ¹⁵⁸ nampak macam keruh-keruh sikit (<i>see that it's a bit murky</i>). This is not cloudy.	153 - To give instruction 154 - To facilitate understanding 155 - To seek confirmation 156 - To give instruction 157 - To seek confirmation 158 - To facilitate understanding
198.	S:	Then it's still normal.	
199.	T:	Ya, what is this for?	
200.	S:	Carbon dioxide.	
201.	T:	My god, ok, try the oxygen. Karbi, give the lime water to Emily's group. ... Dah (<i>done</i>)? ¹⁵⁹ Banyaknya kamu letak (<i>you put a lot</i>)!	159 - To seek confirmation
202.	SS:	(??)	
203.	T:	((Teacher continues walking around class, amongst the group checking their experiments)) Where's your bunsen burner? We don't need the, little stand. The the that one. ¹⁶⁰ Dah (<i>done</i>)? The one that you have used, put inside here, or else somebody will broke it again. Where you put the water? Don't put inside that. The blue become, red. So I think this is carbon dioxide. ¹⁶¹ Dia tersalah label (<i>she accidentally labelled it wrongly</i>).	160 - To seek confirmation 161 - To facilitate understanding
204.	S:	Teacher the wooden thing ah need to light up?	
205.	T:	Ah yes. I want to light up now. If you finish you put here back. K. OK ahh, ok I will light up your bunsen burner now. Emily. Careful ya.	
206.	S:	But this one need to shake?	
207.	T:	Ya, shake.	
208.	S:	Yang satu ni glowing yang mana (<i>that one of this glowing which one</i>)?	
209.	T:	¹⁶² Dua-dua buat (<i>make both</i>) glowing, ¹⁶³ dua-dua serentak (<i>both together</i>). K? K careful, careful. Put away everything. ¹⁶⁴ Jangan buka dulu (<i>don't open first</i>) k? Wooi.	162 - To give instruction 163 - To give instruction 164 - To give instruction
210.	S:	(??) ((in Malay))	
211.	T:	¹⁶⁵ Banyak yang ambil (<i>taken a lot</i>). Careful with the fire. We don't need this. ¹⁶⁶ Tak ada (<i>there's no</i>) gas la.	165 - Unknown

		((teacher is trying to light up the bunsen burner)) ¹⁶⁷ Dia ada (<i>It has</i>) gas.	166 - To seek confirmation 167 - To emphasise
212.	S:	Teacher ni tutup (<i>close this</i>) (?)	
213.	T:	Ya, ¹⁶⁸ pandai (<i>clever</i>), yay, hou ye (<i>(This is Cantonese, which means clever)</i>). Where's the cover? No, that's not the cover. Ah means that ah, no I want to know whether it's glowing or not. Read the procedure please. Eh you ¹⁶⁹ dah pasang tutup (<i>already fix the switch</i>)? Ya. No when because, ¹⁷⁰ kalau api belum datang (<i>if the water isn't here</i>), I mean this thing is not ready, do not ¹⁷¹ buka, nanti kalau kamu tembak, dia punya gas semua dah ada kat sini, ada yang explode ok (<i>open, later if you shoot, its gas is already here, some may (explode) ok</i>)? So kalau kamu dah buka, and then off balik, and then ambil kain bagi dia gerak jauh jauh jauh jauh (<i>so if you have already on it, then off again, and then get the cloth to let it move far far far far</i>). Ah.	168 - To show approval 169 - To elicit response 170 - To facilitate understanding 171 - To facilitate understanding
214.	S:	Teacher nothing happening in here.	
215.	T:	Ah you try to moist it first. I will go to your place, ok.	
216.	S:	Teacher please can I do it?	
217.	T:	No.	
218.	S:	Teacher please I beg you.	
219.	T:	This is glowing ok now put inside, k ¹⁷² dia nyala tak (<i>it ignites or not</i>), aiyo. Oh my god! I'm scared? ((SS are heard speaking in Mandarin among themselves in the background.))	172 - To elicit response

Appendix J

Marina's lesson transcript

Turn No.	Role	Transcript
1.	SS:	Selamat sejahtera cikgu Mastura. (<i>good day teacher mastura.</i>)
2.	T:	K duduk. (<i>sit</i>)
3.	SS:	Terima kasih cikgu Mastura. (<i>thank you teacher Mastura.</i>) (11.5) ((screeching sound as students place their metal chairs on the floor))
4.	T:	K rekod sains (.) sila hantar. (<i>k science record (.) please submit</i>)
5.	S:	Apa cikgu? (<i>what is it teacher?</i>) (18.2) ((researcher trying to fix the microphone for teacher))
6.	T:	K rekod sains hantar. (<i>k science record submit.</i>) (27) ok, class, table five point two sudah ada? (<i>already had it?</i>)
7.	S1:	err (4) ada. (<i>have.</i>)
8.	T:	Dah siap? (<i>already done?</i>) Dah siap? (<i>already done?</i>)
9.	S1:	Dah. (<i>already.</i>)
10.	T:	OK. (14) Hmm? (??) jawapan dalam (<i>answer inside</i>)?
11.	S:	Ya. (<i>yes</i>)
12.	T:	Ya tu je nak (<i>yes that only needs to</i>) measure, the (?) pendulum, yesterday, k write the answer (.) for the (density) of the pendulum. ((long pause)) K back to rekod sains (<i>science record</i>). Dah (<i>already</i>) discuss?
13.	S:	Belum. (<i>not yet.</i>)
14.	T:	Habis bila nak (<i>or else when want to</i>) discuss?
15.	S	(??) All the ener-
16.	T:	Ok sepuluh minit, siapkan, hantar depan. Sepuluh minit! (<i>ok ten minutes, finish it, hand it in to the front. Ten minutes!</i>) (19)
17.	S:	If the mass of volume are mass and volume of the water (??) ((student reading aloud))
18.	T:	Yang mana (<i>which one</i>)? Bukan (<i>No</i>). Five point (.) two. (.) Ini bukan, ini nota (<i>this is not, this is note</i>).
19.	S:	Teacher this one
20.	T:	Sekarang ni, siapkan (<i>now, finish</i>) the record, sepuluh minit (<i>ten minutes</i>). (18) ((Students completing task in 10 minutes. Some students bring their work to the front to ask teacher.)) Masa apa sekarang? (<i>what is the time now?</i>)
21.	S:	Sekarang (<i>now</i>) (??)
22.	T:	K write the mass of the pendulum.

23.	S:	The mass of the pendulum?
24.	T:	Write the mass of the pendulum. Zero zero point berapa (<i>how many</i>) gram? (.) Yesterday you do.
25.	S:	(??)
26.	T:	Sebab itulah semalam saya kata (<i>that's why yesterday I said</i>) write the answer, faster! The mass of pendulum, the mass of stone.
27.	S:	Mass of stone, ten gram.
28.	T:	Dah? (<i>Done?</i>) Initial, final. (18) K ini saya sudah hantar (<i>this I have submitted</i>). Edina, cepat Edina hantar (<i>Edina quickly submit</i>). (28) K lagi dua minit (<i>K two more minutes</i>). Desmond, Desmond, Desmond focus!
29.	S:	I finished already.
30.	T:	Submit. (.)
31.	S:	Cikgu yang ini rekod ke - (<i>teacher is this record or -</i>)
32.	T:	Ini nota, rekod semalam hantar dulu. (<i>this is note, submit yesterday's record first</i>) Ashrin, rekod hantar dulu. (<i>Ashrin submit record first.</i>) K Dalam, Jerich sit down. (.) ok, ready? Ready? K. We go to the (.) next, what page? Page three or page four?
33.	S:	Three.
34.	T:	OK. Turn to page three. The paper given. K. Test for oxygen and carbon dioxide. Number one, the oxygen. K we test the oxygen (.) to? glowing?
35.	SS:	Glowing splint-
36.	T:	Splint become? Ah, become burn brighter. OK, number two. K, fill the, fill the blank. Alright. (.) Aaron, mana (<i>where</i>)?
37.	S:	Dia balik. (<i>he went back</i>)
38.	T:	Jerich! tolong (<i>help</i>). OK, the blank, supports, k. This is because oxygen is the only gas that supports?
39.	SS:	Combustion.
40.	T:	Alright. K next.
41.	S:	Cikgu saya nak pergi ambil kertas tu (<i>Teacher I want to go get the paper</i>) (??)
42.	T:	Haih, tu lah (<i>that's why</i>), next time saya kata dapat je paper terus (<i>I say get the paper straight away</i>) paste, macam ni la punya (<i>like this + possessive word</i>) case. K, carbon dioxide. K, we test carbon dioxide, we use the lime?
43.	SS:	Water.
44.	T:	Water. K what happen the lime water?
45.	SS:	Cloudy.
46.	T:	Become cloudy, ok, write the answer, cloudy. Efan! Efan! Kenapa kamu duduk di tempat Azizi? (<i>why do you sit at Azizi's place?</i>) <i>hmm?</i> Ashwin! Alright. K, five point three, k the oxygen is needed in? Respiration. Ada tak? (<i>have it or not?</i>) K what is the respiration? K the respiration is the process of? Oxidising. (.) K, oxidising. Digested food in the cell of the body to produce?
47.	SS:	Energy.

48.	T:	K number one, produce?
49.	SS:	Energy.
50.	T:	Munish? Number one? produce?
51.	S:	Energy.
52.	T:	OK. Energy, carbon dioxide and water. Sorry. Water vapour. Mana mungkin kita (<i>how is it possible that we</i>) breathe in guna (<i>using</i>) water? Ada (<i>there is</i>) product water. (.) K, water. K number three, k list the product of respiration, number one, [energy], number two carbon dioxide and water vapour.
53.	S:	[carbon dioxide]
54.	T:	K, (this is) refer number three. OK, now, move to number four. Hasrin, Hasrin dah tak sabar nak jawab soalan (<i>can't wait to answer the question</i>). OK, number four Hasrin.
55.	S:	(??)
56.	T:	K glucose and what type of gas?
57.	S:	Water vapour.
58.	T:	Water vapour is a gas?
59.	S:	Eh ah, oxygen.
60.	T:	Ah, right, good, glucose and oxygen, can form?
61.	S:	Energy.
62.	T:	OK, good. K this is number four.
63.	S:	Cikgu (<i>teacher</i>).
64.	T:	Ya?
65.	S:	(??)
66.	T:	Oh. (...) Sekolah lama sampai tajuk err (<i>Previous school reached title err</i>) chapter apa (<i>what</i>)?
67.	S:	(?) dengan (<i>and</i>) (?)
68.	T:	Eh, (around this). You ambil (<i>take</i>) lah, start from beginning five point one. Berapa paper you tak dapat (<i>how many paper you didn't get</i>)?
69.	S1:	tiga. (<i>three</i>)
70.	S2:	dua. (<i>two</i>)
71.	T:	Siapa lagi yang tak ada (<i>who else don't have</i>) paper?
72.	S:	saya saya (<i>me me</i>).
73.	T:	Kenapa ramai sangat yang tak ada (<i>why so many don't have</i>)? ((teacher giving out worksheets to students)) eh number two (?) number two. Ini ada? (<i>have this one?</i>)

74.	S1:	Ada. (<i>have</i>)
75.	T:	Yang ini? (<i>this one?</i>)
76.	S2:	Yang ini belum ada. (<i>haven't had this one</i>)
77.	S3:	Cikgu boleh saya minum air? (<i>teacher may I drink water?</i>)
78.	T:	Ni (<i>this</i>) number three?
79.	S1:	Ni, tak ada (<i>this, don't have</i>). ni (<i>this</i>) this one ada (<i>have</i>).
80.	T:	Ha? Apa lagi? (<i>what else</i>) You datang mahu apa? (<i>You come want what?</i>)
81.	S3:	Cikgu boleh saya minum air? (<i>teacher may I drink water?</i>)
82.	T:	Boleh (<i>can</i>). Ah Irfan ok, Irfan, this is a human, the cellular respiration. OK. The first gas (.) when we inhale, what type of gas, Irfan? Oxygen, and? Oxygen and?
83.	S:	Water vapour
84.	T:	Oxygen
85.	S:	Glucose
86.	T:	Ok, the product, glucose? The product, product.
87.	S:	Cellular respiration.
88.	T:	Memang lah semua sekali tu kita punya cell akan (<i>That's right all our cell will</i>) do the respiration process. Kan? (<i>Right?</i>) Bukannya yang kamu nampak melalui hidung, mulut (<i>Not those that you can see through nose, mouth</i>), lung! K semua (<i>all</i>) cell do the respiration process. OK. When they do the respiration process, the glucose and oxygen, ok, can perform, apa dia (<i>what</i>)? Carbon dioxide.
89.	S:	Water vapour!
90.	T:	Kelas, saya terang tadi ya, empat kali lima ratus kali, dia sibuk dengan buku rekod. (<i>Class, I explained just now, four times five hundred times, he was busy with the record book.</i>) ((student's name))
91.	S:	(??)
92.	T:	tak dengar (<i>can't hear</i>)
93.	S:	(??)
94.	T:	Lagi (<i>more</i>)?
95.	S:	(??)
96.	T:	Lagi (<i>more</i>)? Berapa (<i>how many</i>)? Tiga (<i>three</i>), energy, carbon dioxide and? Water vapour. K. Sambung (<i>continue</i>). K number six, seven (.) and eight. OK. Kita tengok (<i>we look</i>) one by one. Respiration in human, respiration in animals. K number one, human respiration organ (.) K human we use the what type of organ?
97.	S:	LUNGS!
98.	T:	OK, lung for the respiration process. OK, frog?

99.	S:	(?)
100.	T:	Edina! (.) Nak buat apa kat belakang tu? (<i>what do you want to do at the back?</i>) (.) Christina, Shakira. Kerja kat rumah, buat kat kelas (<i>work at home, do at class</i>). K, frog, what type of organ involves in respiration in frog?
101.	SS:	moist skin.
102.	T:	K, the skin and? the?
103.	S:	[lung]
104.	T:	[lung]. K, in plant? K anybody want to share? What's the organ involved?
105.	S:	photosynthesis.
106.	T:	Photosynthesis actually is the process.
107.	S1:	Makanan. (<i>food</i>)
108.	S2:	sunlight lah.
109.	S1:	eh sunlight!
110.	S3:	Sunlight.
111.	T:	Organ involved in the respiration, organ. Hashwin, answer question based on the question. OK, the? Stomata! Stomata at the leaf and the lenticels at the stem. Ah, semua sekali (<i>all together</i>). OK, number eight, during breathing, they are inhale and exhale air. OK now, do one by one. In inhale. k, inhale air is air breathe into the lungs. Exhale air is air breathe out of the lungs. OK, tahu tak apa maksud (<i>do you know the meaning of</i>) inhale and exhale?
112.	SS:	Tahu. (<i>know.</i>)
113.	T:	Inhale, udara masuk (<i>air goes in</i>). Exhale, udara hembusan (<i>exhaled air</i>). Farah? Tahu (<i>know</i>) inhale, exhale? K tempat kosong, tulis jawapan , (<i>blank space, write the answer,</i>) into. K, number two, out. K number three, the exchange of gases takes place in the lung when air is breathed in, oxygen is? ab? sorbed. Why oxygen must absorb?
114.	S:	because (??) air.
115.	T:	Because the oxygen and glucose, ah, to produce the energy yang kamu nak buat bising ni, datang dari mana? (<i>that you make so much noise, where does it come from?</i>)
116.	SS:	Air.
117.	T:	Har? Dari (<i>from</i>) air?
118.	S1:	Oxygen.
119.	S2:	Glucose.
120.	T:	K the oxygen is absorbed and carbon dioxide and water vapour are released by the lungs. K as a result, exhaled air contains? Less oxygen, more carbon dioxide and more water vapour. The exhale air also warm than inhale air. The composition, ok. We stop. OK, this is the pathway, laluan, laluan udara semasa kamu (<i>pathway, pathway for air when you</i>) inhale and exhale. K, number one. Iffan, Mukri.

