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THE TEACHING OF SCIENCE IN ENGLISH IN THE MALAYSIAN CLASSROOM

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INTRODUCTION

In 2003, the Malaysian Government made a purposeful decision to change the medium of instruction for the teaching of Science and Mathematics from Bahasa Malaysia to English. This change was made as a step towards preparing the nation to face the economic globalisation (K-economy) as well as to develop the nation to be on par with the advancement of science and technology globally. This change poses a challenge to teachers who have been trained in Bahasa Malaysia and even for those who have been trained in English, as a large part of their professional experience involved the use of Bahasa Malaysia as a medium of instruction. What is more, teachers who were the products of the KBSM syllabus have learnt the subjects in Bahasa Malaysia and might be less familiar with the subjects in English. This unfamiliarity with the new medium of instruction might cause a gap in the fluency of speech during the delivery of the content. In spite of the directive given by the Ministry of Education that the entire teaching and learning process should be conducted in English, Science teachers may face difficulties in expressing himself/herself and thus, resort to the use of another language so as to “compensate for the deficiency” (Crystal, 1987).

Since the teaching and learning process involves not only the teachers, students may also be affected by this change. Most school students (other than those from English private schools) have been

learning most of their subjects in Bahasa Malaysia other than the English subject. Schools that offer an English speaking environment are rare and usually limited to the premier schools as well as schools in the urban areas. In a study conducted by Mohd Sofi Ali (2005) on the use of the English language in three primary schools in the east coast of Malaysia, it was found that the use of the English language was limited only to the English subject classroom and English as an interaction medium outside the classroom was “practically non-existent”. Students from other regular government schools and schools which are away from the main cities’ influence might have less exposure to an English speaking environment.

Moreover, it is supposed that in areas away from cities, English is not a language that is commonly used as everyday language for transactions or even conversations. Pillay (1995, as cited in Pillay, 1998), in her case study of five different secondary schools indicated that there are serious issues of differences between the level of competency in English between urban and rural schools. It was found that students who have high levels of competency tend to come from English speaking homes, have greater exposure to English outside the classroom and tend to come from the higher socio-economic status group while those who are less competent in the language come from either rural schools where exposure to English is limited or from low socio-economic groups in urban areas.

It is the concern of teachers and parents that these students might face difficulties in coping and understanding the teaching and learning process as they have less exposure in listening to spoken English for input. Students who come from non-English speaking environments have no scaffolding provided for developing their listening skills as the use of the language is usually confined to the language classroom only. In addition to that, students are no longer learning English as a subject but they are now required to use English to learn a subject. Inability to understand the language might result in failure of coping with the teaching and learning process, which might cause loss of motivation and interest in the subject. In order to prevent these detrimental effects from happening, teachers might

resort to using a more ‘familiar’ language to teach; one that the students can comprehend sufficiently to help them understand and access the knowledge.

In a study conducted by Ambigapathy and Revathi (2004), much has been revealed about the teacher’s opinions on the use of the English language to teach Science and Mathematics. Although many indicated that they felt confident in coping with the change, the teachers admitted that they were still prone to using Bahasa Malaysia to explain concepts to students. It was found that 81.8 percent of the respondents studied used the L1 (Bahasa Malaysia) to explain concepts when students faced problems in understanding these concepts in English. These teachers maintained that students’ low proficiency in English was the cause for using Bahasa Malaysia in class.

In addition to that, a study conducted recently by Hamidah et.al (2005) to investigate the effectiveness and adequacy of training programs offered by the ministry to prepare teachers to teach Mathematics in English revealed that while there is improvement and increase in confidence to teach in English, about 40 percent of the teachers surveyed still faced problems in the area of speaking whereby “they have problems in expressing ideas (...) and some difficulties in expressing opinions in this language”. Therefore, it is shown that while teachers have the confidence to teach, they may still be lacking in terms of the ability to manipulate the language for instructional purposes and that students’ low proficiency level is one of the reasons for using Bahasa Malaysia as they are unable to comprehend the content of a lesson taught in English.

