Chapter 4
Instructional Language Use in Environmental Science Classroom

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Specific Area of Interest: Instructional Language Use

While the subject of instructional language has been extensively explored in English language teaching, research-based instructional strategies for EMI have yet to receive proper attention. According to Dearden (2015), nonnative English-speaking EMI teachers should not only have a sufficiently high level of English proficiency to use the language to teach but have teaching skills required of EFL teachers. This is because EMI involves more than translating course materials and presentation slides from students' native language to English. EMI, being a new teaching approach, involves authentic language learning in the classroom and often utilizes multilingual communicative strategies to perform various tasks in order to achieve learning goals. The tasks required of EMI teachers include modifying input, ensuring comprehension, and creating an atmosphere where students are not afraid to speak in English, while taking account of different language levels and, occasionally, cultural differences (Dearden, 2015).

Although it is tempting to think that instructors of EMI programs, especially those who have lived in an English-speaking country during their doctoral studies and who are fluent speakers of English, could teach in English, studies have shown that using English to teach a school subject is a specialized skill to be acquired. The language for school disciplines has been theorized as a "curriculum genre" with its own specialized register features: regulative and instructional (Bernstein, 1996; Christie, 1997). The regulative discourse refers to language used to manage the social environment of the classroom in order to achieve a certain teaching and learning goal, whereas the instructional discourse refers to the content, the knowledge that students are supposed to learn. The theory reflects the teacher's dual role as a

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subject instructor and the manager of the classroom, responsible for initiating students into the act of learning.

This is true of all school subjects, and even in mathematics, often considered an area that depends less on language, has its own discourse. The teaching of mathematics, for instance, primarily relies on teacher's spoken language to explain the meaning of the symbols and codes used in the textbook and the blackboard and to create a link between abstract ideas to students' everyday life (Veel, 1999). The language used in the mathematics classrooms is often grammatically structured differently than the everyday language and thus imposes linguistic challenges to learners (Schleppegrell, 2007).

In the domains of science classrooms, language is mainly used to describe and discuss fact, and it commonly serves purposes such as to conduct laboratory experiments, organize scientific information into taxonomies, explain phenomenon scientifically, and challenge an issue through exposition and discussion (Veel, 1997). In terms of content, it often involves telling the scientific story (concepts, technological issues, etc.), describing processes and procedures (how to do something in the laboratory), and explaining or resolving class management issues (e.g., giving instructions on homework) (Scott, Mortimer, & Aguiar, 2006).

Oyoo (2012) classified language in science classrooms into technical and nontechnical components. The former category is made up of terminology specific to a science subject. The excerpt below shows an example of these two classifications of words. The technical or science terms include *gas*, *molecules*, and *volume*. The nontechnical component includes those words that facilitate understanding of the technical terms. Examples of these nontechnical words are *random*, *predict*, *theoretical*, and *neglect*:

> Gas molecules display random motion; we may predict their behavior from theoretical considerations: the actual volume of the molecules may be neglected. (Gardner, 1972, p. 7; quoted in Oyoo, 2012)

Oyoo's study of science classrooms showed that, to explain concepts and operations clearly, effective teachers often use metaphors or physical objects to help students better understand abstract ideas and the same teachers often utilize projects and discussion to involve students (Matthews, 1998, quoted in Oyoo, 2012). In the study, Oyoo reported on a teacher who used a piece of cake as an edible stone to convey the idea of "crystal cleavage." Students were to observe the straight line at the edge of the edible stone and picture a special type of stone, similar to a crystal, which has the tendency to split along straight lines leaving very smooth surfaces. The explanation helped students to understand the word *cleave* to mean cutting in straight lines along the edge.

Specific issue related to EMI is the use of code-switching. In Hong Kong, the use of code-switching has been observed, especially when students' English proficiency is low (Poon, 2013). EMI teachers believe that in some cases the use of both languages helps clarify difficult concepts, builds rapport by reducing social distance (e.g., experience sharing), or introduces terms in which students are more familiar with the Chinese equivalents (e.g., 三聚氰胺, melamine; 金融海嘯, financial tsunami) (Li, 2008).

Background of the Case

Originally a subject in the civil engineering graduate division of a comprehensive university in southern Taiwan, the Department of Environmental Engineering that participated in the current study was established in 1976. The department is primarily responsible for courses related to the topics of water, waste water, air pollution, soil pollution, environmental toxicants, and environmental management. Courses offered in 2016 covered a range of topics in environmental science, such as atmospheric chemistry and application, environmental organic chemistry, trace chemical analysis, combustion principles and control, advanced water treatment, soil chemistry and analysis, pollution prevention and sustainable materials management, green energy technology, climate change and air, and water resource management, to name a few.

The department has 18 full-time faculty members. Most of the faculty members have earned their PhD degrees from universities in the USA (Carnegie Mellon, Georgia Tech, Northwestern University, the University of Missouri, and the University of Wisconsin, among others). In recognition of the extra preparation required, instructors who teach in English are able to reduce their required teaching load.