		Nose. Siapa yang ada banyak sangat (<i>who has a lot of</i>) mucus dekat dia punya (<i>near his</i>) nose, tak boleh nak (<i>cannot</i>) breathing, buka mulut besar-besar (<i>open the mouth big</i>), ha ha ha. Ah, guna ni (<i>use this</i>), sama juga, sebab apa (<i>it's the same, why</i>)? Dia ada (<i>it has</i>) link. Sama juga (<i>it's the same</i>) () Ah, bila kamu lari (<i>when you run</i>) hundred meter, kan, macam mana (<i>right, how</i>)? Tak boleh awak guna (<i>you can't use</i>) nose, kena guna (<i>have to use</i>)..ah, juga (<i>also</i>). Alright, lepas tu, udara masuk terus ke (<i>after that, air goes straight into</i>) trachea. Trachea ni panjang (<i>this is long</i>). Ini sama je, kamu makan guna sini, kamu breathing pun guna sini (<i>It's the same, you use here to eat, use it to breath also</i>).
121.	S:	Teacher, which part of trachea? Hmm?
122.	T:	Which part?
123.	SS:	(??)
124.	T:	OK. Sebab itu bila kamu cakap (<i>that's why when you talk</i>), eh, Derige, bila kamu bercakap, boleh tak bernafas (<i>when you talk, can you breathe</i>)?
125.	SS:	[tak] (<i>cannot</i>) boleh (<i>can</i>) ((some students say can't, some say can)
126.	T:	Boleh tak (<i>can or not</i>)? Ataupun bila kamu makan, same time boleh tak kamu breathing (<i>Or when you eat, can you breathe at the same time</i>).
127.	SS:	Boleh (<i>can</i>).
128.	T:	Ah, masa telan tu, boleh tak nak breathing (<i>when you swallow, can you breathe</i>)? Tak boleh, sebab apa (<i>cannot, why</i>)? Ah dekat sini dia ada satu saluran yang sama (<i>Ah near here there is a saem pathway</i>). Ni ada (<i>it has</i>) glottis, bila kamu cakap, bila kamu nak makan, glottis nak atas baru makanan jatuh bawah (<i>when you talk, when you want to eat, glottis will be raised and then the food will drop</i>). Satu masa nak cakap nak makan nak breathing, batuk semua keluar (<i>Want to talk and eat and breathe at the same time, cough and everything comes out</i>). OK. Continue. K ini bron? K ada dua cabang di sini (<i>there are two branches here</i>), bron? Brochures. Lepas itu pergi kat (<i>after that it leads to</i>) bronchioles then finally dekat mana ni (<i>near where</i>), kecil-kecil ni (<i>these small ones</i>), sekarang ni saya cerita paru-paru la (<i>I'm talking about the lungs</i>). Ah, sekarang saya cerita last sekali, final pergi dekat (<i>now I'm telling the last time, the final is near</i>) al? veo?
129.	S:	Alveoli.
130.	T:	Ah kat sini (<i>at here</i>) we exchange the gas. The oxygen absorb and carbon dioxide release. (.) Sangat cepat (<i>very quick</i>). K ni udara masuk, ini sama juga, keluar (<i>the air come in, at the same time, goes out</i>). (.) OK next, the composition of the inhale and exhale air. K copy the inhale and exhale air. K oxygen and the environment twenty one percent when you inhale, when you exhale, you release the oxygen less, around sixteen percent. K carbon dioxide when you inhale zero point zero three percent, when you exhale, four percent. K water vapour, less and more. K nitrogen tak ada (<i>doesn't have</i>) effect, same, seventy eight percent. (...) K ada soalan (<i>any question</i>)? Ada soalan? (<i>any question?</i>) Ah, hari-hari kamu bernafas daripada kecil (<i>everyday you breathe since young</i>).
131.	S1:	How do we learn to breathe?
132.	T:	Ah sekarang ni baru tau apa tujuan bernafas (<i>Until now only know what's the reason for breathing</i>).

133.	S1:	How do we learn to breathe?
134.	T:	Hari pertama (<i>the first day</i>)
135.	S2:	How do we learn to breathe?
136.	T:	Tanya la ibu kamu (<i>ask your mother</i>).
137.	SS:	(??)
138.	T:	Yala (<i>yes</i>). Sebab itu la bila kamu lahir, doktor bagi kamu nak menangis, pasal bila kamu menangis, kamu belajar, belajar (<i>because when you were born, doctor made you cry, because when you cry, you learn..learn to</i>) breathing.
139.	SS:	((students making the crying sound))
140.	T:	OK, copy.
141.	S:	Copy?
142.	T:	Copy.
143.	S:	The chicken comes first or the egg comes first?
144.	T:	Ok, everybody copy, ini tak ada (<i>this doesn't have</i>) paper.
145.	SS:	((students sigh))
146.	T:	K copy, copy the subtitle four point four, oxygen is needed for combustion. OK picture ignore. Just copy the subtopic. K write in index also. (.) Jerich ni tak (<i>this doesn't</i>) settle lagi (<i>yet</i>) problem, apa masalah (<i>what's the problem</i>) Jerich?
147.	S:	(??)
148.	T:	Saya rasa kamu datang lewat saya tak start lagi sekarang ni (<i>I thought you came late so I haven't started</i>).
149.	S:	Har?
150.	T:	Kamu datang lewat tadi semua orang buat rekod sains (<i>you came late just now everyone was doing science record</i>). (10)
151.	S:	Cikgu, buku salah (<i>teacher, wrong book</i>) (.)
152.	S:	Teacher.
153.	SS:	(??)
154.	T:	Jerich, follow saya punya kat depan (<i>mine at the front</i>). Tulis. (.) Pulang balik paper saya (<i>Write. Return my paper</i>).
155.	S:	Har?
156.	T:	Pulang balik paper saya (<i>return my paper</i>). (.) Ni, kan sudah ada (<i>this, already had</i>).
157.	S:	Lupa. (<i>forgot</i>)
158.	T:	Ni tadi, ini (<i>this just now, this</i>). Sekarang tulis sini (<i>Now write this</i>) four point four. (10) Baik ada seorang saja (<i>It's good that there's only one</i>) Jerich, kalau ada sepuluh (<i>if there are ten</i>).
159.	S:	Cikgu (<i>teacher</i>) resign from the job.
160.	T:	OK, copy everything.

161.	S:	What? Copy everything?
162.	T:	Rekod dah siap ke (<i>Finished the record</i>)? Rekod dah siap (<i>finished the record</i>)?
163.	SS:	(??)
164.	T:	Ini (<i>this</i>)? The density of (.) ini masuk (<i>this put in</i>) density, quantity of? kan nota ada semua (<i>the note has everything</i>). Dah letak sana (<i>already put there</i>). (.) Jerich! (.) Jerich ni tak boleh duduk atas kerusi la, dia duduk bawah aje bagus (<i>can't sit on the chair, it'll be good if he sits at the bottom</i>). [00:27:42] [00:30:09] ((no talking for about 3 minutes, teacher was looking into the computer and book while giving students time to copy notes)) Munish? Finish? (42)
165.	S:	Cikgu (<i>teacher</i>), hydrocarbon ah?
166.	T:	Hydrocarbon, (?) warna hitam tu, bila kamu bakar, ada (<i>the black colour, when you burn, it has</i>) combustion, it give the colour, black colour, betul tak (<i>right</i>)? Ah you ambil (<i>take</i>) paper, you bakar, ada tak bagi warna hitam (<i>burn, does it give black colour</i>)? Black colour. Itulah (<i>that is</i>) hydrocarbon. (22) Banyak (<i>very</i>) busy-body la Ashwin.
167.	S:	Kawan saya (<i>my friend</i>).
168.	T:	Saya tahu, kawan, tapi ini kan masa sains (<i>I know, friend, but it's science lesson now</i>). (.) Sekarang masa apa (<i>what's the time now</i>) Wushen? ((students submitting work, teacher checking them)).
169.	S:	(??)
170.	T:	K Ashwin, please read point number one.
171.	S:	Combustion is the chemical reaction (??)
172.	T:	OK. Thank you Ashwin. Ah, ok, clear? The products of the combustion and (oxide) heat energy, how you know this is heat energy?
173.	S:	(power)
174.	S:	(sand)
175.	T:	Ah bila kamu datang dekat akan rasa (<i>when you come near you'll feel</i>) hot, k, itulah (<i>that is</i>) heat energy. Light energy?
176.	SS:	(?)
177.	T:	Ok, ok. Soalan seterusnya (<i>the next question</i>), heat energy and light energy adakah dia ini (<i>are they</i>) metal?
178.	S:	yes.
179.	S:	no.
180.	SS:	NO!
181.	T:	Adakah (<i>are</i>) heat energy and light energy metal?
182.	S:	No.
183.	S:	light is no heat (?)
184.	T:	K back to chapter three metal. Metal that has mass and occupies space. K la, heat energy has mass?
185.	SS:	SS: no.

186.	T:	T: OK, no. Light energy has mass?
187.	SS:	SS: No.
188.	T:	T: No. OK, of course the heat energy and light energy consider no?
189.	SS:	SS: [metal]
190.	T:	T: [metal]. Itu pun macam mana you nak relate (<i>that is how you should relate</i>). Itu pun tak dapat nak (<i>even that also you can't</i>) relate. K point number two, Farah. Point number two. Point number two.
191.	S:	((student reads))
192.	T:	Loudly (.) loudly.
193.	S:	((student reads in English))
194.	T:	OK, thank you. K, jika nak buat pembakaran, mesti ada bahan (<i>If wants combustion to take place, must have resource</i>). K bahan tu sama ada (<i>the resource is same as</i>) carbon, tak ada (<i>no</i>) carbon, petroleum, tak ada (<i>no</i>) petroleum?
195.	S:	hydrocarbon.
196.	T:	Ah itu semua adalah jenis-jenis (<i>all these are types of</i>) hydrocarbon. Petroleum, diesel, apa lagi (<i>what else</i>)?
197.	S:	(??)
198.	T:	Ah, itulah (<i>that is</i>) hydrocarbon. K last sekali (<i>ultimate</i>), combustion will not take place if any of this condition is not present. OK. Continue. OK now, list the products of combustion. K number one. An oxidise. Number two heat energy, number three light energy. K please write the equation.
199.	S:	oxide?
200.	T:	Oxide? Carbon dioxide? Anoksida (<i>anoxide</i>). Oxide. Carbon dioxide, bila dia, bila kita gunakan (<i>when it, when we use</i>) carbon, kertas ni (<i>this paper</i>) carbon dioxide.
201.	S:	Cikgu ni apa? (<i>teacher this is what</i>)
202.	T:	rekod. (<i>record</i>)
203.	S:	apa? (<i>what</i>)
204.	T:	kenapa? (<i>why</i>)
205.	S:	Tanya je (<i>just asking</i>)
206.	T:	Recorder.
207.	S:	Untuk apa (<i>what for</i>)?
208.	T:	Untuk nak tau berapa banyak saya sebut nama Ashwin, berapa banyak saya sebut Jerich (<i>to find out how many times I mention Ashwin's name, how many times I mention Jerich</i>).
209.	S:	(??)
210.	T:	Nama-nama pelajar yang bermasalah, berapa kali saya sebut (<i>the names of those students with problems, how many times I mention</i>).

		(??) OK, write the equation. Example one, combustion of carbon. ((no talking for about 2 minutes, allowing time for students to complete work)). Jerich (.) Jerich! sebelum keluar saya nak tengok buku nota (<i>before going out I want to see notebook</i>). (.) Sebelum (<i>before</i>). Pergi paste dulu semua chapter five proper (<i>go paste all the chapter five properly first</i>). K, sudah (<i>done</i>)? Ziwei sudah (<i>done</i>)?
211.	S:	Dah. (<i>done</i>)
212.	T:	K example number two. When the combustion of hydrocarbon. Hydrocarbon and oxygen, combine produce (.) heat, light, carbon dioxide and water. K heat and light considered energy. Ah carbon dioxide consider oxide, ah sorry. (.) Hydrocarbon tu apa-apa (<i>anything</i>) la, petroleum ke, diesel ke. Sebab ada (<i>because there is</i>) carbon, hydrocarbon. Hydro in science, some are, fluid or liquid, hydro. Ah, photo, light. Ah, related to the kalau (<i>if</i>) photo je ada kaitan dengan cahaya (<i>it is related to light</i>). Kalau hydro je ada kaitan dengan (<i>if..it relates to</i>) water, or liquid. Hydroelectric, ah jana elektrik daripada air (<i>generate electric from water</i>). Photosynthesis, ah guna photo mesti ada kaitan dengan cahaya (<i>use photo must have relation to the light</i>).
213.	S:	(??)
214.	T:	Mana ada (<i>where has</i>) photo?
215.	S:	Teacher why (??)
216.	T:	Ah itu banyak sana (.) banyak dosa, sebab itulah sana panas. (<i>there are a lot of sin, that's why it's hot there</i>) Darren, ah relax Darren. Nak jawab soalan lepas ni (<i>want to answer question after this</i>). Tak payah, saya tahu la kamu (<i>don't need, I know you are</i>) excited. K ready? K, Darren, question for you. OK Darren, ah stay. (.) Imran pun, tak, tak boleh ah tak jawab soalan, dia pun angkat tangan (<i>no, cannot not answer question, he also puts up his hand</i>). OK Darren? What is this?
217.	SS:	(??)
218.	T:	OK, ini apa (<i>what is this</i>)? Combustion. Dalam combustion mesti ada apa (<i>in combustion must have what</i>)?
219.	SS:	(??)
220.	T:	Start F, start from F.
221.	SS:	Foto! (<i>photo</i>) Feul! ((Some say photo some say fuel))
222.	T:	Foto?
223.	SS:	Feul.
224.	T:	F?
225.	S:	FEUL!
226.	T:	yes. Repeat Darren. Fuels. OK what is this?
227.	S:	Heat!
228.	T:	Heat?
229.	S:	Api. (<i>fire</i>)