Based on the concerns mentioned, this study was conducted to investigate if alternative languages are used in the teaching of Science and the reasons for using the alternative languages in the Science classroom. Although it seemed that alternative languages are needed to support and facilitate the learning of Science, the over-use of the L1 could propel the teaching towards a Concurrent Translation bilingual teaching model which has its disadvantages in the classroom. As Faltis (1997) points out, although the purpose

of translation is to ensure that all the students can understand what is being taught, students usually ignore the second language and wait instead for information to be provided in their native language (Saville & Troike, 1971), and so they are less likely to develop high levels of English language proficiency and their native language is likely to suffer as well.

Therefore, it seems that teachers should be very careful when using different languages to teach content to bilingual or multilingual students. However, this does not mean that translation or the use of another language in the classroom is prohibited. Sert (2005) suggested that one should have at least an understanding of the functions of switching between the native and foreign languages and its underlying reasons. This understanding will increase the awareness of the choice of language in the classroom discourse. Sert (2005) explained that the teacher's switching of languages is not always performed consciously; which means that the teacher is not always aware of the functions and outcomes of the switching process. Ferguson (2003), in Üstünel and Seedhouse (2005), used recent significant studies of classroom code switching to suggest that classroom code switching can be classified into three main categories according to the pedagogical functions of classroom discourse. They are code switching for curriculum access, for classroom management discourse and for interpersonal relations.

The reason for code switching in the classroom was found to be done usually out of concern for the students' learning process. Based on studies suggested by Castellotti (1997) and Martin (1999), Ferguson (2003) suggested that code switching plays a significant role in providing access to English medium text and in scaffolding knowledge construction for students with limited command of the English language. Martin (1996) looked into three different English-medium content classrooms, which are the History, Science and Mathematics classes, and found that "code-switching was most common in History and then Science lessons, and least common in Mathematics lessons." Nevertheless, the reasons for using code switching was similar in that the teacher realises that students

face “difficulties in the comprehension of the lesson content and resorts to whatever linguistic resources” in order to overcome these problems.

The second function of code switching suggested by Ferguson (2003) based on studies by Canagarajah (1995) was its use to manage the classroom whereby the teacher switch from one language to the another to “discipline a pupil, to attend to latecomers, (and) to gain and focus pupil’s attention”. Code switching here was seen as an act of diversion from the lesson for the purpose of managing students’ behaviour and learning in the classroom. One interesting function highlighted by Ferguson (2003) was the use of code switching as an “attention-focusing device” to re-direct students’ attention and this is usually done at the beginning of a new topic. Flyman-Mattson and Burenhult (1999) identified similar functions but this category was labelled as “topic switch” in that topic change will result in a change in language. Flyman-Mattson and Burenhult (1999) proposed two possible reasons for this kind of change. The first was that “the message in the utterances is so important that the teacher is not willing to risk misinterpretation on the part of the affected students” and the second was similar to Ferguson (2003) in that “code switching is used as an instrument to get students’ attention.”

Both Adendorf (1993) and Merritt (1992) had investigated social and affective classroom environment and found that code switching was also used to negotiate and establish relationships and identities. Flyman-Mattson and Burenhult (1999) also identified similar functions in their findings where by code switching played “socialising functions” and “affective functions”. Code switching was used by the teacher to “signal friendship and solidarity by using the addressee’s first language” as well as to signal affective functions such as to “express sympathies”, “express anger” and so on. The teacher may choose to use a different language when speaking to the students to create a more comfortable learning environment, and thus, lower down their affective filter before the learning begins. However, the teacher can also choose to switch back to the unfamiliar language to indicate seriousness in the next part of the class. Based on Soo’s

(1986) study, the choice to use a more distant language is made to make the command more serious and formal, and since the teacher in Malaysian classrooms are also bilingual or multilingual, it is not surprising that this choice of language is done sub-consciously and automatically.

These findings from previous researches have revealed that there is a role for code switching in the classroom; be it the content classroom or the language classroom and that the choice of using one language or another in the classroom has important pedagogical impact.

