ORAL INSTRUCTIONAL LANGUAGE FEATURES OF SCIENCE TEACHER TRAINEES IN TEACHING SCIENCE IN ENGLISH IN SCHOOLS

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"Experience is a brutal teacher, but you learn. My God, do you learn"

C.S. Lewis

Praise be to Allah subhanawatallah, who made all things possible.

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ABSTRACT

The use of English as a medium of instruction in teaching science has been implemented in many countries, including Malaysia, where English is neither the teachers' nor the students' native language (L2 science classroom). However, insufficient attention has been given to identifying actual oral instructional language features occurring in these L2 science classrooms. This study offers a profile of these features comprising acts, discourse markers (DMs), and communication strategies (CSs) employed by science teacher trainees (STTs) in teaching science in English. Implementing discourse analysis, with a predominantly qualitative research design, and supplemented with quantitative data, twenty Secondary Four science lessons conducted by ten STTs were audio-recorded, transcribed and analysed. Perceptions on the meanings and uses of the features were also obtained from participating STTs and sixty-one Secondary Four students. The findings indicated that most acts generated by STTs were similar to the ones identified in earlier studies. Nevertheless, two of the acts, namely, the 'overt repair' and the 'assist' acts were found to be particular to the context of this study, suggesting that some acts may be dictated by specific contexts. Findings related to discourse marker use suggested that STTs were more aware of using less flexible DMs which displayed more rigid functions, compared to more flexible DMs which displayed multiple functions. Pertaining to CSs, STTs employed a variety of CSs to reflect their multiple roles as teachers, teacher trainees, and English language learners. The study also found that despite students' ability to articulate the meanings and uses of most of the oral features, they may not necessarily be able to apply this knowledge to enhance their understanding. These findings point towards a more holistic and pragmatic view of L2 oral instructional language features which could aid both practicing teachers and teacher trainees in making better informed decisions.

ABSTRAK

Penggunaan Bahasa Inggeris sebagai bahasa perantara dalam pengajaran Sains telah dilaksana oleh banyak negara, termasuk Malaysia, di mana Bahasa Inggeris bukan merupakan bahasa ibunda guru mahupun pelajar. Namun, kurang perhatian telah diberi untuk mengenalpasti ciri-ciri sebenar bahasa lisan yang digunakan oleh guru Sains dalam bilik darjah sedemikian. Kajian ini mengemukakan profil bahasa lisan dalam pengajaran Sains dalam Bahasa Inggeris merangkumi '*act*', penanda wacana (DMs), dan strategi komunikasi (CSs) yang diamalkan oleh guru pelatih sains (STTs). Menggunakan analisis wacana yang berteraskan kaedah kualitatif, dan disokong oleh data kuantitatif, dua puluh pelajaran sains Tingkatan Empat, yang diajar oleh sepuluh STTs telah dirakam suara, ditranskripsi dan dianalisis. Persepsi berkaitan makna dan penggunaan ciri-ciri bahasa lisan tersebut telah juga diperolehi daripada kesemua STTs yang terlibat dan enam puluh satu pelajar Tingkatan Empat. Dapatan kajian menunjukkan kebanyakaan '*act*' yang diguna pakai oleh STTs semasa mengajar Sains dalam Bahasa Inggeris adalah '*act*' yang lazim diamalkan dalam bilik darjah berdasarkan dapatan kajian yang lalu. Namun, dua '*act*' khusus didapati berlaku dalam konteks kajian iaitu '*overt repair act*' dan '*assist act*'. Ini menunjukkan beberapa penggunaan '*act*' mungkin bergantung kepada konteks bilik darjah tertentu. Dapatan kajian berkaitan penggunaan DMs menunjukkan STTs mempunyai lebih kesedaran dalam penggunaan DMs yang kurang fleksibel berbanding DMs yang lebih fleksibel yang mempunyai pelbagai fungsi. Berkaitan penggunaan CSs, STTs didapati menggunakan CSs yang mempunyai pelbagai tujuan bagi menggambarkan peranan mereka sebagai guru, guru pelatih, dan pelajar Bahasa Inggeris. Maklum balas pelajar menunjukkan keupayaan mereka megenalpasti tujuan penggunaan ciri-ciri bahasa lisan dalam pengajaran yang diamalkan oleh STTs. Namun, mereka tidak semestinya mengaplikasikan pengetahuan tersebut untuk membantu proses pembelajaran. Dapatan kajian ini memberikan gambaran yang lebih holistik dan pragmatik berkaitan penggunaan bahasa lisan dalam pengajaran Sains dalam Bahasa Inggeris. Ini boleh membantu guru dan guru pelatih membuat keputusan yang lebih tepat berkaitan pengajaran mereka.