230.	S:	Energy.
231.	S:	Oxygen.
232.	T:	OK. Actually, this is the gas.
233.	S:	What gas?
234.	T:	What type of gas?
235.	SS:	Carbon dioxide! Oxygen! ((some say carbon dioxide, some say oxygen))
236.	T:	Oxygen! Ah. K ini?
237.	S:	Heat.
238.	T:	OK, heat energy, good. K boleh jawab soalan (<i>can answer question</i>). Ah Keeshaw dah angkat tangan (<i>has put up his hand</i>). OK good Keeshaw, number one, what is combustion?
239.	SS:	(??)
240.	T:	Keeshaw?
241.	S:	Combustion is a chemical reaction (??) ((student reads from book))
242.	T:	Ah sama (<i>same</i>) la Keeshaw, hundred percent! Complete answer. OK. Mukri, what factors are necessary for combustion to take place?
243.	S:	Err, err, fuel, oxygen (?)
244.	T:	OK. Ubah lain sikit je (<i>change a bit from other</i>). OK, good, last, what are the products of burning (coconut oil) in air? (coconut oil) actually the type of the hydro?
245.	S:	gen!
246.	T:	Hydro?
247.	S:	gen!
248.	SS:	Hydrocarbon.
249.	T:	Eh, hydrocarbon, so? (.) K, habis (<i>finish</i>)!
250.	S:	Jerebu (<i>haze</i>)!
251.	T:	Ya sekarang di Cheras, di kawasan Cheras, jerebu sudah berapa (<i>Right now in Cheras, in the area of Cheras, how much is the haze</i>)?
252.	SS:	(??)
253.	T:	OK. Mana yang kamu suka (<i>which one do you like</i>)? Picture A or picture B?
254.	SS:	B! A! ((some say B some say A))
255.	T:	Ah, sebelum (<i>before</i>) call saya nak tengok (<i>I want to see</i>) rota. Eh buku itu (<i>the book</i>)? Mana (<i>where's the</i>) paper?
256.	S:	(??)
257.	T:	Tak boleh bagi (<i>cannot give</i>)? Mesti ada (<i>must have</i>) point kan?
258.	S:	dapat, tapi nanti tak dapat point enam enam enam. (<i>got, but later can't get six six six points</i>)

259.	T:	Tak payah (<i>don't need</i>) lah (??) Point enam (<i>six</i>) seven cukup (<i>is enough</i>) la. K next. Last chapter, last subtopic chapter five. Five point five. OK. Jadi tak lama lagi, kena hantar buku (<i>not long after this, have to submit book</i>).
260.	SS:	((sigh))
261.	T:	Ah, bukan ada yang tak letak lagi paper saya (<i>not that there are some who haven't put my paper</i>). Ada yang tak buat apa-apa lagi, ah tolong cepat (<i>There are some who haven't done anything yet, please be quick</i>).
262.	SS:	((??))
263.	T:	Apa (<i>what</i>)? Ini (<i>this is</i>) last chapter. Saya tak kiralah tak bawa, habis saya ajar (<i>I don't care if you didn't bring, as soon as I finish teaching</i>) five point five, saya nak (<i>I want to</i>) collect. Habis (<i>finish</i>). Yala, habis (<i>finish</i>) chapter five point five ini. Esok (<i>tomorrow</i>) la. (20) Imran, saya belum soal lagi dah bangun (<i>I haven't asked and you stood up already</i>).
264.	S:	(??)
265.	S:	Cikgu, kalau nak jawab soalan angkat tangan. (<i>teacher, if wants to answer question needs to put up hand</i>)
266.	T:	K last ialah Mukri lah. Mukri, ok saya belum soal lagi kamu dah bangun (<i>I haven't asked and you stood up already</i>). OK. Apakah yang menyebabkan apa ni, jerebu (<i>what is the cause of what's this, haze</i>), haze?
267.	S:	Open burning.
268.	T:	K, number one open burning, apa lagi (<i>what else</i>)?
269.	S:	Indonesia.
270.	T:	Open burning lah tu. K so.
271.	S:	Deforestation.
272.	T:	K last subtopic, air pollution. What is air pollution? K the air pollution actually unclean air. Unclean air around us is commonly known as the air pollution. Ah, jangan hisap rokok (<i>don't smoke cigarette</i>).
273.	SS:	((students calling each others' names))
274.	T:	K there is the air pollution when substances that are harmful, ok. K number three, the use of motor, (nature) forest fire, open burning of rubbish and industrial activities produce pollution such as? OK next, number three, write dust, smoke and (soot). K habis (<i>finish</i>). Dah (<i>done</i>). OK. Kita pergi (<i>we go to</i>) table number one, the factor of the air pollution, sources and the effect. Number one dust. K dust can cause, apa (<i>what</i>)?
275.	S:	coughing.
276.	T:	Ah, batuk, lagi (<i>cough, some more</i>)? Asthma. K ni, paling bahaya ni (<i>this is the most dangerous</i>), lung? cancer. OK.
277.	S:	((student heard speaking in Cantonese - don't smoke))
278.	T:	K number two, smoke and (soot). ah, yang ni la tadi, sekarang ni dah tukar, tak nak guna, guna rokok elektronik, betulkan? Sama saja. (<i>ah, this is the same as just now, now it's changed, don't want to use cigarette, use electronic cigarette, right? It's the same.</i>) (46) Next, carbon dioxide and carbon monoxide. Farah, berapa lama dah rabun (<i>how long have you been shortsighted</i>)?

279.	S:	Apa tu? (<i>what is it?</i>)
280.	T:	Rabun (<i>shortsighted</i>). Kenapa tak pakai (<i>why you don't wear</i>) spec?
281.	S:	Saya dah beli tapi tak (<i>I've bought it but it's not</i>).
282.	T:	Tapi tak cantik, mengapa kira cantik tak cantik (<i>but not pretty, why bother if it's pretty or not</i>)?
283.	S:	bukan dia dah hilang (<i>no it's lost</i>)
284.	T:	Macam mana spec boleh hilang (<i>how can you lose your specs</i>)? Besar yang di depan mata tu (<i>it's something big in front of your eyes</i>). Kalau contact lens ok juga nak hilang (<i>if contact lens it's ok to lose it</i>).
285.	S:	Saya tak tahu. (<i>I don't know</i>). ((no talking for about 1 minute, teacher going around checking students' work))
286.	T:	Faham tak (<i>understand or not</i>) Imran? Nota semua dah (<i>all the notes are</i>) proper?
287.	S:	Dah (<i>done</i>).
288.	T:	Bila satu masa (<i>When is one period</i>)?
289.	S:	(??)
290.	T:	Hari Khamis saya bagi latihan (<i>Thursday I give exercise</i>). (30) K exercise B, bolehlah hantar (<i>can submit</i>). Siapa yang belum hantar (<i>who else haven't submitted</i>)? Takkan nak kena sebut nama pula baru nak hantar (<i>Don't let me call your name then only you want to submit</i>). Desmond, berapa lama nak cari (<i>how long do you want to look for</i>) exercise A?
291.	SS:	(??)
292.	S:	((asks in Malay))
293.	T:	Memanglah kena (<i>of course have to</i>).
294.	S:	Nak hantar dulu ke? (<i>need to submit first?</i>)
295.	T:	Nak hantar dulu nanti saya (<i>submit first later I</i>) return double. Desmond? Dah hantar (<i>submitted</i>)? Jerich? Dah hantar (<i>submitted</i>)? Farah? Rekod sains (<i>science record</i>)? Rekod sains (<i>science record</i>). (.) Lapan belas (<i>eighteen</i>). K ada soalan (<i>any questions</i>)? Ada soalan (<i>any question</i>)? Tak ada soalan (<i>don't have question</i>)?
296.	S:	Teacher, what's carbon monoxide?
297.	T:	Monoxide, carbon monoxide, kenderaan, asap kenderaan itu (<i>transportation, the smoke from transportation that's</i>) monoxide. (.) K time's up. Boleh kemas (<i>can pack things</i>). K continue on Thursday. Sembilan belas, dua puluh (<i>nineteen, twenty</i>). Lagi enam buku rekod (<i>another six record book</i>). ((Teacher takes down the mic and students say thank you to teacher.))

Appendix K

Shahrul's lesson transcript

Lesson on 24/7/2013 (26 minutes into the lesson, about 34 minutes transcribed in the following)

Turn No.	Role	Transcript
1.	T:	OK, class, you have learnt in chapter 4 that air is one of the resources on earth. K, udara merupakan salah satu sumber in permukaan bumi yang penting kepada kita la. (<i>Okay, air is one of the most important resources on earth to us.</i>) It is needed to sustain life, diperlukan untuk meneruskan kehidupan kita (<i>it is necessary for us to carry on living</i>), and then air is all around us. Sekarang ni, awak duduk dalam makmal ni, ada udara ke tidak? (<i>Now, you're sitting in this laboratory, has air or not?</i>)
2.	SS:	Ada! (<i>have</i>)
3.	T:	Ah siapa kata tak ada udara? SieLee? Ada udara ke tidak? (<i>Ah, who said there is no air? SieLee? Has air or not?</i>)
4.	S:	Ada. (<i>has</i>)
5.	T:	Ah kalau tak ada itu, maksudnya awak tak dapat nak bernafas. Ataupun menjalankan proses semula jadi awak. (<i>Ah, if no, that means you're unable to breath. Or you're carrying out your natural process.</i>) K, dah, dah bersedia ya? Dah tulis tajuk semua? (<i>Okay, are all of you ready? Have you written your title?</i>) OK, kelas, kita teruskan kepada yang pertama sekali sebelum tu kita lihat dulu five point one ya. (<i>Okay class, let's go on to the very first part before looking at five point one.</i>) Look at your textbook 5.1 what is air made up of? K look at the learning outcomes there. Cuba lihat pada bahagian hasil pembelajaran. (<i>Try looking at the learning outcomes section.</i>) K by the end of this lesson, you should be able to, the first one, state what air is made up of? K, apakah yang membina udara tersebut (<i>Okay, what makes up the air</i>), and then explain why air is a mixture? Awak perlu nyatakan kenapa udara tu adalah suatu campuran. (<i>You need to state why air is a mixture.</i>) K and then state the average percentage of nitrogen, oxygen and carbon dioxide in air. Awak perlu juga nyatakan apakah er, peratusan purata bagi setiap kandungan udara k? (<i>You also need to state the average percentage of each composition, okay?</i>) Khususnya, ah, terdiri daripada gas la. (<i>Specifically, ah, it consists of gas.</i>) OK, our earth is surrounded by a layer of air called the atmosphere. Kalau awak lihat, sekarang ni awak berada di permukaan bumi dan juga terdapatnya udara yang meliputi permukaan bumi kita, yang kita panggil sebagai lapisan atmosfera. (<i>If you look, you're now on the surface of the earth and there is a layer of air that envelops our earth's surface. This is what we call the atmospheric layer.</i>)
6.	S1:	((asks in Malay))
7.	T:	Ya (<i>Yes</i>)?
8.	S1:	((repeat question in Malay))
9.	T:	Ya sentiasa berkitar, berlaku kitaran dalam udara tersebut. (<i>Yes? Yes, it is always circulating. There is always circulation in the air.</i>)

		OK the atmosphere protects living things on earth, from harmful rays from the sun. K pada permukaan atmosfera kita ni, ianya berfungsi untuk melindungi manusia dan juga benda hidup daripada sinaran yang merbahaya daripada matahari. (<i>Okay, the surface of our atmosphere serves to protect humans and also living things from the dangerous rays of the sun.</i>) OK?
10.	S:	Sinaran UV (<i>UV ray</i>).
11.	T:	Ah, yang kita panggil sebagai sinaran UV, (<i>Ah, that is what we call UV rays,</i>) k, ultraviolet. Kenapa? Awak pegang tu kenapa? Tak kenal sinaran UV ke? (<i>Why? Why are you holding that? You don't know what are UV rays?</i>) OK, air is colourless. Udara ni adalah tidak berwarna. (<i>Air is colourless.</i>) Awak nampak ada warna ke? (<i>Do you see any colour?</i>)
12.	SS:	Tak (<i>no</i>).
13.	T:	K, kadang warna hijau, kadang warna kelabu, itu adalah daripada cahaya ok? (<i>Okay, sometimes it is green, sometimes grey, that is due to light okay?</i>) And then no colour, tasteless, tidak ada rasa (<i>tasteless</i>) and odourless, tidak ada bau (<i>odourless</i>). We cannot see air but we can feel it. When it moves as wind. K, kita tak ada, kita tak nampak udara tu. (<i>Okay, we don't have, we don't see the air.</i>) Nampak ke? Nampak? (<i>Do you see it? Can you see it?</i>)
14.	SS:	Tak (<i>no</i>).
15.	T:	Ya, tapi kita boleh rasa, rasa dekat mana? (<i>Yes, but we can feel it. Where can we feel it?</i>) Bukan rasa dengan lidah (<i>Not using your tongue</i>)
16.	S:	Skin!
17.	T:	ah, pada permukaan kulit kita (<i>on the surface of our skin</i>). K kita dapat rasa tiupan angin, ok? (<i>Okay, we can feel the wind blowing, okay?</i>) Itu adalah daripada udara. (<i>That is from air.</i>) OK, can I proceed?
18.	SS:	No. ((T allows students to copy from the slides hence the need of waiting for students to finish copying)).
19.	T:	Cannot? Ah, faster. OK for composition of air, kita nak lihat apa (<i>what do we want to see</i>)? Composisi air, eh air pula, udara, betul tak? (<i>Composition of water, oh, not water, air, is that right?</i>) Composisi tu apa? (<i>What is composition?</i>) What is the composition? Aih, kenapa masuk macam ni? (<i>Oh, why do you enter like this?</i>) ((A student suddenly came into the lab looking for his ruler)) Tak ada, tak ada. Ada kawan ambil itu? Tak ada. (<i>No, no. Did any friend take that? No.</i>) Thank you, goodbye. OK what's the composition. Ah, who can tell me?
20.	S:	Composisi. (<i>composition</i>)
21.	T:	Composisi (<i>composition</i>), yes, pandai, pandai dia translate (<i>smart, he's good at translating</i>). Apa makna lain ataupun awak boleh nyatakan dalam bentuk apa? (<i>What is another meaning for it or can you say in what form?</i>)
22.	S:	(?)
23.	T:	Kedudukan (<i>position</i>), position! That is a position.
24.	S:	Pergerakan (<i>movement</i>).
25.	T:	Pergerakan (<i>Movement</i>)! What is air made of. Pandai WengKit, itu yang tepat. (<i>Good WengKit, that is accurate.</i>) Maksudnya di sini, WengKit bagi tau apakah yang membentuk udara tersebut. (<i>This means, WengKit said what makes up the air.</i>) Ah, iaitu kandungan