METHODOLOGY

This study focused on only one Science teacher, who himself studied and trained under the KBSM syllabus. This teacher, T, was teaching three Form Two Science classes - Form 2.3, Form 2.4 and Form 2.7. Form 2.3 and 2.4 are considered classes with average academic performances while Form 2.7 consists of students who are academically weak. However, the general command of English is rather weak and the proficiency level in all three classes range from beginner to lower intermediate with the majority at the beginner's level while only a handful belonged to the lower intermediate level. As a large part of the classroom activities and pedagogical role of a teacher require him to speak such as giving instructions and explanations, this study focused only on the use of alternative languages during the teacher's spoken discourse. T was audio-recorded, observed and interviewed over a period of two weeks. T was interviewed at the beginning of the data collection to gather information about his background and opinion about the use of English in the teaching of Science as well as about the classroom setting and composition. Later, another interview using the Stimulated Recall technique (Nunan, 1992) was conducted by getting him to comment on what was happening using the transcribed lessons.

A basic transcription system was used because the focus of this study was on the use of the alternative languages and not on the specific features of the discourse.

Symbol	Meaning	Example
T	Teacher	-
S	Student	-
Ss	Students	-
La	Lab Assistant	
Capital Letters	Raised volume	HA?
// ... //	Overlap (two persons talking at the same time)	T: //K, it's all in your SPS book// S: //Cikgu, buat ni dua ah?//
xxx = = xxx	Latching (immediate continuation from the previous speaker)	T: Mana buku? = S:= Ah, buku apa?
...	Prolonged sound	T: Ah...
Xxx -	Truncated sentence	T: One black -
(.)	Pauses below 5 seconds	T: One black box (.) plasticine (.)
(n)	Pauses for 5 seconds and above with "n" number of seconds.	T: Draw one line (5) Ok, then... T: Same. Don't do it. (10) Buku? SPS?

Table 3.0: Symbols used for the transcription of the audio recordings

The transcribed data was later analysed and interpreted using a cue-response system adapted from Jacobson's (1982) New Concurrent Approach found in Faltis (1996). This framework provided a means of categorising the data into different "cues" at which the alternative language was used and provided several reasons for the use of different languages during the teaching of a content subject.

USE OF ALTERNATIVE LANGUAGE IN THE SCIENCE CLASSROOM

A total of 12 classes were observed and an average of 11 hours of recordings revealed that the teacher did use an alternative language during the teaching of Science, which is Bahasa Malaysia (BM). Extracts below are examples of use of BM during the teaching of Science. The number in the bracket () indicates the number of extract. "Tn" indicates the number of transcription from which the extract is taken and the numbers after that indicate the lines at which the utterance can be found.

<i>(1) [T11:139-40]</i>	
T:	<i>Ok. Sounds are produced by vibration. Ok, bunyi dihasilkan melalui getaran.</i>
<i>(2) [T9: 75-76]</i>	
T:	<i>Page twenty six checkpoint one point seven (.) do it now (.) Then, saya dah bagi latihan sebelum ini kan? K, buat mind-mapping dekat dalam buku nota.</i>

It was also observed that T's use of BM varied in frequency depending on the proficiency level of the students. However, this study did not investigate in depth the frequency of BM used in the classrooms as it would require a different type of analysis. Nevertheless, a quick glance at the transcriptions showed that BM occurred in almost every line especially when the teacher is not teaching content. This was done by looking at the amount of lines which contained BM in each transcription. This suggests that BM was used in the Form 2.7 classroom more frequently compared to the other two classes. T confirmed this observation and explained that this was due to the low language proficiency level among the students in the class although T claimed that even with the use of BM, there were still some students who faced problems understanding him. T admitted that it is frustrating to teach when students do not seem to understand what he is saying. Since T does not speak any other alternative languages, he would resort to speak in BM; a language that all students are familiar with so that they can understand his lesson and communication can take place.

The transcribed lessons also revealed that T's use of BM varied with the type of teaching and learning activities. Based on the observations, T was observed to use more BM when teaching and learning activities require T to move around during the lesson to monitor the students instead of speaking at the front of the class. Thus, BM was used mostly when students were working on the exercises and also during experiments. T explained that he had to use more BM during experiments because he needed to explain the steps to the students to make sure that the experiments are conducted correctly.

REASONS FOR USING BAHASA MALAYSIA IN THE SCIENCE CLASSROOM

The data analyzed based on the Cue-Response System adapted from Jacobson (1982) has revealed that BM was used when T talked

about matters related to the content taught for the day's lesson. It was observed that BM was used only when needed during content teaching depending on the students' proficiency level and therefore, it was used less frequently in Form 2.3 but very frequently in Form 2.7. Extracts (3) and (4) show instances of BM use during the content development.