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LIST OF ABBREVIATIONS

CA	Conversation analysis
CCM	Constant comparative method
CI	Communication intention
CIs	Communication intentions
COLT	Communicative Orientation of Language Teaching Observation Scheme
CS	Communication strategy
CSs	Communication strategies
DM	Discourse marker
DMs	Discourse markers
DMgmt	Discourse management
DRpr	Discourse repair
EAP	English for Academic Purposes
Ep	Elicitation probe
ESP	English for Specific Purposes
EMS	English for Mathematics and Science
ETeMS	English for the Teaching of Mathematics and Science
FIAC	Flanders' (1970) Interaction Analysis Categories
FLINT	Moskowitz's (1971) Foreign Language Interaction system
IRF	Initiation-response-follow-up move
ITAs	International teaching assistants
L1	Bahasa Malaysia
L2	Second language / English language
MUET	Malaysian University English Test
NNS	Non-native speakers
NNSs	Non-native speakers
NS	Native speaker
NSs	Native speakers

NVC	Non-verbal communication
RQ	Research question
RQs	Research questions
S	Student
Ss	Students
SPC	Bachelor of Science with Education (Chemistry) programme
SPF	Bachelor of Science with Education (Physics) programme
SPEAK	Speaking Proficiency English Assessment Kit
SPN	Bachelor of Science with Education (Science) programme
STT	Science teacher trainee
STTs	Science teacher trainees
SR	Stimulated recall
T	Teacher
TA	Teaching assistant
TAs	Teaching assistants
TIMSS	Third International Mathematics and Science Study
TT	Teacher trainee
UHB1412	English for Academic Communication course
UHB2422	Advanced English for Academic Communication course
UTM	Universiti Teknologi Malaysia

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CHAPTER 1

INTRODUCTION

1.0 Introduction

The relationship between technological advancement and science education in particular, is symbiotic and cyclical in nature. On the one hand, science has the power to influence society as it fosters technological advances which continuously alter the way we live (Longbottom and Butler, 1999). On the other hand, as society becomes increasingly discerning of the benefits produced through science and technology, the quality of life in the future would depend greatly on the knowledge and skills acquired through science education (American Association for the Advancement of Science, 1993). Furthermore, being literate in these subject domains is perceived as giving a person a competitive edge to compete in today's global marketplace (Hannover and Kessels, 2004). In view of this, it is thus natural for scientific research to be one of the first areas to become global in nature, with post-doctoral scientific education following close behind. With this trend, it is envisaged that lower-level science education encompassing undergraduate and school levels will also become progressively globalised (Charlton and Andras, 2006).

Becoming globalised implies a need for standardisation in communication. As most sciences depend upon spoken and written language forms for their communication, this would entail the use of a shared language recognised internationally. The English language, mainly due to historical circumstances, information access and economic development, has dominated international communication (Kaplan, 2001). Due to these factors, it was natural for English to become the de facto choice as the international language for science.

English has since taken over the key registers of science (Kaplan, 2001) and is now the communication language of significant scientific research both at the intra- and inter-personal levels (Charlton and Andras, 2006). Thus, utilising the English language

in science education would undeniably benefit the participants. Non-conformation to using English in the teaching and learning of science and technology based subjects would put both individual citizens and educational institutions of the excluded nation at a disadvantage (Charlton and Andras, 2006). Citizens of the excluded nation could be prevented from attaining their full individual potential due to their inability to communicate effectively in the global science language. Similarly, educational institutions of non-participating nations would be hindered by their inability to expand their science based programmes as they are neither able to recruit international students nor staff members due to language barriers.

In view of this, many Asian countries, namely Japan, China, South Korea and Taiwan, which had previously ignored the English language in favour of the vernacular language, are now promoting the English language in education. For instance, top schools in large cities in China have started teaching mathematics and science in English (Nunan, 2003), whilst prestigious universities such as Beijing University and Qinghua University have begun using English language textbooks in some of their courses and plan to conduct lectures in English for certain disciplines such as biology and information technology (International Herald Tribune, 2002).

Malaysia was no different. Acknowledging that the English language is crucial to acquiring science and technology related knowledge which leads to human capital competitive advantage, the government, in 2002 announced that commencing 2003, English would be used as the medium of instruction in the teaching and learning of mathematics and science subjects. It was envisaged that by adopting English in the teaching and learning of science, Malaysians would be able to keep abreast with developments in science and technology through their ability to comprehend English language scientific texts (Ministry of Education Malaysia, 2006a, 2006b). However, merely equipping Malaysians with the ability to access global knowledge is insufficient in itself. Another important element is the ability to articulate the acquired knowledge (Mohd Ridzuan Nordin, 2001). Thus, using English as the medium of instruction in science and technical subjects was also a move seen to provide opportunities for learners to use the English language in the science and technology context, thereby enhancing their English language proficiency level (Ministry of Education Malaysia, 2006a, 2006b).

The move, from using Bahasa Malaysia (L1), to English, the second language (L2) in the teaching of science, in national schools, although perceived to be desirable and progressive, changed the dynamics of teaching and learning science in Malaysian classrooms. Subject specialists, who were previously able to deliver the content effortlessly via the L1, had to grapple with the task of imparting the content of the subject via the L2. Learners, instead of only having to concentrate on understanding the content of what was being taught, had to understand the language in which the subjects are taught. This resulted in the government's policy on the teaching of mathematics and science in English meeting resistance from both academic and non-academic quarters. The government finally relented to the pressure, and in July 2009 announced that the policy would be reversed (Star, 2009a). This means that the medium of instruction in the teaching and learning of mathematics and science would revert to the previous policy of using the L1 in national schools.