		udara. (<i>Ah, that is the contents of air.</i>) OK? The content of air. K, saya boleh teruskan lagi ya? (<i>Okay, can I continue?</i>) Now, we look at the what we call carta alir (<i>flow chart</i>), kita panggil sebagai carta alir (<i>we call it a flow chart</i>). Air is a mixture of many components. As you can see here. OK, for the first box there at your left, pada bahagian kiri awak (<i>on your left</i>), siapa yang boleh bagi saya, k udara terdiri daripada apa (<i>who can tell me what is air made up of</i>)? Yang pertama sekali (<i>The first</i>).
26.	SS:	((Some students shout carbon dioxide some say oxygen, simultaneously))
27.	T:	Main.
28.	SS:	Oxygen.
29.	T:	Yang utama sekali. (<i>the most important.</i>)
30.	SS:	Oxygen!
31.	T:	Terdiri daripada yes, oxygen tu apa? (<i>Made up of, yes, what is oxygen?</i>)
32.	S:	(??)
33.	T:	Pandai. (<i>Clever.</i>) Oxygen lagi apa lagi? (<i>Oxygen and what else?</i>)
34.	SS:	Nitrogen.
35.	T:	Nitrogen, lagi (<i>some more</i>)?
36.	SS:	Carbon dioxide.
37.	T:	Carbon dioksida lagi? (<i>Carbon dioxide, and?</i>)
38.	SS:	Inert gases!
39.	T:	Inert gases itu semua apa benda? (<i>What are those inert gases?</i>) Hah? Kan tu jatuh. Apa dia? (<i>What? Look, that fell. What is that?</i>) That is what we call gas err pandai (<i>clever</i>).
40.	S:	Gangster?
41.	T:	Bukan gangster! (<i>Not gangster!</i>) Gases! Ah, terdiri daripada gas-gas. K. (<i>Ah, made up of gases.</i>) Then the next one, at your right side. Sebelah kanan awak. (<i>On your right.</i>) Apa tu, apa lagi kandungan udara? (<i>What is that, what else is air made up of?</i>) Har? Apa dia WengKit? (<i>What? What is that WK?</i>) Habuk, lagi? (<i>Dust, and?</i>) Peshwa? Apa? (<i>What?</i>)
42.	S:	((silence))
43.	T:	Cepat (<i>quick</i>) Peshwa. Jangan buang masa, ah siapa nak tolong PW? (<i>Don't waste time here, ah, who wants to help Peshwa?</i>) Ha?
44.	S:	Dust.
45.	T:	Dust. Dust and habuk sama tak? (<i>Are dust and 'habuk (dust)' the same?</i>) Ah, sama. (<i>Ah, same.</i>) OK, Yuru, Yuru sini (<i>here</i>). Ah Yuru, apa lagi kandungan udara selain daripada gas-gas tadi. (<i>Ah YR, what else is air made up of besides those gases?</i>)
46.	S:	Microorganism.
47.	T:	Microorganism, very good, thank you Yuru. OK, kalau awak lihat dekat sini, other components kita panggil sebagai other

		components. (<i>Okay, if you look here, we refer to other components as other components.</i>) We call it as other component. Yang gas tadi, gas terdiri daripada (<i>The gas earlier on is made up of</i>) oxygen, nitrogen, carbon dioxide and also inert gases. K? For other components, ah itu baru betul (<i>ah, that's right</i>), kita panggil sebagai (<i>we refer to them as</i>) water vapour, dust and also microorganisms. K? OK. Who can give me example of inert gas? Siapa boleh bagi saya contoh, contoh bagi gas nadir? (<i>Who can give me examples of inert gases?</i>) Ah, Wendy.
48.	S:	Helium.
49.	T:	Helium, very good, sit down. Other example? Who want to tell me? Siapa nak bagi saya jawapan? (<i>Who wants to give me an answer?</i>) Ah. Tivashini, apa dia cikgu? (<i>GV, what's that teacher?</i>)
50.	S:	Neon?
51.	T:	Neon, pandai (<i>smart</i>) Tivashini. Sit down. Berdiri lah saya tanya. Tak larat kan? (<i>Stand up when I'm asking. You can't right?</i>) OK lagi? Ada contoh lain tak? (<i>Okay, anything else? Are there other examples?</i>) Kenny? Nanti, sabar. (<i>Wait, be patient.</i>) Kenny. Peshwa? Peshwa is not the example of inert gas. Apa awak cakap? Saya tak dengar. (<i>What did you say? I can't hear you.</i>) Kenny?
52.	SS:	Xenon.
53.	T:	Ahh, xenon. K K, lagi apa? (<i>what else?</i>) Amira, apalagi contoh? (<i>any other examples?</i>)
54.	S:	Argon.
55.	T:	Argon. Thank you, sit down. Tu kenapa tu (<i>that why is that</i>)?
56.	S:	Dia (<i>he</i>) jealous. Dia pun nak jawab (<i>he also wants to answer</i>).
57.	T:	Dia pun nak jawab (<i>he also wants to answer</i>), ok. Jadi contoh (<i>So for example</i>), for example of inert gases, argon, krypton, helium, neon and xenon. OK? OK, let's look, ah ini kalau awak lihat dekat depan ni, adalah rumah siapa ni? (<i>If you look at this, in front here, whose house is this?</i>) Ada rumah ke tak ada kan? (<i>There is a house, right?</i>) Rumah? (<i>House?</i>) ShiaWei? Rumah ShiaWei macam ni ke? Macam tadika lah ShiaWei kan? (<i>ShiaWei's house is like this? Like a kindergarten, ShiaWei, right?</i>) Kalau awak lihat dekat situ, udara kan? (<i>If you look there, that's air right?</i>) mengandungi nitrogen, oxygen, ShiaWei marah ke? (<i>Contains nitrogen, oxygen, is SW angry?</i>) Tak kan? Saya bergurau ya. (<i>No, right? I'm just joking.</i>) Kemudian (<i>And then</i>) inert gases, carbon dioxide and other components. OK, let's look at the average percentage of.
58.	SS:	(??)
59.	T:	Not yet? Yang tadi tak apa, awak buat je bulat-bulat. (<i>Forget the previous one, just draw some circles.</i>) K? Ah, belum ke? Kesiannya. (<i>Done? Ah, no? That's pitiful.</i>) Eh?
60.	S:	Salin sambung macam ni ke (<i>continue copy like this is it</i>)?
61.	T:	Ya la, tapi ini ulangan supaya awak ingat. Supaya awak tau. (<i>Yes, but this is repeated so that you remember. So that you know.</i>) OK. Can I proceed class? OK next we look at the average percentage of components in air. Kita lihat apakah ah, peratusan bagi komponen secara purata yang terdapat pada udara. (<i>We will look at the average percentage for the components in air.</i>) K component, the first component in air is nitrogen, the average percentage are seventy-eight percent k, tujuh puluh lapan peratus (<i>seventy eight percent</i>), ok,

		ianya adalah jumlah yang banyak, yang terkandung dalam udara (<i>that is a large amount in air</i>). And then oxygen, twenty-one percent, for inert gases, zero point nine percent and carbon dioxide zero point zero three percent and for water vapour, dust and microorganisms it is variable. Hanya sekadar hadir saja (<i>it just present a little only</i>). OK jadi kalau lihat ini secara purata, dia tidak tetap lah (<i>Okay, if you look at this on average, it is not fixed</i>). Not fixed. The composition of air is not fixed, it changes according to time, the condition of the environment and our activities. Ah, sebab tu saya kata tadi dia berubah-ubah. (<i>That is why I said earlier it will change constantly.</i>) sentiasa ada kitaran dia, k kita panggil sebagai kalau untuk carbon dioksida kita ada kitaran carbon dioksida dan juga untuk oksigen ada kitaran oksigen (<i>always have its cycle, k we call it as if for carbon dioxide we have carbon dioxide cycle and also for oxygen have oxygen cycle</i>). OK, salin semua. (<i>Okay, copy this down, all of you.</i>) OK sudah? (<i>Okay, done?</i>)
62.	SS:	(??)
63.	S:	((asks about TIMMS and PISA exam next Tuesday in English))
64.	T:	Saya rasa dwibahasa. (<i>I think it is in two languages.</i>) OK. Dah (<i>Done</i>). OK, untuk water vapour, dust and microorganisms also you can err, eh for inert gases is it, 0.97 kan (<i>right?</i>)? Jadi kat sini dan juga dalam buku teks kau mungkin berbeza, sebab apa saya kata tadi? (<i>So here and also in your textbook, it might be different, because what did I say?</i>) Dia tak tetap. (<i>It is not fixed.</i>) K? Jadi ini purata, secara purata. Ratus purata. (<i>Okay? So this is on average, an average. An average percentage.</i>) OK. Let's look ah, we call err, kita nak lihat apakah (<i>we want to see</i>), what is the characteristics of each of the gases inside the air. Dalam udara, jadi kita nak lihat ciri-ciri yang terdapat pada setiap unsur dan juga komponen yang terdapat dalam udara. (<i>We want to see the characteristics of each element and also component in air.</i>) Yang pertama kita lihat (<i>First, we will look at</i>) nitrogen. K? For nitrogen, very inactive gas. Merupakan gas yang kurang aktif. (<i>It is a less active gas.</i>) Ianya berfungsi untuk apa sebenarnya? (<i>What is its function, exactly?</i>) Untuk melarutkan apa? (<i>What does it dissolve?</i>) Melarutkan oxygen. (<i>Dissolves oxygen.</i>) Sebab tu kandungannya lebih banyak. (<i>That's why its content is higher.</i>) OK, not burn and does not support combustion. Ia tidak terbakar, membakar dan juga tidak membantu pembakaran. (<i>Okay, it does not combust, burn or helps with combustion.</i>) K? Nitrogen dilutes oxygen in the air so that the process such as respiration, burning and decay go on more slowly. Ya, jadi ianya membantu dalam mencairkan oxygen. (<i>Yes, so it helps to dissolve the oxygen.</i>) Dan juga ianya membantu dalam melambatkan proses pembakaran, respirasi dan pereputan. (<i>Okay, and it also helps to slow down the combustion, respiration and decay process.</i>) OK, sudah? (<i>Okay, done?</i>) K cepat, dah? (<i>Okay, quick, done?</i>)
65.	SS:	(??)
66.	T:	Whooi, apa tu? Macam buka stadium. (<i>Wow, what was that? Sounds like a stadium.</i>) Tengok bola ke? (<i>Watching football?</i>) OK. Dah ya? (<i>Done?</i>) Oxygen. Next component in the air is oxygen. Eh used up during respiration, burning, decay and rusting. Jadi untuk oxygen yang terdapat dalam udara ni, ia digunakan dalam proses apa? (<i>So for the oxygen that is in the air, what are the processes that use it?</i>) Respirasi, kemudian ia diperlukan dalam pembakaran, pereputan ah dan juga pengaratan. (<i>Respiration, and then it is needed in combustion, decay and also rusting.</i>) OK. Needed for living things to survive. Jadi diperlukan benda hidup, organisma hidup untuk,

		<p>untuk apa? (<i>So it is needed by living things and organisms to survive, what for?</i>) Har? Untuk berbuka? (<i>What? To break fast?</i>) Ahh, untuk bernafas. (<i>Ah, to breathe.</i>) K? Lagi dan menjalankan proses-proses lain la yang memerlukan kandungan oxygen. (<i>Okay, and carry out other processes that require oxygen content.</i>) OK and then set free during the process of photosynthesis. Dalam proses fotosintesis, eh, ianya membebaskan gas oksigen. (<i>In the photosynthesis process, it releases oxygen.</i>) Ya sebab tu kat rumah awak, pastikan ada tumbuhan hijau la, at least awak ada oxygen yang cukup di rumah. (<i>Yes, that is why at home, ensure that you have green plants, at least you will have enough oxygen at home.</i>) Jangan tak ada langsung, kalau ada rumput pun awak simen semua sekali. Rumput ke, pokok ke. (<i>Don't have none at all. If there is grass, you put cement all over them. Grass or trees.</i>) OK, seterusnya kita lihat inert gas. (<i>Okay, next we will look at inert gases.</i>) OK for inert gases in the air. The content is, example helium, neon, argon, krypton, xenon and radon. OK. These gases are very inactive but have their uses. Jadi lepas ni, balik nanti, setiap satu inert gas tu, saya nak awak cuba cari kat rumah. (<i>After this when you go home, I want you to look up each inert gas at home.</i>) Nanti next class saya nak tanya (<i>I will ask during the next class</i>), randomly I want to ask. The function or the uses of each of the gases.</p>
67.	SS:	(??)
68.	T:	OK ya? (<i>Okay?</i>) These gases are very inactive but have their uses.
69.	S:	(?)
70.	T:	Nak balik? Ah, lambat lagi balik. Ada lagi setengah jam nak balik. (<i>You want to go home? It is not time yet. There's still another half an hour to go.</i>)
71.	SS:	(??)
72.	T:	<p>Belum, itu dia sekolah lain. Hari ini balik pukul enam ya? (<i>No, that is another school. Today you go home at six, okay?</i>) OK dah. Sebab apa lambat? Sebab awak salin lambat. (<i>Okay, done. Why late? Because you copy slowly.</i>) Eh? Carbon dioxide, ok. For carbon dioxide, it's set free during, eh untuk karbon dioksida ini, dihasilkan daripada proses respirasi, ya kemudian pembakaran juga membebaskan karbon dioksida (<i>for carbon dioxide, it is produced from the respiration process, yes, and combustion also releases carbon dioxide.</i>). And then for decay, untuk pereputan (<i>for decay</i>), dia membebaskan juga karbon dioksida (<i>it also releases carbon dioxide</i>). Tetapi karbon dioksida diserap oleh tumbuhan untuk menjalankan proses fotosintesis. (<i>But carbon dioxide is absorbed by plants to carry out the photosynthesis process.</i>) Ada last lagi satu. (<i>There is one last one.</i>) OK. Alright, very good. Ok, number five. Content number five. Water vapour, dust and microorganisms. K these things varied in air, k pelbagai di dalam udara, bercampur-campur (<i>there are various things in the air, a mixture</i>). K, most microorganisms in air are bacteria from?</p>
73.	S:	(?)
74.	T:	<p>Pandai, kebanyakannya adalah terdiri daripada bakteria, spora yang terhasil daripada kulat, kita panggil sebagai kulat. (<i>Good, most of them are made up of bacteria, spores from fungus, what we call mould.</i>) OK. Ini adalah antara ciri-ciri yang, bagi menunjukkan kandungan gas-gas yang kita pelajari pada hari ini. K? (<i>These are among the characteristics to show the content of the</i></p>