(3) [T11:139-40]	
T:	<i>Ok. Sounds are produced by vibration. Ok, bunyi dihasilkan melalui getaran</i>
(4) [T8: 105-109]	
S: T:	<i>Cikgu, apa maksud soalan ini? (...) What's the connection between taste and smell? Ok. If you get flu, selsema, you ada selera makan? Ada tak? You kena selsema, you ada selera makan? Tak ada? K, that is the connection. You must smell first, then only you have the appetite to eat. You ada selera untuk makan.</i>

BM was used especially in Form 2.7 as the students could not understand the concepts in English. Although it was important to use English to prepare students' for their examinations, T's main concern was for the students to understand the content first thus BM was used to ensure efficiency of content delivery and comprehension of content. Nevertheless, he tried as much as possible to provide input in English and he is also very conscious of the use of BM during the lesson. Therefore, T uses BM for concept development only if he feels that students do not understand him. It is also possible that T's decision is influenced by his need to comply with the instructions from the school principal to teach Science fully in English if possible.

In addition to content development, it was found based on observation that many of T’s students were easily distracted, and therefore, T had to constantly ask questions to draw and maintain students’ attention in the lesson as shown in extracts (5) and (6).

<i>(5) [T4: 323-325]</i>	
<p>T:</p> <p>S:</p>	<p><i>K, jadi kamu, kedudukan kotak ini mempengaruhi kedudukan i dengan r kamu (.) dan juga sinar tuju kamu, incident ray, sinar tuju. Jadi kalau kotak kamu kat sini, adakah sinar tuju kamu kat sini juga?</i></p> <p><i>Ha.</i></p>
<i>(6) [T9: 431]</i>	
<p>T:</p>	<p><i>Yah, Goh. Why? Ada – any questions? Ada soalan?</i></p>

BM was used to encourage students to participate and engage their attention in learning. BM was also used to ask questions as students can relate to the language and respond to the questions immediately. Some students might be able to understand the question in English but they would not feel comfortable or confident to respond. It was observed that whenever T asked questions in English, the students would look down at their books but when the questions were asked in BM, they were spontaneous and responsive. This could be because when a question is posed in English, students would want to reply but their lack of ability to speak might hinder them from participating in the lesson.

Besides giving explanations, it was found that instructions formed a large part of T’s discourse and these were divided into two; content-related instructions and regulatory instructions. Content-

related instructions are those related to the subject and learning process such as instructions about the experiment procedures, which book to do their exercises in, which exercise to work on and so forth. These instructions were occasionally if not frequently issued in BM. The choice of language was dependent on the urgency of the instruction. If the value of the instruction is less important or not urgent, T can take the time to provide more language exposure. However, if the message or the instruction is of high importance and imperative, T will switch to BM so that the students can understand and act upon the instructions immediately. Two examples are taken from one same transcript to illustrate this point. Extract (9) is an example of which the urgency of the instruction is low. T was giving instructions on how to use the transformer and explaining which volt level to use. Note that the transformer is yet to be switched on.

<i>(9) [T 4: 134-136]</i>	
T:	<i>K, mula-mula saya nak kamu, k, switch the lowest current volt (.) Two. Not the high one ah, choose the lowest one first. (.) K, on.</i>

However in extract (11), the transformer has been switched on and therefore; students needed to be more careful handling the expensive device. Thus, his instructions were given immediately in BM.

<i>(10) [T4: 137-139]</i>	
S: T:	<i>Cikgu, tak terang kan? Ok, tak terang. Baru kamu naikkan sikit-sikit. K, naikkan sikit. Saya bagi maksimum sampai sepuluh saja. Jangan naikkan sampai dua belas.</i>

Therefore, the value of the message is an important factor that affects T’s choice of language when teaching as what is important is the effectiveness of the instructions. In order for the message to be delivered effectively, students must be able to understand the meaning of the utterance immediately.

As was mentioned earlier, T’s discourse in the classroom was not limited to content development and classroom management but it also included interpersonal conversations (formal or informal matters) which are not related to the content or the classroom context. It was noticed that these cues were mostly carried out with BM as the main medium of interaction.