However, the changes would be implemented in stages as shown in Table 1.1, with the teaching of mathematics and science fully reverting to the L1 in the year 2016 for secondary schools, and 2017 for primary schools.

Table 1.1: Medium of Instruction for Teaching Mathematics and Science in National Schools

Year	2010	2011	2012	2013	2014	2015	2016	2017
Primary Schools								
Primary 4	L2	L2	L1/L2	L1/L2	L1/L2	L1	L1	L1
Primary 5	L2	L2	L2	L1/L2	L1/L2	L1/L2	L1	L1
Primary 6	L2	L2	L2	L2	L1/L2	L1/L2	L1/L2	L1
Secondary Schools								
Secondary 4	L2	L2	L1/L2	L1/L2	L1/L2	L1	L1	L1
Secondary 5	L2	L2	L2	L1/L2	L1/L2	L1/L2	L1	L1

Where L1 = Bahasa Malaysia, L2= English

(Source: Star, 2009b)

Additionally, it was also announced that the teaching of mathematics and science would remain in English for Secondary Six, Matriculation colleges as well as public and private tertiary institutions (Star, 2009a). Thus, despite a reversal in policy, English will continue to play a pivotal role in the teaching and learning of science and mathematics subjects.

This chapter provides the background and rationale for undertaking this study. Section 1.1, presents an overview of the educational system in Malaysia leading to current challenges in implementing the L2, namely English, as the medium of instruction in science education. This is then followed by the statement of the problem in 1.2. Section 1.3 briefly discusses the conceptual framework of the study. In 1.4 and 1.5, the study's objectives and research questions are presented. Next, the operational definition of terms employed in the study is defined in 1.6. The scope and significance of the study is addressed in 1.7 and 1.8 respectively. The chapter is finally concluded in 1.9.

1.1 Background to the Problem: An Overview of the Role of English in Malaysian Education

The British colonisation era before World War II saw the formation of both vernacular and English medium schools in Malaysia. The English medium schools, comprising either missionary or government schools, were better organised and more developed than the vernacular schools. This resulted in such schools attaining a prestigious status as it was felt that the type and depth of knowledge offered in the schools were better than the ones offered in vernacular schools (Gaudart, 1987). This notion was further propagated by the fact that success in English medium schools would result in the attainment of good jobs and white-collar employment (Koh, 1967). The English language proficiency level of both teachers and learners produced by the education system then, was never in question as the curriculum of the English medium schools was based on the Education Code of 1899. This code emphasised the importance of teaching English by making English grammar and construction a class subject as well as integrating English vocabulary and composition with reading, writing and arithmetic subjects (Kok, 1978).

Although the English medium schools were successful in providing knowledge to learners, their major weakness lay in the transmission of western values alien to Malaysian culture. In other words, while vernacular schools reinforced the group identity of each of the three major groups comprising Malay, Chinese, Indian, the English medium schools imparted western values to its students, weakening their cultural loyalties towards Malaysia (Gaudart, 1987).

This divide was realised by the Malaysian Education Committee of 1956, who published a document known as the Razak Report which made recommendations aimed at removing such divisions and inequalities in education. Although the Razak Report did not object to the learning of three languages in secondary schools or to the use of more than one language in the same school as the medium of instruction, it puts forward a policy which was to change the fabric of education in Malaysia. This policy was related to converting the then government English medium schools into 'standard schools' in which the national language would be the main medium of instruction. (Razak Report cited in Keng Yang Pei, 2003)

The policy was eventually effected through the Education Act of 1961, which views the Malay language as a unifying feature in the education system. This policy was implemented in stages, to ensure a gradual transition (Rahimah, 1998), with the process being completed in 1983 (Pillay, 1998). The implementation of the Act resulted in the use of the Malay language, which was assigned the constitutional status of Bahasa Malaysia, in schools. Thus, Bahasa Malaysia became the medium of instruction for all subjects except English, with English being relegated as only one subject among many, taught in schools.

The success of the national language policy had an adverse effect on Malaysians' ability to speak and write in English. Although English is deemed to remain as the second important language in Malaysia (Asmah, 1992), in reality, it is now more of a foreign language rather than a second language (Nunan, 2003). In fact, anecdotal evidence supported by reactions from the Ministry of Education, suggests that even English language teachers, particularly those teaching in the rural areas, lack English language proficiency (Nunan, 2003). With such a dismal scenario on the decline of English proficiency in Malaysia, the announcement by the Malaysian government in 2002 to implement English as the medium of instruction in mathematics and science subjects raises an immediate concern of whether teachers are able to deliver the subjects effectively in the English language.

To mitigate this problem, The Ministry of Education took steps to equip practising mathematics and science teachers with the necessary English language skills. The foundation to the English for the Teaching of Mathematics and Science (ETeMS) in-

service training programme, is the belief that practising teachers would be able to teach their respective content subjects in English through the development or the re-activation of the teachers' English language proficiency level (ETeMS webpage, n.d.). To achieve this goal, the programme provided opportunities to develop language in three broad areas: i) for accessing information, ii) for teaching mathematics and science, and iii) for professional exchange (ETeMS Module, 2003). The ETeMs programme involved a total of 240 hours of instruction conducted in two phases as shown in Table 1.2 below.