		<i>gases that we have learnt today. Okay?)</i> Jadi kalau untuk mengetahui lebih mendalam, awak boleh cari eh, awak boleh enquiry. (<i>So to know in detail, you can look, eh, you can make an enquiry.</i>) K, cuba dapatkan maklumat berkenaan dengan udara ini lebih lanjut lagi. (<i>Okay, try to get more detailed information on air.</i>) Jangan awak balik buka YouTube, buka orge and cockroaches. (<i>Don't go home and go on YouTube, and watch Oggy and the Cockroaches.</i>) Aduh, itu tak patut la. (<i>Oh no, you shouldn't do that.</i>) OK. Untuk hari ini setakat itu tetapi sebelum itu, saya nak bagi latihan. (<i>That's all for today, but before that, I want to give some exercises.</i>) OK. Open your textbook, textbook page fifty-five, exercise five point one, wait, exercise five point one, number 1 until number 3, inside your exercise B.
75.	S:	(?)
76.	T:	Tak ada? Dah Hantar? OK nanti saya bagi. OK? (<i>You don't have that? You've handed it in? Okay, I'll give it to you later.</i>) Inside your exercise B book. Oi, belum lagi. (<i>Hey, it's not time yet.</i>) OK. Ada apa-apa soalan setakat ini? Ha? Tak ada? (<i>Are there any questions up to this point? What? None?</i>) Tanyalah saya saya puasa ke tidak. (<i>Ask whether or not I'm fasting.</i>)
77.	S:	(?)
78.	T:	Ah, tanya la saya sihat ke tidak. Saya je tanya awak. (<i>Ah, ask whether or not I'm well. I'm always the only one asking you.</i>)
79.	S:	Cikgu (<i>teacher</i>) are you sihat (<i>healthy</i>)?
80.	T:	Apa? Ayu sihat? Ayu saya tak kenal. Ayu to siapa? (<i>What? Is Ayu well? I don't know Ayu. Who is Ayu?</i>) (Student actually meant Are you sihat (<i>well</i>)). Ya, ada apa soalan? (<i>Yes, any other questions?</i>)
81.	SS:	(??)
82.	T:	Dah habis ke? Eh pukul enam la balik. (<i>The time is up? You go home at six.</i>) Ah line up. Don't want to line up I hold you until six o'clock. K. ((Students say thank you to teacher))
83.	S:	Thank you cikgu (<i>teacher</i>) Shahrul ((name changed to pseudonym)) and Ms Joyce.
84.	SS:	Thank you cikgu (<i>teacher</i>) Shahrul ((name changed to pseudonym)) and Ms Joyce.
85.	T:	OK, thank you. Pelajar perempuan jalan dulu. (<i>Ladies first.</i>)

Lesson on 25/7/2013 (about 35 minutes transcribed as following)

86.	T:	Kenny.
87.	S:	Selamat sejahtera Cikgu Shahrul ((name changed to pseudonym)) (<i>good day teacher Shahrul</i>).
88.	SS:	Selamat sejahtera Cikgu Shahrul ((name changed to pseudonym)) (<i>good day teacher Shahrul</i>).
89.	S:	Selamat sejahtera Ms Joyce (<i>good day Ms Joyce</i>)
90.	SS:	Selamat Sejahtera Ms Joyce (<i>good day Ms Joyce</i>)

91.	T:	OK sit down. Ok boleh duduk (<i>can be seated</i>). Ok before I start my lessons for today, sebelum saya mulakan (<i>before I start</i>), pastikan lepas ni, sebelum berakhir masa nanti pastikan awak kumpul semua buku exercise B (<i>make sure that after this, before the end of the lesson later make sure you collect all the exercise B book</i>). Apa tu (<i>what's that</i>)? Ok class yesterday we have learned about the composition of air isn't it. Kita dah belajar apa (<i>what have we learnt</i>), what is air is made up of. Kita dah mempelajari berkenaan apa yang membina udara atau pun yang dikandungi oleh udara tersebut (<i>we have learned about what make air or what does air consist of</i>). K. Saya harap awak dah faham berkenaan dengan kandungan udara (<i>I hope you have understood about the contents of air</i>), K, kemudian (<i>and then</i>) class, yesterday also I have asked you to, to search for what is the uses of inert, inert gasses, ada tak (<i>yes or no</i>)? Ada tak saya mintak awak cari berkenaan dengan kegunaan antara gas-gas, apa, gas-gas nadir tersebut yang awak berikan contoh (<i>did I not ask you to search the uses of gases, what, inert gases that you gave example</i>), for example argon, krypton, helium and neon. Haa who can tell me one example of gas, one, what we call, one example gas that you can give me the uses of the gas. Haa.. K, siapa nak bagi (<i>who wants to give</i>)? Kenny? Boleh? Haa.. Kenapa tak boleh (<i>why cannot</i>)? Macam mana ni (<i>how is it like this</i>)? sebelum ni saya dah tunjukkan HOTS kan (<i>before this I've shown you HOTS right</i>)? Ha jadi takde sambutan la maksudnya (<i>that means it's not well accepted now</i>). Next week awak nak menjalankan ujian lagi (<i>you will take the test again</i>). Cepat siapa yang boleh bagi jawapan kepada saya (<i>quick who can give me an answer</i>)? Atau apa yang telah awak lakukan pencarian semalam (<i>or what have you done regarding your research last night</i>).
92.	S:	Oxygen.
93.	T:	Not just okxygen. I'm asking you to search for the inert gasses. The uses. The one of inert gasses. Saya minta awak cari bekennaan dengan apa (<i>I ask you to find out about what</i>)? Gas-gas nadir yang semalam awak berikan kepada saya (<i>the inert gases that you gave me yesterday</i>). Saya nak contoh kegunaan (<i>I want example of the uses</i>). Siapa boleh bagi ada tak (<i>is there anyone who can give me</i>)? Ha kenapa lambat (<i>why late</i>)?
94.	S:	((Explains in Malay))
95.	T:	Ha cepat duduk tempat awak (<i>quickly sit at your place</i>). OK Peshwa, what type of inert gas you want to explain to me? Apakah jenis dia (<i>what is its type</i>)? Argon, krypton or helium? Cepat sebab sebelum ni saya nak proceed dengan lesson yang terbaru (<i>quick because before this I want to proceed with the newest lesson</i>). Ha cepat (<i>quick</i>).
96.	SS:	(???) inert gasses consist of argon.
97.	T:	Sorry? yes. inert gasses consist of argon, krypton lagi (<i>some more</i>)? Helium, and neon? Lagi (<i>some more</i>)? Saya minta awak semalam apa (<i>what did I request yesterday</i>)? Ni tak catat la ni (<i>didn't take note</i>). ha sepatutnya awak catat (<i>you were supposed to note it</i>). Saya minta cari apa Afif (<i>what did I ask you to search for Afif</i>)?
98.	S1:	Ha?
99.	T:	Saya minta cari apa (<i>what did I ask to search</i>)?

100.	S1:	Kegunaan argon (<i>uses of argon</i>).
101.	T:	Ha, kegunaan gas-gas nadir tu (<i>the uses of the inert gases</i>). Antara satu lah yang awak boleh berikan kepada saya (<i>one of those that you can give me</i>). Apa (<i>what</i>)? Ha apa (<i>what</i>) Shapnam? Semua tak boleh (<i>all cannot</i>).
102.	S2:	Ok teacher if it's wrong then (???)
103.	T:	Ha, never mind, you can try.
104.	S2:	Ok, I think helium, helium is used for filling (?) ballon and it is a much safer gas and it is unflammable.
105.	T:	Ok very good Shapnam. OK, tadi Shapnam kata apa (<i>what did Shapnam just say</i>)? Helium. Dia bagi contoh kegunaan gas helium (<i>he gave example of uses of helium gas</i>). K apa kegunaan dia (<i>what is its use</i>)? Untuk diisi ke dalam belon (<i>to be filled into ballon</i>). Digunakan dalam belon, untuk apa (<i>to be used in ballon, what for</i>)? Maksud saya awak beli belon dekat pasaraya tu kan, yang dia terapung, dia naik, sebab apa gas helium ni sangat ringan dan berketumpatan rendah berbanding dengan oksigen (<i>I mean when you buy ballon at the supermarket, the ones that float, it rises, because of gas helium is very light and its density is lower as compared to oxygen</i>). Ok other uses of helium gas? Apa kegunaan lain (<i>what are other uses</i>)? Siapa boleh bagi saya (<i>who can give me</i>)? Takde (<i>no</i>)? Ha ni lambat ni kenapa (<i>ha this is late, why</i>)?
106.	SS:	Solat (<i>prayer</i>).
107.	T:	Alhamdulillah. Heh solat. tapi awak kena tepati masa. Betul atau tidak (<i>Heh prayer. But you must be on time. Correct or not</i>)?
108.	SS:	Ye betul cikgu, tepat sekali (<i>correct teacher, exactly</i>).
109.	T:	Ok siapa lagi nak bagi saya? Ada tak (<i>OK who else wants to give me? Anyone</i>)? Other examples of uses of helium? Ada tak lagi (<i>anymore</i>)? Tak ada (<i>don't have</i>)? Heh? Helium gas juga kita gunakan untuk apa (<i>we also use helium gas for what</i>)?
110.	S:	Mengubah suara (<i>change voice</i>).
111.	T:	Mengubah suara (<i>change voice</i>)? Mengubah suara jadi apa (<i>change voice become what</i>)?
112.	S:	Macam suara dalam tu (<i>like the voice in the</i>)?
113.	T:	Itu bukan kegunaan yeh, itu adalah kita panggil sebagai, ianya boleh mengubah suara seseorang apabila gas tersebut, disedut oleh seseorang tersebut (<i>That is not its use, that is what we call, it can change a person's voice when the gas, is inhaled by the person</i>). Kenapa (<i>why</i>)? Sebab apa (<i>because of what</i>)? Gas helium ni dia apa (<i>what is gas helium</i>)?
114.	SS:	Dia ada (<i>it has</i>) element.
115.	T:	Amira nak jawab berdiri lah Amira (<i>Amira wants to answer stand up Amira</i>). Ianya merupakan gas paling kurang tumpat eh berbanding dengan keadaan udara yeh, jadi ianya boleh menyebabkan suara seseorang itu semkain tinggi tone dia, ha, makin dalam tone dia (<i>it is a gas with least density as compared to air, so it can cause a person's voice to have higher tone, if he has lower tone</i>). Betul tak (<i>correct</i>)?

116.	S:	Betul cikgu (<i>correct teacher</i>)
117.	T:	Ha ok. Tetapi ianya juga merbahaya sekiranya awak (<i>but it is also dangerous if you</i>)?
118.	S:	sedut banyak-banyak (<i>inhale a lot</i>).
119.	T:	ha sedut banyak banyak boleh menyebabkan (<i>inhale a lot can cause</i>) choking, kita panggil sebagai (<i>we call</i>) choking apa itu (<i>what</i>)? Tercekik (<i>choking</i>).
120.	S:	Tercekak.
121.	T:	Tercekak tercekik tercekak tercekik. Tercekik sebab apa (<i>choking because of what</i>)? Sebab tidak dapat apa (<i>because cannot get what</i>)?
122.	S:	Oxygen.
123.	T:	Ha oxygen. Due to the lack of oxygen. Ye kurangnya oksigen (<i>lack of oxygen</i>). jadi hari ini class, saya nak masuk kepada subtopic seterusnya, iaitu (<i>so today's lesson, I want to enter into the next subtopic</i>), we are still in 5.1, we continue our class, why is there air, there is a question here, ada satu soalan di sini yang awak boleh baca, boleh baca tak (<i>there's a question here that you can read, can you read</i>)? Nampak tak yang belakang (<i>can those at the back see</i>)? Is air an element mixture or compound? Who wants to answer this question? Please put up your hand. Siapa nak jawab (<i>who wants to answer</i>)? Is air an element, mixture or compound? Adakah udara merupakan unsur, campuran atau sebatian (<i>is air an element mixture or compound</i>)? Yes, apa nama dah lupa dah (<i>Yes, what's your name I've forgotten</i>), Wahidah?
124.	S:	Farah
125.	T:	eh, Farah, ye lah tu Farah Wahidah. Apa jawapan awak (<i>what's your answer</i>) Farah Wahidah?
126.	S:	Air is a mixture of (???)
127.	T:	OK, itu jawapan awak (<i>that's your answer</i>). Ok duduk (<i>sit down</i>). Thank you. Thank you for your answer. Other answer? Ada tak selain daripada (<i>anything else other than</i>) mixture? Ada tak yang nak jawab compound ataupun kita panggil, compound ni apa (<i>Anyone wants to answer compound or what we call, what's compound</i>)? Sebatian (<i>compound</i>). Ataupun ada yang nak jawab udara ini adalah unsur (<i>or anyone wants to answer that air is an element</i>)? ha Sharon? Apa jawapan awak untuk ini (<i>what's your answer for this</i>)? Ha, diri (<i>stand up</i>). what is this? Tolong kutip (<i>please pick it up</i>)? Ha Sharon, apa jawapan awak ni (<i>what's your answer</i>)? Cepat cepat cepat (<i>quick quick quick</i>). Is air an element mixture or compound?
128.	S3:	Air is a mixture of of nitrogen, oxygen carbon dioxide.
129.	T:	Sorry? Air is a mixture?
130.	S3:	of nitrogen, oxygen, carbon dioxide.
131.	T:	Oh, ye ok thank you, sit down. Jawapan yang penuh (<i>full answer</i>). Ha, air, eh udara, merupakan suatu campuran gas termasuklah nitrogen, oxygen dan karbon dioksida dan berserta dengan (<i>air is a mixture of gas including nitrogen, oxygen, carbon dioxide and</i>