<i>(11) [T8: 127-133]</i>	
S:	<i>Boleh kongsi?</i>
T:	<i>kongsi- kongsi apa?</i>
S:	<i>Boleh photostat buku?</i>
T:	<i>Mana boleh photostat?</i>
S:	<i>Ada cikgu, ni?</i>
T:	<i>Mana boleh photostat? You mau kena penjara ke? Ni siapa punya? Ni copy right lah, you mau kena penjara kah?</i>

It was noted that T moved around from student to student to monitor their work and while doing so, T tries to foster a good relationship with them by discussing matters other than the content. He tries to gain their trust by showing that he is as concerned about the individual as he is about their studies. In order to establish such solidarity, T uses BM as it is a common language used by the students. In addition to that, T mentioned that he is also more comfortable using BM to talk about things that are non-related to the content as that

is how he normally speaks. Even though the classroom is a formal situation, T is also occasionally influenced by his personal preferences and so uses BM for personal matters.

Indirectly, the use of BM here helps T reduce the status gap between him and his students and this enables him to be more approachable. Teacher and student communication is important in the classroom and so T tries to foster a close relationship with the students by using this method. This is noted when T occasionally slips in some advice in BM to students during such interpersonal conversations to encourage them to study. For example,

(12) [T10: 371-376]	
T:	<p><i>You lain kali belajar tak berapa pandai kan, bukan bodoh. Tak berapa pandai kan, and then you can get good results, that's ok. You masih ada masa boleh perbaiki. Kalau you mahu perbaiki, you boleh repeat SPM. K, lepas tu dapat ok sikit punya result. Tapi not as good as yang lain kan. Tapi you ada sukan, you dapat medal semua tu ah. Ok, now syarikat swasta macam Maybank, TNB ambil juga orang yang boleh bersukan. Ok.</i></p>

Thus BM can also be viewed as a tool to establish rapport as well as to create a positive, comfortable and warm classroom climate.

Besides these occurrences, there were other uses of BM which were not accounted for in the Cue Response System by Jacobson (1982). Similar utterances were grouped together and the general purposes for using BM in each group were identified. One of these groups is the 'Classroom Management Cues' whereby T used BM to control the students' behaviour in the classroom. An obvious

and recurrent instant of such use was when T scolded, warned or reprimanded students as seen in the following extracts:

<i>(13) [T3: 112-113]</i>	
T:	<i>Quiet! One more time (.) Jangan melampau sangat. Jangan buat saya marah dulu.</i>
<i>(14) [T7: 69-72]</i>	
T:	<i>Kalau tak nak belajar, jangan datang kelas saya. K? Jangan buat kacau dalam kelas saya. Sama juga dengan perempuan yang sini. K, yang belakang sebelah sana. Jangan ingat kamu ni baik sangat. Pandai sangat (.) Tak nak belajar tak payah datang sekolah. Lepas tu kita boleh buang terus. Tak perlu datang sekolah lagi. (.) Tak faham-faham lagi! (.) EY, TAK HABIS LAGI? ... SAYA TAK TEGUR, SEMUA MAIN-MAIN!</i>

The purpose of reprimanding the students was so that they will stop their misbehaviour immediately and in order for this to be effective; the students must first understand what is being said. Therefore, T used BM because the students will understand what he is saying and produce the desired behaviour. As was noticed in extract (13) when T used English first to scold the students and instruct them to keep quiet, there were no visible changes in the students' behaviour but when T used BM with an increased volume, the students kept quiet immediately. It is interesting to note that when T used English to warn or scold students, they had the tendency to laugh it off and take it less seriously but when T used BM, they took heed of the warning and changed their behaviour even if only for a while. This differed from Soo's (1986) study, where it was noted that the choice

to use a more distant language is made to make the command more serious and formal. It could be possible that because the students could not understand what T was saying, they chose to ignore his admonishments. In addition, T did not like to reprimand in English because he felt uneasy doing so as English was almost like a foreign language to him and so, he could not express his thoughts fluently. Therefore, BM was used to deliver the affective meaning of the message efficiently.

Besides scolding and reprimanding students, it was also found that there was an extensive use of BM when T checked on students' behaviour as seen in extract (15) and (16).