Table 1.2: Structure of the ETeMS Programme

Description of Modules	Hours	Content Allocation
Phase I • 5 modules distributed over a period of 5 weeks (2 days per module, covering a total of 12 hours per module) • 5-day module • Self-instructional package	5 modules x 12 hours = 60 hours 30 hours 30 hours	70% allocated to language for teaching mathematics and science 30% allocated to language for accessing information
Phase II • 5 modules distributed over a period of 5 weeks (2 days per module covering a total of 12 hours of interaction) • 5-day module • Self-instructional package	5 modules x 12 hours = 60 hours 30 hours 30 hours	More time allocated to language for teaching mathematics and science Less time allocated to language for professional exchange

(Source: ETeMS Webpage, n.d., http://www.tutor.com.my/tutor/etems/)

In developing mathematics and science teachers' English language for teaching purposes, the focus of the Ministry of Education, Malaysia is on, "… typical language forms and functions commonly used in the mathematics/science classroom." (ETeMS Module, 2003) : iii). A scrutiny of the 5-day training modules reveals that in terms of language function, this involves ones such as drawing attention, praising, questioning and responding to answers, whilst language forms involve focusing on verbs and mathematical expressions.

All practising mathematics and science teachers were required to attend the ETeMS training programme module as stipulated by the ministry, after which they had to sit for an English language proficiency test. An informal interview session with officers from the English Unit, Johor Education Department revealed that if teachers did not meet the set passing grade, they would then need to undergo another English language course known as the English for Mathematics and Science (EMS) programme, before again sitting for the proficiency test. The EMS programme resolves to aid

participants in problematic areas related to grammar, pronunciation, terminology and vocabulary as well as in oral skills (EMS Module, 2003).

However, despite such a large scale and concerted effort, a study conducted by the Ministry of Education in 2008 found that on average, only 53 percent to 58 percent of teachers fully used English to teach the two subjects (Star, 2009a). This is somewhat unsurprising because even during its initial inception, it was found that although teachers support the use of English as the medium of instruction in the teaching and learning of mathematics and science (Pandian and Ramiah, 2004), a significant percentage of respondents indicated their reservations of their English language spoken ability in the classroom (Hamidah Ab Rahman et al., 2005) with a high percentage admitting to needing help in spoken English (Noraini Idris et. al., 2007).

Other studies continue to provide evidence to support the important role of teachers' oral instructional language in formal classroom settings. For instance, needs assessments of practising mathematics and science teachers teaching in English revealed that practising teachers rate oral instructional English language ability as the most crucial in implementing the teaching and learning of science and mathematics in English (Noraini Idris et al., 2007; Hamidah Ab Rahman et al., 2005). In addition, comprehension of oral language has been deemed to be one of the key elements which facilitates the acquisition of basic academic skills and content-area information (Lloyd et al., 1980).

However, what constitutes effective oral instructional language in the L2 science classrooms remains obscure. Yore and Treagust (2006) reported that an informal survey of science teaching articles in teacher journals found that the suggested language applications for science classroom practice have not been substantiated empirically. Instead, the suggestions tend to be based merely on personal experience and opinions. Relying on experiences occurring in specific contexts or intuitions which are prescriptive in nature could result in the English language training of both experienced and novice L2 science teachers to be either inaccurate or unsuitable. Inaccurate, as the language prescribed might not be the one which is naturally occurring in the target speech community. Unsuitable, as prescriptive materials are usually written for a native speaker (NS) audience which non-native speakers (NNSs) find to be difficult, incomprehensible or offensive (Dubois, 1986).

A good place to start in order to make informed decisions pertaining to the oral instructional language needs of science teachers in the L2 science classrooms would be to investigate the target speech community itself. However, as mentioned earlier, practicing mathematics and science teachers in Malaysia had in fact received English language training through the ETeMS in-service training programme. Thus, taking this group of teachers as participants might not provide an accurate picture of their actual needs as any data collected might instead reflect the effectiveness or ineffectiveness of the ETeMS programme.

In contrast, science teacher trainees (STTs) are a group of teachers who have largely been ignored and whose English language training has not been seriously addressed. Thus, investigating STTs' oral instructional language features in the L2 science classroom could provide a more accurate picture of the oral instructional language needs of L2 science teachers.

1.2 Statement of the Problem

Goodlad (1990) suggests that one of the factors contributing towards a successful teacher trainees' professionalization process is by improving their learning process. Without adequate support in the training process, teacher trainees are likely to adopt practices they experienced as students (Goodman, 1986), which might or might not be effective in the teaching and learning process. The arguments put forth suggest that the language training of STTs could be an important factor in shaping not only their teaching practices but also their thinking which would be crucial to the successful implementation of any education policy.

However, current practices in teacher training programmes tend to emphasize content-area knowledge, pedagogical knowledge and general education courses (National Research Council, cited in Kang, 2007). This emphasis is understandable, as several research studies have found that lack of content-area or subject knowledge can be a barrier against better science teaching (Halim and Meerah, 2002). In other words, teachers with inadequate pedagogical knowledge and ineffective teaching methods or

classroom management would result in the teacher not being able to impart knowledge to the learners (Van Leuvan, 1997). Nevertheless teacher training programmes which ignore teachers' oral instructional language needs might be inadequate because language is needed to reformulate thought processes (Vygotsky, 1978). In other words, being good at doing mathematics or science does not equate to being good at teaching them (Ozgun-Koca and Sen, 2006) as effective language in which to impart the knowledge is also an important element.