		<i>together with</i>) inert gas. Ok jawapan lain ada tak (<i>any other answer</i>)? ShiaWei? Last?
132.	S4:	Element.
133.	T:	Element! Element ShiaWei cakap (<i>says</i>). Ada tak jawapan lain (<i>any other answer</i>)? Ha Yuro what is your answer. That is the question. Is air an element mixture or compound?
134.	S5:	Mixture.
135.	T:	ha, mixture. macam tu ke jawab (<i>that's it the answer</i>). Ha berdiri (<i>stand up</i>). Jadi jawapn yang tepat adalah, eh, jawapan yang sebenarnya eh, udara merupakan campuran (<i>so the correct answer is, eh, the real answer is, air is a mixture</i>). Air is a mixture. Ok now I want to know why? Kenapa udara dikatakan sebagai campuran (<i>why is air a mixture</i>)? why is air a mixture? Ha siapa yang nak cuba jawab (<i>who wants to try answering</i>)? Why is air, a mixture ataupun (<i>or</i>) why air is a mixture? Tivashini. ha apakah Tivashini?
136.	S6:	((silent))
137.	T:	Tiva?
138.	S6:	Because.
139.	T:	Because what? Takpe sebut je, cuba, awak cuba tak apa (<i>it's ok just say it, try, it's ok to just try</i>).
140.	S6:	ada (<i>have</i>) answer tapi tak tahu mana (<i>but don't know where</i>) (??)
141.	T:	Ha, cari jawapan dia (<i>find the answer</i>). Baca depan tu (<i>read the front</i>). Eeyyy. Tu lepas ni saya kata bawa sudu besar-besar, suap awak (<i>after this I'm going to bring a big spoon, feed you</i>).
142.	S6:	Air is considered a mixture because of the following reasons, the gasses in air are not present in fixed amount.
143.	T:	Ok thank you sit down. Thank you for your readings. Ha. Salin (<i>copy</i>). Ni awak perlu salin (<i>this you need to copy</i>). Kenapa udara merupakan campuran (<i>why is air a mixture</i>). Ok eh, udara dikategorikan sebagai campuran yang pertama sekali disebabkan oleh udara merupakan apa (<i>air is categorised as mixture firstly because air is what</i>), gasses in air are not present in fixed amount. Udara yang terdapat dipersekitaran kita ini, eh, dia sentiasa berubah tidak tetap (<i>air around us, eh, it's always changing not fixed</i>). Jadi kalau kita kira daripada (<i>So if we count fron</i>) percentage ataupun peratusan, ianya berubah-ubah (<i>or percentage, it keep changing</i>). And then next reason? Who wants to try? Amira?
144.	S:	Ah, the gasses in air can easily separated during burning, decay, rusting and respiration.
145.	T:	Ok thank you Amira. Sit down. Ok for the gasses in air, semua gas yang terdapat dalam udara ni, eh, kalau ianya bukan merupakan campuran, campuran ini kita dapat pisahkan eh dengan secara (<i>all the gases in the air, if it's not a mixture, this mixture we can separate it by</i>) physical. Betul (<i>correct</i>)? Jadi tak susah untuk kita pisahkan suatu campuran tersebut (<i>so it's not difficult for us to separate the mixture</i>). Jadi ianya boleh membantu dalam mengasingkan gas-gas yang terdapat dalam udara ini, contohnya semasa dalam proses pembakaran, ok, pereputan, pengaratan and dan juga perespirasian, ha bukan, proses respirasi (<i>So it can help in</i>

		<i>separating the gases in the air, for example during combustion, ok, decomposition, corrosion and also respiration, no, respiration process).</i> Boleh (can)? Ok ada lagi tak (anymore)?
146.	S:	Takde. (no)
147.	T:	Takde dah (no more)?
148.	S:	Ada (yes).
149.	T:	OK, Afif, apa lagi (what other) reason dia? Sambil tengok depan, sambil fikir, sambil salin (while looking at the front, think at the same time, copy at the same time). ((student answering, not clear what is being said)) Ok thank you Afif. Ok for the next reason, air can be obtained easily. Udara dapat dihasilkan atau dapat diperolehi dengan mudah (air can be created or obtained easily). Ok. by mixing the correct gasses together in the right proportion. (?) Kita campurkan semua gas gas yang diperlukan untuk kita menghasilkan gas tersebut (we mix all the gases that are needed to create the gas). Ok ada lagi tak (anymore)? Ha siapa nak cuba (who wants to try)?
150.	S:	Yasmin.
151.	T:	Yasmin. Itu Amira yang suruh (Amira calls that). Saya nak suruh Kainan (I want to call Kainan). Ok Kainan please try. What is the other reason? Ahh, for air is considered as a mixture.
152.	S:	(??)
153.	T:	Ok Thank you Kainan sit down. the preparation of gas by mixing its gasses does not absorb or set free energy. Jadi, apabila eh, penyediaan sesuatu ataupun untuk mendapatkan sesuatu tenaga tu dengan kita mencampurkan segala gas yang ada, ianya tidak menyerap segala apa (So when preparing something or to get certain energy with us mixing all the available gases, it doesn't absorb all what)? segala tenaga ataupun membebaskan tena, tenaga (all enery or release ener, energy). Ini adalah antara sebab kenapa udara ini kita panggil sebagai campu, campuran (this is one of the reasons why we call air as a mix, mixture). OK, ok yang ini (this one), this one is the experiment, to show some components in air. Ini awak perlu salin dalam buku nota sebagai rujukan awak (this you need to copy in your notebook as your reference). Saya akan terangkan terus, nanti kita akan buat eksperimen berkenaan dengan udara ini (I will continue to explain, later we will do the experiment about the air)
154.	S:	Cikgu? (teacher)
155.	T:	Yes?
156.	S:	(??)
157.	T:	No, inside your note. untuk rekod sains, nanti saya bagi PBS barulah kita, awak salin dan jalankan eksperimen (for science record, later I give PBS only we'll, you copy and conduct the experiment).
158.	S:	Ah itu ekseprimen salin dalam nota (Ah copy the experiment in the note)?
159.	T:	Ah. Ini pun perlu untuk awak eh (this is also for you). Nak suruh awak baca sampai bila (need to ask you to read till when)? Sampai

		bila, bila awak sempat nak baca? (until when, when will you read it in time) Dengan sedih saya katakan (with sadness I say this). Ok sudah, sudah yang ni (ok done, that's it), can I proceed to the next slide?
160.	SS:	Can.
161.	T:	Ok this is an experiment to show some components in air. Jadi, ada tiga, ah, untuk menunjukkan udara, komponen-komponen udara ini terdapat beberapa ekseprimen yang perlu dijalankan untu membuktikan bahawa setiap ataupun udara itu mempunyai pelbagai komponen (so there are three, ah, to show air, components in the air there are a few experiments that need to be carried out to show that each or the air has different components). Salin dalam nota awak terus (Copy in your notes straightaway). Ok ekseprimen 5.1, oxygen in air. The aim, to determine the percentage of oxygen in air. Untuk kita melihat berapakah peratusan oksigen dalam udara (for us to see what's the percentage of oxygen in the air). Method, kaedahnya atau kita panggil sebagai (method or what we call) procedure, bagaimana kita nak jalankan eksperimen (how we want to conduct the experiment), yeah, the first one, a candle placed on a glass jar stand, in , uh, in a through of water, apa ni (what)? Ok, a candle placed on a glass jar stand in a through of water. Ini salah ayat dia (this sentence is wrong)ye. A candle placed on a glass jar. Sekejap ya (a while ya) ((teacher thinking of a sentence, and changing it on computer, long pause)) Ok, candle placed on a glass jar, eh awak masukkan, kita akan sediakan dua, kita panggil sebagai apa (you insert, we prepare two, we call it), ha, gas jar, ataupun kita panggil sebagai kelalang gas (or we call it gas jar), bukan kelalang kon (not conical flask). ha. Ha, you have to, maksudnya, dekat sini (meaning, near here) candle placed on a glass jar, awak masukkan (you insert), place a lighted candle inside a container containing air, awak masukkan, kita akan masukan apa (you insert, what do we insert)? Lilin yang bernyala ke dalam balang gas yang di mana kita letakkan pada suatu kita panggil sebagai bekas air yang besar, bekas berisi air (the lighted candle into the gas jar where we put it in something we call as a big water container, a container filled with water). Lepas tu (after that), the candle is lighted, maksudnya lilin tersebut perlu dinyalakan terlebih dahulu (meaning the candle needs to be lighted beforehand). A gas jar is inverted over the burning candle. Nanti awak akan lihat gambarajah dia (you will see the picture later). Jadi gas jar tu diterbalikkan (So the gas jar is inverted) ok, when the candle flame is extinguished, allow the air in the gas jar to cool. Perlu maksudnya apabila ah, nyalaan lilin terpadam, eh, gas jar ataupun kelalang kon, eh gas dibiarkan menyejuk (needs to, it means when, the candle is extinguished, jas jar or the conical flask, the gas if left to cool down). And then, measure the height of water rises dalam gas jar. Awak perlu ukur, berapakah ketinggian air yang naik maksudnya yang rises yang menunjukkan peningkatan dalam balang gas tersebut (you need to measure, what's the height of the water that rises that shows the increase in the gas jar). Kemudian (then), and then, you have to calculate the proportion of air used up in the gas jar. Awak juga perlu megira dan menganggar berapakah ah, kandungan udara yang digunakan dalam kelalag gas tersebut (you also need to calculate and estimate how much, content of air has been used in the gas jar). Ok ni dah ah (ok is this done)?
162.	SS:	Dah.
163.	T:	Ok ni gambarajah dia awak perlu salin (ok this picture you need to copy).

164.	SS:	(??)
165.	T:	ha dia akan naik (<i>it will rise</i>). takpe nanti kita akan jalankan eksperimen (<i>nevermind later we will conduct the experiment</i>), next week. Ok. Salin ni dulu (<i>copy this first</i>). ((students copying notes))
166.	S:	Cikgu.
167.	T:	Apa. (<i>what</i>)
168.	S:	(??)
169.	T:	ha, dia turun, ha lukis (<i>it decreases, ha draw</i>).
170.	S:	(??) Cikgu kata dia meningkat (<i>teacher said it rises</i>).
171.	T:	ni yang saya tulis tadi ye (<i>is this what I wrote just now</i>)? rise, rise?
172.	S:	rises meningkat (<i>rise</i>) lah
173.	T:	Ha salin dulu nanti saya tengok balik (<i>copy first I'll look at it later</i>). ((teacher looking at notes)) Oh ok, awak nampak dekat sini dia menurun kan, kan (<i>you see here it's decreaseing right, right</i>)?
174.	S:	Ya cikgu (<i>teacher</i>)
175.	T:	tapi, kita lihat dia masuk ke dalam ni. dia naik kat mana. Bukan dekat sini, awak tengok di bahagian luar betul tak (<i>but, we see it enters into this. Where does it rise to. Not here, you see at the outside correct or not</i>)?
176.	S:	Betul. (<i>correct</i>)
177.	T:	Di bahagian luar ini, nampak ianya berkurangan, tapi ke mana airnya pergi (<i>on the outside, see that it's lessen, but where did the water go</i>)?
178.	S:	Maksudnya (<i>its meaning</i>) (??)
179.	T:	Ha, dia akan pergi ke bahagian dalam ni, kalau awak tengok rujukan dekat mukasurat lima puluh (<i>it will go inside this, if you look at the reference on page fifty</i>) activity 5.1 eh text book, eh dia akan naik sebanyak 1 per 5 dalam kelalang (<i>it will rise as much as 1 over 5 in the jar</i>), di bahagian luar kelalang gas (<i>outside the gas jar</i>). Ok dah eh (<i>are you done</i>)?
180.	SS:	Belum (<i>not yet</i>)
181.	T:	Belum (<i>not yet</i>). ((students continue to copy notes)) Ok eh.
182.	SS:	Belum (<i>not yet</i>).
183.	T:	Kita habiskan yang ini (<i>we finish this</i>).
184.	S:	Cikgu, itu ada candle ah (<i>teacher, does it have a candle</i>)?
185.	T:	Apa (<i>what</i>)? yes, inside the gas jar ya, is a candle eh. ada, lilin dalam tu (<i>there is, candle in it</i>). ((students still copying notes)) Ok sudah ah (<i>Ok done</i>). Ok we proceed to observation. Ok the observation, the candle flame is extinguished after some time. Setelah beberapa

		ketika, apa yang berlaku ke atas ah lilin tersebut, ini adalah pemerhatian yang sepatutnya dilihat, eh yang sepatutnya diperlehi, Okay, lilin akan terpadam (<i>after some time, what will happen to the candle, this is the observation that should be seen, that should be obtained, ok, the candle will be extinguished</i>). The candle flame is extinguished after some time selepas beberapa ketika (<i>after some time</i>). and then what happen? Water rises one fifth of the gas jar or we call it in percentage it's about twenty percent of gas jar. eh, 1 per 5 daripada balang gas (<i>one fifth of the gas jar</i>). air akan, air naik melalui balang gas yang mengandungi lilin tadi (<i>water will, water rises through the gas jar which has the candle</i>). Dah ke (<i>done</i>)?
186.	S:	Dah (<i>done</i>).
187.	T:	Ok last eh. Conclusion. The result shows that one fifth, twenty percent of air, in the gas jar is used up during burning and then the air used up is oxygen. Maksudnya apabila terdapat ehh, kenaikan ataupun peningkatan air dalam balang gas tersebut, yeh, ianya adalah penggunaan berdasarkan daripada penggunaan oksigen untuk pembakaran. Bermaksud di sini, dalam udara, dia memerlukan, ataupun mengandungi oksigen (<i>meaning when you get, rise or increase of water in the gas jar, ya, it is the use of base on the use of oxygen for combustion. The meaning here, in the air, it needs, or consists oxygen</i>). Ok please hand in exercise B books. Amira tolong kutip (<i>please collect</i>) ye Amira.
188.	S:	(??)
189.	T:	Ok nevermind. Hantar kertas lah (<i>hand in the paper</i>).
190.	S:	Cikgu lepas ni saya hantar. Cikgu nak sekarang ke (<i>Teacher I'll submit after this. Teacher you want it now</i>)?
191.	T:	Yes. Takpa nanti kejap lagi awak balik kelas kutip and then hantar pada meja saya (<i>nevermind later you go back to the class and collect and then send to my table</i>). Ok? Ok please kemas buku (<i>pack you book</i>).
192.	S:	Cikgu, saya bawa buku ni saja, tak bawa buku B (<i>teacher, I only bring this book, didn't bring book B</i>).
193.	T:	B, B. B kena hantar (<i>have to submit</i>).
194.	S:	Esok (<i>tomorrow</i>) ah.
195.	T:	Esok (<i>tomorrow</i>) ? Tomorrow. Bagi tau. Amira, siapa tak hantar tulis nama (<i>write the names of those who don't submit</i>).
196.	S:	OK.
197.	T:	ok, kemas (<i>pack up</i>), eh nanti, nanti (<i>wait wait</i>) Amira, dah habis masa dah ni (<i>the lesson is over</i>). Dekat kelas ye (<i>in the class k</i>).
198.	S:	Bangun.
199.	T:	Dah kemas (<i>after packing up</i>), line up dulu (<i>first</i>). ((students queueing up)) ((Teacher puts down the mic and walk over getting the students to queue up, speaking in Malay))
200.	S:	Thank you Cikgu Shahrizat and Ms Joyce. ((SS: Thank you Cikgu Shahrizat and Ms Joyce.))