<i>(15) [T9:284-287]</i>	
<i>T:</i>	<i>Sekurang-kurangnya saya tengok dua orang ni da ada kemajuan (.) dah ada dua soalan. Yang ini? Baru apa? Chapter – checkpoint one point seven? Apasal? Susah sangat ke nak tulis jawapan tu, mungkin susah juga kamu nak cari.</i>
<i>(16) [T7: 227-234]</i> <i>(Some girls just broke a beaker in the lab)</i>	
<i>T:</i>	<i>WHICH GROUP? OK SIAPA NAK BERTANGGUNGJAWAB? ... Ok. Siapa nak tanggungjawab?... Siapa yang buat?... Siapa yang langgar?</i>

Therefore, it was important that students could understand what the teacher was saying or asking about, thus in order to therefore BM was used to check their behaviour. Another possible reason could

be because behaviour checks are not related to the content and they usually occur during the non-formal teaching and learning process during the lesson, which is why T might feel less compelled to use English than the extensive use of BM for such a purpose.

There were other minor uses of BM observed and identified from the data collected throughout the two week period. This paper has highlighted only the major occurrences of BM use in the teaching of Science but in general, it was found that BM was used as an alternative language for different reasons in the Science classroom.

CONCLUSION

Based on the findings and discussion, it can be concluded that the main reasons for using BM as an alternative language in the Science classroom was because students could not comprehend the content as well as instructions delivered in English. Therefore, there was a need for an alternative language to deliver the message effectively and efficiently. Furthermore, it was also important to engage students' attention and encourage their participation in the classroom activities so that the teaching and learning process can take place, thus, BM was used. However, a teacher's personal background could have affected his use of BM as it is his mother tongue so while he was comfortable and confident teaching in English (which may not be too difficult because there is a book to follow and read from), he naturally reverts to BM which is incidentally his mother tongue for certain purposes such as building rapport with the students or even to express his emotions.

Several pedagogical recommendations can be suggested based on the findings of this study. From the observations, findings and feedback during the interview, it can be noted that the teacher is able to use English as a medium of instruction but an alternative language is needed to help students understand the lesson better. Hence, it is recommended that Science teachers be trained to use an

alternative language for designated purposes and only when really needed during the lesson so that the alternative language will not become a ‘crutch’ for the students to depend on when learning in the ‘unfamiliar’ language. Teachers who are professionally trained to use both languages can slowly reduce students’ dependency on the alternative language during content learning while at the same time create a need in them to learn or improve their command of the English language.

The students’ inability to cope as shown in the findings also reveals that there is a need for supplementary language support classes that could help students cope with this change from BM to English. It must be realized that the language taught in the English classes in schools are more aesthetic and communicative in nature and therefore, insufficient to be used as a tool for learning a content subject. Students in the upper form are provided with the English for Science and Technology (EST) classes to help them learn the language of Science but students in the lower form are not exposed to such language input. It is recommended that the English classes provide language support to help students cope with their content learning. For example, a language teacher could spend a few minutes of the lesson to teach or review certain language items (tenses, vocabulary, etc) required in the particular chapter of the Science subject that the students are learning.

Nonetheless, these conclusions and recommendations are drawn and made based on the findings gained from a small scale case study which focused on only one Science teacher. Therefore, it is recommended that this study be extended to a larger scale to include more subjects so that this situation can be investigated in more detail. A larger scale of this study could also provide findings that are more reflective of the general situation in the Science classrooms. It is also recommended that future research could look into the use of the alternative language according to race and gender. It would be interesting to find out if the race and gender of the participants does affect the teacher’s choice of language and if this choice is limited only in the content classroom or also found in the language classroom.

More detailed research could also be carried out to investigate whether the teacher will use the alternative language when placed in classes where students have higher language proficiency levels. The students in this study were mostly lower proficiency learners thus it would be interesting to find out if this same condition happens in the higher language proficiency classes. It would also be interesting to find out if the teacher needs to use the alternative language when teaching students in the upper form who should have developed their cognitive ability of learning Science and have learnt Science in English since the beginning of their secondary schools.

Lastly, this study has found that while the teacher is able to use English to teach and communicate in the Science classroom, students still faced difficulties in coping with the change. Although very preliminary, this study has shown that the alternative language is useful and important in scaffolding students' content learning as well as bridging communication gaps between teacher and students. While the findings are specific for this case and may not be reflective of the larger population, future studies in this area, supported by larger corpora, are likely to shed more light on this area of language choice for the teaching of Science in English.

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