Universiti Teknologi Malaysia's (UTM) Mathematics, Science and Technical Education programmes have adopted a view similar to various other teaching associations such as the Mathematics and Science Teaching Associations and the Education Associations (Committee on Science and Mathematics Teacher Education, 2000) which contribute effective teaching to three main elements, namely knowledge of content subject, pedagogical courses and practice and lastly general education courses. This is evident from UTM's Mathematics, Science and Technical Education programme description summarised in Table 1.3.

Table 1.3: Classification of Subjects in Terms of Percentages for Mathematics, Science and Technical Education Programmes in UTM

	Classification of Subjects	Percentage (%) Range
A.	Fundamentals of Education a) Theory Based b) Final Year Undergraduate Project c) Information Technology and Multimedia	17.89 - 19.70
B.	Subject Matter and Methodology a) Lecture b) Laboratory	59.35 – 60.2
C.	Practicum a) Micro Teaching b) Practicum	7.3 – 9.76
D.	Contemporary Issues in Education and Society a) University Compulsory Subject	6.5 – 6.6
E.	Personal Development a) Language b) Co-curriculum	6.5 - 6.6

Source: Faculty of Education Academic Guidelines, 2006/2007, UTM

Table 1.3 indicates that content, pedagogy and general education courses (Components A, B and C), form the bulk or approximately 90% of UTM's mathematics, science and technical education programme. The remaining 10% of the programme has been allocated to exposing learners to contemporary issues in education and society

(component D) and to enhancing self-development (component E). Although these teacher trainees are required to take English language courses (component E), these courses are academic in nature (Faculty of Management and Human Resource Development UTM Academic Guide Book 2007/2008). Like other English for Academic Purposes (EAP) courses, the main objective is to facilitate learners' study or research in the English language (Flowerdew and Peacock, 2001). Such EAP courses are thus designed to meet learners' current English language needs as students rather than their future English language needs as mathematics and science teachers.

This implies that one area which has not received due recognition in teacher education in general, is the importance of providing teacher trainees with effective language with which to impart knowledge. This oversight is still prevalent despite the call from several researchers, who have promulgated the inclusion of linguistic knowledge as one of the elements to be included in the repertoire of all teachers (cf. Dutro and Moran, 2003) and the value of integrating content and language (cf. Bruna et al. 2007).

The importance of effective use of language in content or mainstream classrooms cannot be underestimated even if the medium of instruction is in the native language of both teachers and learners. This is because every subject area has its own specialised language style dictated by the use of vocabulary, grammar, idioms and metaphors as well as the avoidance of stylistic devices found in other kinds of language (Lemke, 1990). However, in countries such as Malaysia, where non-English speaking students are enrolled in subjects where the medium of instruction is English, the mainstream teachers' language use plays an even more critical role. This is due to the fact that there is evidence which links learners' failure in mainstream classrooms to inadequate language support provided by the teachers (Clegg, 1996). Such findings underscore the importance of teachers supporting the learning needs of learners through the use of appropriate language in the classroom.

Numerous studies in both second language classrooms (cf. Jarvis and Robinson, 1997) and mainstream classrooms (cf. Bruna et. al., 2007) focusing on the impact of content-contextualised teachers' use of the language on learners' understanding, have supported the notion of the importance of teachers' oral language in the classroom.

However, all these studies have made use of native or near-native teachers who do not have problems in using the language as the medium of instruction in the classroom.

In other words, the findings of these studies might not be directly applicable to the Malaysian context or other countries with English as a second or foreign language. Here, the context involves mainstream teachers who are non-native speaker (NNS) of English, who might or might not be highly proficient in the English language, and yet have embraced English as the medium of instruction in teaching the content area. In an L2 language classroom context, experts argue that in order for the pedagogical objectives to be achieved, the teachers should have native or native-like fluency or at least a high proficiency level of the language (Nunan, 2003; Marinova-Todd et al. 2000). However, it is not clear whether the same English language expectations should be applied to NNS teachers using English as a medium of instruction in mainstream classrooms. Alptekin (2002) for one argues that training NNS to attain native like communicative competence is a massive undertaking which might not be achievable. Perhaps a more realistic approach would be the one advocated by Hoekje and Williams (1992) who suggest that a more realistic expectation is for the NNS teachers to attain L2 proficiency level which reflects both the context in which the L2 is used and the role of the NNS as teachers. It is this latter view which this study intends to pursue. It intends to investigate specific oral instructional language features that NNS STTs employ in the L2 science classroom, and the influence these features have on students' understanding.

1.3 Conceptual Framework of the Study

In investigating STTs' oral instructional language features, several key concepts shown in Figure 1.1 are addressed.

Sinclair and Coulthard's (1975) descriptive framework, particularly at the rank of exchanges and acts, were used to analyse STTs' oral discourse in the L2 science classroom. However, the acts in particular were not categorised rigidly based on Sinclair and Coulthard's framework. Instead, deletions, modifications and additions were made to reflect information as generated by the data. This flexibility was incorporated so as to better reflect the particular context and setting of the L2 science classroom.