Appendix L

Amina's lesson transcript

Turn No.	Role	Transcript
1.	T:	OK, lepas ni ade ujian ya, so dengar baik-baik. (<i>OK, there's a test after this, so listen carefully</i>). OK, the composition of air. (??) OK? (??) K number one, air is a mixture because of what? Because it contains?
2.	SS:	Nitrogen, oxygen, carbon dioxide, inert gases, water vapour, dust and microorganisms.
3.	T:	So, that's why it's a mixture ya (<i>alright</i>). Air is a mixture. OK, certain nitrogen, nitrogen is the biggest component. K, biggest component maksudnya komponen yang paling besar (<i>meaning the biggest component</i>). Paling banyak ialah nitrogen (<i>The most is nitrogen</i>). K, second component ialah oksigen (<i>is oxygen</i>) cos the air is needed by all living things to process apa (<i>what</i>)?
4.	SS:	Respiration.
5.	T:	K, carbon dioxide is needed by the plants for?
6.	SS:	Photosynthesis.
7.	T:	And then inert gases. Inert gases consist of ada lima gas (<i>has five gases</i>), ialah apa (<i>are what</i>)?
8.	SS:	Argon, helium, xenon, neon, and krypton.
9.	T:	Ok, ini kamu boleh ingat tak (<i>can you remember this</i>)? Argon, xenon, neon, helium and krypton. So ada (<i>has</i>) five inert gases. K. and then microorganisms, microorganisms (?) virus, bacteria and (?). Ada tiga ya (<i>has three alright</i>), virus, bacteria and (?). (??) It changes according to conditions of what?
10.	SS:	(??)
11.	T:	Condition of the environment. Ok, component of air and the average percentage, ini tak perlu ingat (<i>this don't need to remember</i>), hanya komponennya (<i>just its component</i>) nitrogen, oksigen, carbon dioxide, inert gases, water vapour, dust and microorganisms. Ok, (?) nitrogen, nitrogen has 78%, oksigen, 21%, carbon diokside, 0.08%, inert gases, 0.97%. K, water vapour, dust dan (<i>and</i>) microorganisms, varies. Tau varies tak? (<i>Do you know varies?</i>) Boleh berubah (<i>can be changed</i>). (??) Kita ada satu eksperimen (<i>we have an experiment</i>). Ok, sebelum membuat eksperimen, kita tengok ini dulu (<i>before doing the experiment, we look at this first</i>). To show the percentage of oxygen in the air. K, so kita ada (<i>we have</i>) candle, kita ada (<i>we have</i>) (?), kita ada (<i>we have</i>) (?) and water. K, this one, at the beginning of the experiment, k, this one after the experiment (??). OK, variable, control variable volume of air, (?) sama ya, dua-dua sama saiz (<i>same alright, both are same size</i>), k and then second manipulated candle flame, candle flame ok, sama ada menyala (<i>whether it's lighted</i>), second, ia padam (<i>it's extinguished</i>), then selepas padam kamu tengok apa berlaku kepada (<i>after it's extinguished you look at what happen to</i>) water level, rises or drop? Ok, procedure, set up the apparatus as shown in the figure. Ok, second, light the candle

		<p>(??) third, observe what happen after that. (??) K ambil besin ni, isikan air, (<i>take this basin, fill in water</i>) fill up water until the water level sampai palang ni (<i>reaches this level</i>). Ok? Sikit mesti naik. (<i>a bit of it must rise</i>) (??) I give you ten minutes. K? ((Students getting all materials needed for the experiment)). K, switch off the fan. ((Students work together in groups)) Cepat, cepat, jangan main. Panas. (<i>Quick, quick, don't play. Hot.</i>) Eh, siapa move ke sana (<i>who move there</i>)? Duduk kat meja awak (<i>Sit at your desk</i>). Gunting (?) macam mana boleh berlaku (<i>cut ? how can that happen</i>)? (students should cut the candle for the tip). Satu per lima saya nak (<i>One fifth I want</i>). ((Teacher going around to the different groups. Giving instructions and correcting them in Malay. Students speak Malay to teacher all the time.)) ((About 3 minutes later)) Ini kemas semua (<i>tidy up all these</i>). Cepat sikit (<i>hurry up</i>). (...) Kenapa awak ganggu orang punya eksperimen (<i>why do you disturb other's experiment</i>)? (...) OK, sekarang kamu buat kamu punya PBS (<i>now you do your PBS</i>). OK, sebelum itu kamu refer kepada (<i>before that you refer to</i>) textbook, ok, page, turn page twenty. OK first step, you must read the procedure. K, one two three four and then you make the conclusion, what you observed just now. OK? That procedure, langkah-langkah, ada empat langkah (<i>steps, there are four steps</i>), k? Last sekali (<i>very</i>), kamu buat (<i>you make</i>) conclusion, conclusion yang nombor tiga tu (<i>the number three</i>), yang last sekali (<i>the very last one</i>). Conclusion that you make from the observation, tolong baca ya (<i>please read alright</i>), (??) is supported by apa gas (<i>what gas</i>)? Ya oksigen (<i>yes oxygen</i>), so the flame of the candle goes off, means all the oxygen has been used up. So the water level rises one? One? One fifth. Not one five. One fifth. Faham tak (<i>understand or not</i>)? Satu per lima (<i>one fifth</i>). One fifth of the air space in the gas jar. K, it shows the percentage of oxygen in air is about? About twenty percent. Twenty percent. K? After that, (?) procedure and conclusion. K you punya ni (<i>possessive verb + this</i>), you punya sangat ringkas (<i>possessive verb + is very brief</i>). (??) K, water level rises one fifth. K, sudah ya (<i>done alright</i>). K close your textbook. K write your name. Tutup buku ya (<i>close book alright</i>). Write today's date. ((students are given time to complete the PBS by themselves. The teacher was sitting in front of the class, waiting for them to complete it.)) K number one you write about setting up the apparatus. And show in the, the picture. Set up, the set up of it. ((School announcement through speaker made in Malay)) ((students continue completing the test)) ((about 5 miutes later)) Dah siap belum (<i>are you done</i>)?</p>
12.	SS:	Belum (<i>not yet</i>). (??)
13.	T:	K dah siap belum (<i>are you done</i>)?
14.	SS:	Belum (<i>not yet</i>).
15.	T:	K ya, hantar (<i>alright, submit</i>). Siapa yang belum siap (<i>who is not done yet</i>)? K, hantar hantar (<i>submit submit</i>). K semua berhenti dan hantar, cepat (<i>everyone stops and submit, quick</i>). Tak mau lagi lama menunggu (<i>don't want to wait for long</i>). K semua hantar (<i>everyone submits</i>). Hantar dulu (<i>submit first</i>). OK. Hantar dulu . (<i>submit first, quick</i>). Sudah habis ni (<i>this is already done</i>). OK second ya (<i>alright</i>), to show that it contains water vapour. Eh ni panjang (<i>this is long</i>) (chair screeching) (??) OK, yang di luar tu kamu nampak apa (<i>what do you see on the outside</i>)?
16.	SS:	(??)
17.	T:	Apa dia? (<i>What is it?</i>) Water?
18.	SS:	Droplets.

19.	T:	Droplets. OK, so set up the apparatus as shown in the picture above. OK, what the external surface of the boiling tube (??) K then, put some ice into the boiling tube or glass la, tu (<i>that's</i>) glass ya, and then after that leave the external surface of the boiling tube and test the liquid. So finally observe the external surface of the boiling tube and test the liquid formed with a piece of dry cobalt chloride paper. So kena test dengan (<i>have to test with</i>) cobalt chloride paper. K, cobalt chloride paper, this one, cobalt chloride paper. Cobalt chloride paper colour dia apa? (<i>its what?</i>)
20.	SS:	Blue.
21.	T:	Blue. Tuliskan dia ya, warna biru. (<i>Right it down alright, blue colour</i>) (?) ((demonstrating))
22.	SS:	((??))
23.	T:	Ni pink sedih. (<i>This pink is sad</i>) Haha. So, kemudian (<i>after that</i>), cobalt chloride paper, turns to pink, not white ya. K, cobalt chloride paper turns to pink. K. So conclusion yang kamu boleh buat (<i>that you can make</i>), the liquid formed on the external surface of the boiling tube is..
24.	SS:	Water.
25.	T:	Water. So air contains (SS: water vapour) water vapour. Yes. So the properties of oxygen and carbon dioxide. OK properties of oxygen and carbon dioxide k (?) first, the colour, oxygen and carbon dioxide, colourless. What is colourless?
26.	SS:	Tidak berwarna (<i>colourless</i>).
27.	T:	Tidak berwarna (<i>colourless</i>). Odour? Odourless. Carbon dioxide juga (<i>also</i>) odourless, tidak ada bau (<i>no smell</i>). OK yang ketiga (<i>the third</i>), taste, rasa (<i>taste</i>). Tasteless, k carbon dioxide?
28.	SS:	Sour.
29.	T:	Sour. Sour apa ni (<i>what is this</i>)?
30.	SS:	(??)
31.	T:	Masin (<i>salty</i>)?
32.	SS:	Masam (<i>sour</i>).
33.	T:	Masam (<i>sour</i>). K solubility in water? K solubility maksudnya kebolehlarutan dalam air (<i>its meaning is solubility in water</i>). Oxygen, slightly soluble. Carbon dioxide?
34.	SS:	(??)
35.	T:	Carbon dioxide also slightly soluble. Slightly soluble. K? Mixture with sodium hydroxide solution. Ini ialah (<i>This is</i>) sodium hydroxide. Ini, tunggu kamu naik tingkatan lima, empat, kamu tahu (<i>This, when you reach form five, four, you will know</i>). Boleh minum (<i>Can be drunk</i>)? Ini adalah (<i>this is</i>) chemical bukan air (<i>not water</i>).
36.	SS:	(??)
37.	T:	Ok. Sodium?
38.	SS:	Hydroxide.

39.	T:	Hydroxide. K. Oxygen, not soluble. But carbon dioxide very soluble (SS: very soluble). K. And then effect of glowing wooden splinter. This one glowing wooden splinter. Ini dia (<i>This is it</i>) glowing with a splinter. Tahu (<i>Know</i>) glowing tak (<i>not</i>)?
40.	SS:	Tau.
41.	T:	Glowing tu apa (<i>that is what</i>)?
42.	SS:	(??)
43.	T:	Glowing maksudnya membara (<i>its meaning is glowing</i>). Kita nyala lepas tu kita bagi dia padam (<i>We light it then we extinguish it</i>). Kalau (<i>If</i>) burning? (S) Ok. Glowing wooden splinter, oxygen rekindles menyalakan (<i>light it</i>)? Tapi (<i>But</i>) carbon dioxide extinguish maksudnya dia padam (<i>meaning it's extinguished</i>). In fact, our glowing wooden splinter, kalau (<i>if it's</i>) oxygen, burns small breathly, carbon dioxide extinguish. Ok if test on litmus paper, oxygen.
44.	SS:	Nothing happens.
45.	T:	Nothing happens. Carbon dioxide turns to red (SS: Turns to read). OK, in fact our bicarbonate indicator, bicarbonate indicator, colour dia merah (<i>its colour is red</i>). Nanti saya tunjukkan (<i>I will show it later</i>). (??) Kalau (<i>If</i>) oxygen? Apa (<i>what</i>)?
46.	SS:	(??)
47.	T:	Kalau (<i>if</i>) gas carbon dioxide dia (<i>it</i>) turn to?
48.	SS:	Yellow.
49.	T:	Yellow. Ok and then, lime water. Last sekali kita buat (<i>we do it at the very last</i>) ok. (??) Ok lime water untuk (<i>for</i>) oxygen nothing happen, and then untuk (<i>for</i>) gas carbon dioxide turns to cloudy ataupun (<i>or</i>) milky. OK saya akan tunjukkan kepada awak dulu selepas itu (<i>I will demonstrate to you first and then</i>) (??) ((Teacher prepares items needed for demonstration)) Ok cikgu tunjukkan ini (<i>Teacher shows this</i>). Awak boleh teka yang mana satu (<i>You can guess which is it</i>). ((demonstrating)) Ok which one is gas oxygen?
50.	SS:	(??)
51.	T:	This one?
52.	SS:	(??)
53.	T:	Why?
54.	SS:	(??)
55.	T:	OK This one?
56.	SS:	(??)
57.	T:	Ok ini saya guna apa ini (<i>What do I use for this</i>)? Bi-car-bonate indicator (SS: Bicarbonate indicator). So for gas oxygen nothing happen ataupun (<i>or</i>) no change but then for gas carbon dioxide the bicarbonate indicator change to?
58.	SS:	Yellow.

59.	T:	(??) (...) Litmus paper untuk (for). (...) (?) the blue litmus paper change to?
60.	SS:	Red.
61.	T:	T: Red. Ok. (...) K ini ialah (this is) lime water. Ok this one, lime water, ok ini ialah (this is) gas carbon dioxide, lime water turns to cloudy. Ini ialah (this is) gas oxygen. So lime water, still will be the same. Nampak kan (see it)? Ini keruh, ini, tiada perubahan (This is murky, this, no change). Ini ialah water (this is water). Ok, ini adalah (this is) sodium hydroxide solution.
62.	S:	Ini boleh minum cikgu? (Can it be drunk teacher)
63.	T:	Ini (this) chemical, tak boleh minum (cannot be drunk). Bukan (Not) lime juice! Lime water, not lime juice. Lime water chemical, lime juice tu yang kamu minum tu (that is what you drink), (??) Ha, itu memang (exactly), minum (drink). Ok. Ini dia panggil apa (what is this called)?
64.	S:	Burning.
65.	T:	This one, burning wooden splinter. Burning, nyala tau (burning, (you) know). Ok, yang ini (this)?
66.	SS:	Glowing.
67.	T:	Glowing. Ok tengok sini buat (look here do) magic kejap (for a bit). Aik, tak jadi pulak (doesn't work). Gas dah keluar dah ni (has already gone out this).
68.	SS:	OOhhhh.
69.	T:	T: Ha, jadi tak (work or not)? Ok, this one, tengok (look), yang ini (this one) glowing ya. OK ni gas apa (what gas is this)?
70.	SS:	Carbon dioxide.
71.	T:	Ini (this) burning, ini padam (this (is) extinguished). Burning atau glowing wooden splinter extinguished. OK.
72.	SS:	Oohhh, wah.
73.	T:	Nampak tak ((do you) see it)? Ox? Oxygen. Ok ini tutup balik (close this back) ok. Ok, effect glowing wooden splinter jadi apa (becomes what), re-kindles or ignites. Ignites maksudnya (its meaning)? Menyala (ignite). Ok, carbon dioxide is extinguished. Dia menyala atau padam (It's ignited or extinguished). Ok lagi (more), lime water, effect of lime water, ok oxygen nothing happen ataupun (or) no change but then gas carbon dioxide turns cloudy or chalky. K, cloudy or chalky. Effect of bicarbonate indicator untuk (for) gas oxygen nothing happen ataupun (or) no change but untuk (for) gas carbon dioxide the bicarbonate indicator turns to yellow because gas carbon dioxide is acid. Acidic, berasid (acidic). Ini tak payah (This is not needed). Yang paling penting, antara test yang paling penting untuk gas oksigen kita menggunakan (The most important, amongst the most important test for oxygen gas we use) glowing wooden splinter. So rekindles ataupun (or) ignites glowing splinter. Untuk (for) gas carbon dioxide yang paling baik untuk test ini ialah, ialah apa (the best to test this is, is what)?
74.	SS:	lime water.

75.	T:	lime water. Lime water turns to cloudy. Boleh faham tak beza dia (<i>can (you) understand the difference</i>)? So ciri-ciri tu kamu kena ingat (<i>the properties you have to remember</i>). K solubility in water. Ok you nak buat sendiri (<i>want to do it yourself</i>)?
76.	SS:	Nak (<i>want</i>).
77.	T:	Saya rasa elok kamu buat yang (<i>I feel it's best you do the</i>).
78.	SS:	Yang water droplets tu (<i>that water droplets</i>). (???)
79.	T:	Ok kita buat yang paling senang (<i>ok we do the easiest</i>). Yang tadi tak perlu sebab susah sangat (<i>don't need to do (the one mentioned) just now because it's too difficult</i>). Cikgu bagi yang (<i>teacher give you the</i>) composition of air, and then percentage. Ok, percentage of air. Oxygen how many percent? Carbon dioxide, inert gasses. Give examples of inert gasses. Page 49. Keep quiet, page 49 you can refer now. Ok, tiga minit (<i>three minutes</i>). ((Time given for students to revise for their PBS)) Ok dah (<i>done</i>). Tutup (<i>close</i>). Ok, close your textbook. Very simple. Band 2. Ini kamu boleh buat (<i>this you can do</i>). Dah mengantuk dah (<i>already feeling sleepy</i>)? Mesti tidur lambat (<i>must have slept late</i>)? Ok write your name and date. Class. Very simple. (??) Three components. Gasses inert.
80.	S:	Teacher yang A tu (<i>the one in A</i>), yang inert gas tu boleh namakan yang xenon dan lain tu (<i>the inert gas can name those xenon and others</i>).
81.	T:	Apa (<i>what</i>)? A?
82.	S:	Ya (<i>yes</i>).
83.	T:	Ini tak perlu namakan (<i>this doesn't need to be named</i>). Itu (<i>that's</i>) component of the gas. (??) Yang tiga tu (<i>it's that three</i>). No, no need to write the name of the inert gasses. Faham ke tak (<i>understand or not</i>)? Gas apa (<i>what</i>)? Ok done, senang je (<i>easy only</i>). Tengok kat atas tu (<i>look at the above</i>). Itu pun tak tahu ke (<i>that also don't know</i>). Ok ketiga-tiga gas yang utama tu apa (<i>what are all the three important gases</i>)? Cepat (<i>quick</i>). Nak kena ni (<i>(you) going to get it (from me)</i>). Percent tu kamu dah tau kan gas apa (<i>you already know which gas it is</i>). Yang utama sekali gas apa (<i>the most important gas is what</i>)? Tak tahu gas pun kena (<i>don't know the gas will also get it (from me)</i>). Gas utama (<i>important</i>). Three main gas. Gas yang utama (<i>gas that's important</i>). Ok cepat sikit (<i>hurry up</i>). Ok ada dua lagi tu (<i>there are two more</i>) gas. Ok yang (<i>that</i>) B tu, Yazmeen, tolong fikir tiga komponen gas yang utama (<i>please help to think about three important components of gas</i>). Tengok yang utama (<i>look at the important</i>), main tu (<i>that</i>). Bukan yang paling baik, yang utama (<i>not the best, the main</i>). Be careful dengan soalan itu (<i>with that question</i>). Either inert gasses ataupun (<i>or</i>) gas carbon dioxide. Yang mana lebih utama (<i>which is more important</i>)?
84.	SS:	Inert gases.
85.	T:	Mana lebih utama (<i>which is more important</i>)? Kalau tidak ada (<i>if don't have</i>) gas carbon dioxide, apa berlaku dengan tumbuhan itu (<i>what will happen to the plants</i>)?
86.	SS:	Mati (<i>die</i>).

87.	T:	Kalau tidak ada inert gas tu apa yang akan berlaku (<i>If there's no inert gas what will happen</i>)? Siapa yang mati (<i>who will die</i>)? Mana yang lebih penting (<i>which is more important</i>)?
88.	SS:	Carbon dioxide.
89.	T:	Mesti fikir ya, macam mana ni (<i>must think alrghit, how can it be like this</i>). Ok ada dua lagi cepat (<i>there are two more</i>). Lagi lambat saya bagi lima lagi (<i>if you are slow I give five more</i>). Cepat (<i>quick</i>). Sebab minggu lepas kan cuti banyak (<i>because last week had a lot of holidays</i>). Ok. Cepat cepat cepat (<i>quick quick quick</i>). OK. Yang ini lebih senang (<i>this is easier</i>). Ini yang kamu suka (<i>this is what you like</i>). Pasal inert gasses tu (<i>it's about inert gases</i>). Tak sabar-sabar nak tulis nama (<i>can't wait to write the names of</i>) inert gasses tu. Ok, and then kamu fikir (<i>you think</i>), (?) why the air is a mixture, kamu dah hafal kan (<i>have you memorised</i>)? Why air is a mixture, k why air is a mixture? K page 54, why air is a mixture, you kena ingat (<i>have to remember</i>), fikir (<i>think</i>). ((SS are heard mumbling at the background, trying to memorise before answering the questions later)). Ah ok cukup (<i>enough</i>). Dah ye (<i>done</i>)? Ok. Tutup tutup buku (<i>close, close book</i>). Okay lagi satu yang ringkas sahaja (<i>another brief one</i>). Lepas ni baru boleh buat eksperimen (<i>after this only can do experiment</i>). (??) ((Students are given about 5 minutes to complete worksheet while teacher sits at the front)) Ok awak tengok (<i>you look</i>), turn to page 56. Ok listen. 56. To show the properties of oxygen and carbon dioxide, ok ini yang (<i>this is that</i>) you kena buat lepas ni (<i>need to do after this</i>) (??) Ok first, ok follow dia punya (<i>its</i>) procedure 5.5. Place the (?) with water. Fill a basin with water. Pakai besen je (<i>use the basin only</i>). Faham tak (<i>understand or not</i>)?
90.	SS:	Faham (<i>understand</i>)!
91.	T:	Ok, second remove the stopper of the test tube contain oxygen, yang ada getah ini adalah gas apa (<i>the one with rubber is what gas</i>)?
92.	SS:	Carbon dioxide.
93.	T:	OK. Ini ialah oksigen (<i>this is oxygen</i>). Jangan biar buka je benda ni (<i>don't just let it open</i>). Gas akan keluar lah (<i>gas will come out lah-interjection</i>), sebab dalam ni ada gas (<i>because there's gas in it</i>). Faham tak (<i>understand or not</i>)? Ok? Ok remove and then kamu dah (<i>you already</i>) remove kamu masuk ke dalam air (<i>you place it into the water</i>). Sebelum tu kamu kena (<i>before that you have to</i>) (?) dengan air (<i>with water</i>). Faham tak (<i>understand or not</i>)? Sampai (<i>until</i>), until 200ml. Boleh (<i>can</i>)? Ok. Buka terus masukkan ke dalam air and then kamu goncangkan (<i>Open and straight away place it in the water and then you shake it</i>). Goncang sikit (<i>shake a little</i>). Masukkan ke dalam air dan goncang (<i>place into the water and shake</i>). Very simple je punya eksperimen (<i>only + possessive verb experiment</i>). Ok kamu tengok (<i>you look</i>) you punya (<i>possessive pronoun</i>) water level naik ke tak (<i>rises or not</i>). Ok second, tadi you guna (<i>just now you use</i>) oxygen, second one you guna (<i>use</i>) gas carbon dioxide, sama je cara dia (<i>the method is just the same</i>), to compare. K kalau teori kita dah buat kita tahu (<i>if we make the theory we already know</i>) both are slightly soluble in water. So water level rises a little bit. Ok and then kamu tak perlu gunakan (<i>you don't need to use</i>) nitrogen hydroxide mixture because dia punya larutan ini sangat (<i>its mixture is very</i>).
94.	S:	Cair (<i>soluble</i>).

95.	T:	<p>Bahaya (<i>dangerous</i>). Nanti tangan kamu sakit (<i>later your hand is painful</i>). Ok ini ialah (<i>this is</i>) sodium hydroxide solution is about the same (??) You terus dengan (<i>continue with</i>) glowing wooden splinter. Ok you ambil bunsen nyalakan bunsen (<i>take the Bunsen and light up the Bunsen</i>) and then buat macam cikgu tadi (<i>do what teacher did just now</i>). K glowing wooden splinter. Guna (<i>use</i>) glowing dulu (<i>first</i>). (??) Nanti awak terperanjat (<i>later you get a shock</i>). And then page 60. K Moist litmus paper, litmus paper cikgu ada bagi dua (<i>teacher gave two</i>), litmus paper yang (<i>that's</i>) red dengan (<i>and</i>) blue. And then lime water. Lime water. And then bicarbonate indicator, this one. Ok, bicarbonate indicator be careful ye, dia akan (<i>it will</i>), tak boleh pegang dekat sini, kena pegang dekat badan dia (<i>cannot hold near here, have to hold near its body</i>). Jangan pegang sini nanti hancur (<i>don't hold here it'll break</i>). Ok boleh mula (<i>can start</i>). Setiap kumpulan ambil satu (<i>each group takes one</i>). Keep quiet. Simpan buku, tinggal satu je buku (<i>keep the books, leave one book only</i>). ((Students conducting experiment in groups while teacher walks around the class, leaving recorder on the desk. Students get really excited while conducting experiment and they also get noisy. Hence difficult to capture what's being said between teacher and students while she walks around the class. This lasts for about 4 minutes.)) Lamanya (<i>so slow</i>)! Mulalah dah pukul berapa (<i>start, already what time</i>). Seorang lagi buat yang satu lagi tu (<i>another person do the other one</i>). Water level rises. Jangan ganas ye (<i>don't be too aggressive</i>). Ini sudah pakai ke (<i>has this been used</i>)? Buka, masuk dalam (??) kamu (<i>open and place in your ??</i>). Jangan tutup balik (<i>don't close it back</i>). Yang sudah guna jangan tutup nanti (<i>those which have been used don't close it later</i>) confused. Ok next. Jangan bagi tumpah lagi (<i>don't spill it again</i>). Buat eksperimen ni macam masak ke (<i>doing experiment like cooking</i>)? (...) Bila buka, jarak daripada bunsen (<i>when open, keep away from the Bunsen</i>). Letak bunsen jauh (<i>place bunsen far</i>). Jangan halakan bikar, tabung uji dengan bunsen (<i>don't face the beaker, test tube to the Bunsen</i>). Nanti meletup (<i>later it explodes</i>). Kenapa bunsen terletak dekat dengan kamu (<i>why place the bunsen near you</i>)? (...) K saya bagi lima minit lagi, habiskan (<i>I give another five minutes, finish it</i>). (...) Ok class. OK, conclusion? The properties of oxygen and carbon dioxide. Ok, turn to page 63. Ok properties dia ada berapa (<i>its properties has how many</i>)? Ciri dia ada berapa (<i>how many properties do they have</i>)?</p>
96.	SS:	Tujuh (<i>seven</i>).
97.	T:	<p>Seven ya. First is solubility in water. OK, oxygen slightly soluble (SS: soluble). Gas carbon dioxide slightly soluble (SS:soluble). Ok second solubility is sodium hydroxide solution. Yang ini kamu tak buat tadi kan (<i>this is the one you didn't do just now</i>). (??) Tapi hasilnya berbeza (<i>but its results are different</i>), oxygen not soluble but gas carbon dioxide very soluble (SS: Soluble). Bila kamu goncang, air naik lebih tinggi (<i>when you shake, water rises higher</i>). Tadi naik sikit je kan (<i>just now it rose a bit only right</i>). Ha, bila yang ini you goncang, dia akan naik penuh test tube untuk (<i>when you shake this, it will rise and fill the test tube for</i>) gas carbon dioxide, oxygen takde apa-apa (<i>has nothing</i>). Ok number three, semua kamu dah buat (<i>all these you've done</i>), effect of glowing wooden splinter untuk (<i>for</i>) oxygen.</p>
98.	SS:	Splinter ignites.
99.	T:	Ignite, ignite ataupun (<i>or</i>) rekindle, ataupun menyala (<i>or ignite</i>). Gas carbon dioxide, glowing wooden splinter goes out ataupun awak

		boleh guna perkataan apa (or what other word you can use)?
100.	SS:	Umm, turn out, kejap-kejap (wait for a bit).
101.	T:	Goes out ataupun (or) ex?
102.	SS:	Extinguish.
103.	T:	Ya. Ok number 4. Effect of burning wooden splinter sama juga jawapan dengan (same answer as the) glowing wooden splinter, ok the splinter burns brighter kalau (if) gas carbon dioxide k the splinter goes out. Ok number 5 effect of blue litmus paper. Kamu tadi dapat tak (did you get it just now)?
104.	SS:	Dapat (got it).
105.	T:	Ok blue litmus paper turns to red untuk (for) gas carbon dioxide, oxygen? No change ataupun (or) no effect. Why? Because oxygen is natural gas 4(SS: natural gas). Carbon dioxide is acidic gas (SS: Acidic gas). Gas yang berasid (that's acidic). Acidic gas that means? Apa maksudnya (what's its meaning)? Gas yang berasid (that's asidic). Ok number six. Effect of lime water. Gas oxygen?
106.	SS:	No change.
107.	T:	Gas Carbon dioxide? Turns (SS:cloudy) cloudy ataupun (or) chalky. Bahasa Melayu kamu guna keruh (Malay language you use murky). Keruh (murky). Ok number 7, effect of bicarbonate indicator. Untuk (for) gas oxygen, no change, no change that means still remain warna apa (what colour)?
108.	SS:	Merah (red).
109.	T:	Merah (red). Untuk (for) gas carbon dioxide change to?
110.	SS:	Yellow.
111.	T:	K from red to (SS: yellow). Ok that's all. Ada tujuh (there are seven). Kena ingat (have to remember). Antara tujuh tu, yang paling baik untuk test gas oksigen adalah guna apa (amongst the seven, which is the best to be used for testing oxygen gas)?
112.	SS:	Glowing wooden splinter.
113.	T:	T: So ignite glowing wooden splinter. Untuk (for) carbon dioxide, test yang paling baik ialah apa (that's the best is what)? Guna (use) lime water (SS: Lime water). Lime water turns to cloudy (SS: cloudy). K dah sampai masa dah (time's already up). OK dah (done). K boleh kemas (can pack).