The conceptual framework of the study also included Canale and Swain's (1980) and Canale's (1983) Communicative Competence Theory. Although they posited four components of communicative competence comprising grammatical, sociolinguistic, discourse and strategic competence, this study discusses STTs' communicative competence only in terms of discourse and strategic competence. The sub-areas under these two communicative competence components were further refined to include only the following: i) under discourse competence, the focus is on STTs' ability to generate discourse cohesion via the use of macro and micro discourse markers, and ii) under strategic competence, the focus is on STTs' conscious and unconscious use of both verbal and vocal communication strategies employed to either compensate for communication breakdown due to limiting conditions such as memory decay or L2 deficiencies, or to enhance communicative effectiveness, for instance through the use of repetition.

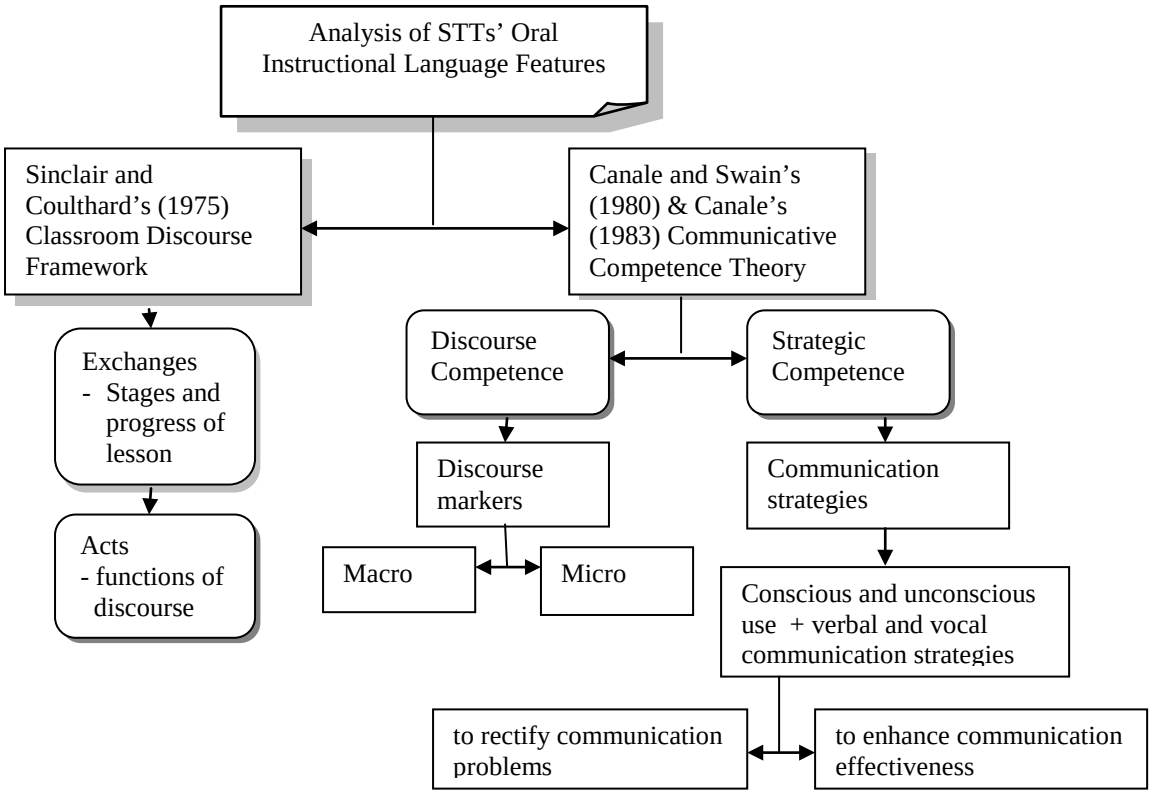

Figure 1.1: Conceptual Framework of the Study in Investigating Science Teacher Trainees' Oral Instructional language Features in the L2 science Classroom

The rationale for including the identified key concepts in this study is discussed in Chapter 2.

1.4 Objectives of the Study

The main aim of this study is to identify and describe STTs' oral instructional language features in the L2 science classroom. In particular, this study is interested in investigating the acts generated by STTs in the L2 science classroom. Additionally, this study also examines STTs' use of both macro and micro discourse markers, and STTs' employment of communication strategies in the L2 science classroom. Finally, the study seeks to gain better insights into how the acts generated by STTs and their use of discourse markers and communications strategies may help promote understanding in the L2 science classroom. This is expected to be achieved by exploring STTs' and students' perceptions on the meanings and uses of the respective acts, discourse markers and communication strategies employed by STTs in their oral instructional language in the L2 science classroom.

1.5 Research Questions

In attempting to address the objectives of this study, the following research questions are posed:

RQ1 What oral discourse features do science teacher trainees employ in the L2 science classroom instruction?

a) What acts are used?
b) What discourse markers are used in the acts?
c) What communication strategies are used in the acts?

RQ2 What are the perceptions on the meanings and uses of acts, discourse markers and communication strategies in science teacher trainees' oral instructional language?

a) Which acts are perceived by students as facilitating their understanding?
b) What are the science teacher trainees' and students' perception on the meanings and uses of discourse markers?
c) What are the science teacher trainees' and students' perception on the meanings and uses of communication strategies?

1.6 Operational Definition of Terms

The operational definitions of key terms employed in the context of this study, sequenced in alphabetical order for ease of reference, are as follows:

- Acts : Functions of the discourse which takes into account the context of an utterance preceding or succeeding it in the discourse. (e.g. the informative act functions to provide information to students, the elicitation act functions to elicit or request a linguistic response from students).
- Communication strategies : Conscious and sub-conscious use of both verbal and vocal communication strategies to either solve communication problems or enhance communication effectiveness
- Discourse markers : Structuring and organising linguistic cues used to mark relationships between discourse at the macro or global text structure, and at the micro or clause text structure.
- L2 science classroom : Use of the English language (L2) as the medium of instruction in teaching science, where neither the teachers' nor the students' native language is the L2.
- Oral instructional language : Verbal language generated by teachers in the classroom within a pedagogic context which serves some form of pedagogic focus (e.g. for curriculum access, for classroom management purposes, for interpersonal or affective purposes).
- Utterance : A stream of speech with at least one of the following characteristics: i) under one intonation contour, ii) bounded by pauses, and iii) constituting a single semantic unit.
- Understanding : Awareness of meanings and uses of specific oral language features. The term understanding is also used interchangeably with the term comprehension.

1.7 Scope of the Study

Several criteria have been used to limit the scope of this study. First, is the subject content area observed. Although the Faculty of Education, Universiti Teknologi Malaysia offers fourteen educational programmes, they can effectively be

categorised under four main areas namely: i) Bachelor of Science with Education (Sciences), ii) Bachelor of Science and Computer with Education (Sciences), iii) Bachelor of Science with Education (Social Sciences) and iv) Bachelor of Technology with Education (Technical and Vocational). Each category has its specific programme objectives, programme learning outcomes as well as classification of subjects (Faculty of Education Academic Guidelines, 2006/2007) Thus, in view of this information, it is prudent to select one category from the four. As the study intends to investigate the use of English in the L2 science classroom, the natural choice would be to select the Bachelor of Science with Education (Sciences) programme. This programme can be further subdivided into four programmes with students majoring in Science, Physics, Chemistry and Mathematics. Further scrutiny of the subjects' curriculum specification revealed that Chemistry and Physics teachers are required to imbue learners with the same scientific and thinking skills (Ministry of Education Malaysia, 2006a, 2006b). The similarities in terms of input received by the teacher trainees as well as the output required of them in the L2 science classrooms make them the obvious choice for the study. Thus, for this study, the subject content area to be observed will be Physics and Chemistry. However, they are not regarded as separate entities. Instead, these two subjects are treated as one entity under the umbrella term of science subjects.

Next, is the classroom observed. An informal interview with the Practicum teaching coordinator from the Faculty of Education, UTM revealed that it is compulsory for teacher trainees majoring in Physics or Chemistry to teach at least one Physics or Chemistry class – depending on their major – at Secondary Four level. However, if requested by the school to which they are attached, in addition to the Secondary Four Physics or Chemistry subjects, the teacher trainees might have to teach science at either the Secondary One or Secondary Two levels. The teacher trainees are not allowed to teach either the Secondary Three or Secondary Five levels as students in these classes will be sitting for major national examinations. Based on this information, it is felt that the best classroom to be observed would be the Secondary Four Physics and Chemistry classes. In addition, observing Secondary Four Physics and Chemistry classes would result in a high probability of mitigating any variables brought by learners attending the classes. This is because the learners would have been exposed to the same amount of formal education in science and English language.

The third limiting scope is related to the type of data to be collected. The focus would be on the oral instructional language produced by the STTs. For the purpose of this research, oral instructional language has been defined to include verbal language generated by STTs in the classroom within a pedagogic context which serves some form of pedagogic focus such as to impart content knowledge, to manage classroom activities, or to create teacher-student rapport. This would involve analysing data collected which would include any oral language produced by STTs, including oral interaction occurring in the classroom between teacher and student, regardless of whether it is teacher or student initiated. However, any student-student interaction which does not involve any participation of the teacher has been excluded.

This study intends to investigate STTs' oral instructional language which is very much related to their communicative competence. However, the focus would be on discourse and strategic competence, rather than grammatical and sociolinguistic competence. Grammatical competence is perceived to play a secondary role in promoting understanding in spoken discourse. This is because misunderstanding rarely occurs even if non-standard grammar is used (Carter and McCarthy, 2006), due to the interactive, face-to-face nature of spoken language. Sociolinguistic competence is also seen as a non-issue in the classroom context due to the highly ritualised procedure occurring in the classroom (cf. Sinclair and Coultard, 1975), with both teachers and learners aware of the classroom convention. Due to these reasons, the study has chosen to investigate STTs' use of discourse markers which may be reflective of their discourse competence (Celce-Murcia, 2008; Carter and McCarthy, 2006) and their use of communication strategies which may be an indication of their strategic competence (Tarone and Yule, 1989; Canale and Swain, 1980) The scope of what entails discourse markers and communication strategies is further limited by their operational definition as postulated under their operational definition presented in sub-section 1.6.

Druckman et. al., (1982) identified four non-verbal communication (NVC) categories comprising vocal (paralanguage or prosodic devices), facial, body (kinesics) and visual. Of these four, only the vocal or the use of prosodic devices has been included to be part of the oral instructional language component to be analysed. This is due to findings of previous studies (cf. Leeser, 2004) which suggest that some paralanguage features do affect comprehensibility. Nevertheless, they were not the main focus of this

study, but form only a component of the communication strategies. Thus, no specialised machinery was used in their identification and description. The other three NVC channels, namely, the facial, body (kinesics) and visual components were not taken into consideration. Nonetheless, any significant influence of these three NVC channels on students' understanding and perception were duly noted to enrich the data.

Another criterion is the proficiency level of the STTs. Only those falling into the norm of the English language proficiency level displayed by the average UTM students were selected as samples for this study. Observation of STTs displaying English language proficiency level which is the norm for UTM students will tend to provide an unbiased set of data. Criterion for the norm is based on the STTs' achievement in the Malaysian University English Test (MUET) and the two English language courses they have taken at UTM. Only those who had achieved a specific band for MUET and a specific grade for both English language courses which is deemed to be the norm for UTM students were selected (Refer to Chapter 3 on how the norm is derived).

The final criterion is the duration of the L2 science lesson analysed. Data was collected via the observation of at least two science lessons from each participating science teacher trainee (STT). If a sub-topic in the first observed lesson required to be extended in the next lesson, then data for the consecutive observations were collected immediately from the following lesson. However, if a particular sub-topic was completed within the first observed lesson, then data for the second observation was collected at a slightly later date. The rationale for observing the classroom over a sustained period of time was to gain a more accurate picture of what is occurring in the classroom (Gibbons, 2003; Otha 2000). Furthermore, it could minimise the possibility of STTs producing 'show-piece' lessons (Andrews, 2007) and mitigate Labov's (1972) Observer's Paradox, which could cause STTs' speech habits to be influenced,

1.8 Significance of the Study

In light of the government's reversal in policy with the teaching of mathematics and science reverting back to the L1, the focus of this study becomes a moot point.

However, the policy of using the L2 as the medium of instruction in teaching mathematics and science at the Secondary Six, matriculation and tertiary levels remains unchanged, whilst the use of the L2 will only be completely phased out in both primary and secondary schools in Malaysia in the year 2017 (see Table 1.1). Thus, there is still a need to explore what transpire in the L2 science classroom, where neither the teachers nor the students are proficient in the language used as the medium of instruction.

This study is an effort to describe, analyse, and interpret authentic oral instructional language features employed by science teacher trainees in the L2 secondary science classroom. Thus, data collected from this research could act as baseline information in formalising and profiling effective oral instructional language features which could help facilitate students' understanding in L2 mainstream classroom in general, and L2 science classrooms in particular. Furthermore, findings of this study could be used for both pre-service and in-service training of L2 science teachers, which would allow them to make better informed decisions as to how to maximise the effectiveness of their oral instructional language in the L2 science classroom. Additionally, empirical evidence attained via this study could also be used to help enhance the awareness and self reflection of all science teachers involved in L2 science classroom. This in turn could act as a catalyst to empower these science teachers in making informed decisions as how to create joint understanding between themselves and students in the L2 science classroom.

Finally, this study offers a more holistic view of the oral instructional language occurring in the L2 science classroom. This was firstly achieved through the integration of both the etic or outsider perspective and emic or insider perspective. The employment of these two accounts is complementary in that they tend to result in the occurrences of checks and balances, which have a higher probability of generating more reliable findings. Secondly, a more holistic view was also achieved by extending the study to include not only a description of the features, but to also include an analysis of the features or the oral instructional language employed by STTs in the L2 science classroom. In other words, this study explores the link between what is articulated in the oral instructional language and how they are being articulated.

1.9 Conclusion

As this chapter has highlighted, English employed as a medium of instruction in the Malaysian science classroom context has been fraught with challenges. These challenges culminated in the termination of the educational policy, with the medium of instruction for the teaching of mathematics and science at both primary and secondary school levels reverting fully back to Bahasa Malaysia in the year 2017. Nonetheless, the government was still mindful of the key role that the English language continues to play in the acquisition of science and technology related knowledge. This has resulted in the continual use of the English language as a medium of instruction in the teaching of mathematics and science at the Secondary Six, matriculation, and tertiary levels.

In view of the fact that the English language continues to play a role in the Malaysian science classroom, findings of this study would still be very much relevant. Findings of empirical studies such as this one, which are based on actual language use in the L2 science classroom, would empower both science teacher trainers and practicing science teachers to make more informed decisions on linguistic elements which may help facilitate students' understanding.

The next chapter, through the review of literature, will first set the foundation for the conceptual framework of this study. This is achieved through the discussion of literature related to the approaches to analysing spoken language in the classroom, the communication challenges that non-native speaker teachers face in the classroom, and the English language competence needs of non-native speaker teachers. Following this literature linking discourse markers to discourse competence, and communication strategies to strategic competence are discussed. Then, the review on discourse markers and communication strategies will ensue.