In recent years, the department has gradually internationalized the curriculum by introducing EMI. During the fall semester of 2015, 10 of the 16 (or 63%) graduate-level courses, excluding seminar courses, were EMI. In the spring semester, 2016, 12 of the 15 courses (or 80%), excluding seminar courses, in the graduate school program used English as the instructional language. A sample of EMI courses offered by the department is presented in Table 4.1.

The primary aim of the department's EMI program is to attract international enrollment and to strengthen domestic students' English language skills. The department chair regularly visits Southeast Asia to recruit international students. In the 2014 academic year, the department had 15 international students in the graduate program, including 4 in the master's program and 11 in the doctoral program. In

Table 4.1 Environmental science classes observed

Classes (graduate)	Class size	Total time of class data collected observation	Duration of teacher interview
Chemical Principles for Environmental Engineering (two teachers)	26 students, including 6 international students	6 h	2 h (1h/teacher)
Water Quality Management	11 students, including 8 international students	4 h	2 h
Soil Chemistry and Analysis	11 students, including 2 international students	3 h	1 h

the 2015 academic year, the department had 14 international students, including four in the master's program and ten in the doctoral program. Countries of origins for these two academic years included those located in Asia and the Oceania region (India, Indonesia, Iran, Kiribati, and Thailand), the Americas (Belize, Canada, Haiti, and the USA), and Africa (Burkina Faso, Gambia, and Kenya).

According to the students' own reports, the EMI courses allow international students to fulfill their dreams to study abroad and learn about another culture while obtaining professional training. The comments below, downloaded from the departmental website, represent a positive view of the program's success in meeting international students' needs.

> [on the overall learning environment] "From the first time I came to this department, I already feel a warm acceptance from the faculty members despite the language barrier (How they tried their best to explain everything in English makes my heart feels warm)."

> [on laboratory training and interaction with classmates] "Not only from the courses, but also from laboratory I can learn some methods and technologies that are new for me. Actually that makes me really nervous and less confident, but again a lot of people, especially my friends, help me to learn that until I am confident enough for doing many things by myself."

> [overall impression] "This department provides many things for me, not only just excellent intensive knowledge efforts by marvelous and kind professors. Many interesting comprehensive course work of environmental engineering field make my strategic vision wider. Many insight experience which I could never have from field trip of great company, factory and others, make me more understanding and help me planning what I want for my future."

While the EMI implementation received positive comments from international students, teachers have unanimously felt that Taiwanese students' acquisition of content knowledge was their top priority. In lecture delivery, teaching in a second language usually meant that less material was covered. In the meantime, the language barrier likely led to students' low comprehension because they were forced to devote more of their cognitive processing to understanding and translating lectures delivered in a second language. According to interviews with the instructors, checking understanding was a problem in class because while international students tended to be more responsive in classes, Taiwanese students were not. Thus it was difficult for teachers to assess whether Taiwanese students had sufficient English listening skills to respond and to know how much content they had comprehended in the EMI classes.

The current study collected data from classroom observations, student surveys, and teacher interviews (Appendices 1, 2, 3, 4). The classes were audio-recorded and their content transcribed for analysis. The instruments also included an observation checklist, which was developed after the researcher and her colleagues watched online engineering courses (Appendix 2). The student survey, administered after classroom observation, contains both closed- and open-ended questions about students' experience with and opinions on EMI implementation (Appendices 1 and 3). To triangulate the data, follow-up interviews, which took place after classroom observation, were conducted with the EMI instructors. The guiding questions for the interviewers are presented in Appendix 4. Data gathered from the classroom

observations, student surveys, and teacher interviews were collected to answer the following questions:

1. What were the teachers' and students' views on EMI?
2. What were the teachers' views on instructional language and lecture delivery?
3. What were the students' views on instructional language and lecture delivery?
4. What were the students' training needs?

Case Study and Findings

The study involved four teachers teaching in a graduate-level environmental science program in a comprehensive university located in southern Taiwan, as well as 48 Taiwanese students and 24 international students studying in the same program. Three classes were observed, and classroom data were collected over 2 weeks of time from March to June in 2015 (Table 4.1). The courses observed in this study were Chemical Principles for Environmental Engineering, Water Quality Management, and Soil Chemistry and Analysis. All three of these classes had international students.

The instruments of the study included classroom data collection and analyses observations, a student survey, and teacher interviews. A total of 13 h of class time were observed, audio recorded, and transcribed. The questionnaire for the Taiwanese students consisted of 26 statements using a 4-point Likert scale (Appendix 1) and six open-ended questions (Appendix 3). Students from the three observed classes and a seminar course (taught by one of the participating teachers) completed the survey during the last class session of the spring semester, 2015. The survey was administered by English teachers of the university to ensure that students would be more honest with their answers.

Four teachers were interviewed at their offices in May and June of 2015. One of the courses observed, Chemical Principles for Environmental Engineering, was taught by two teachers. All four teachers were Taiwanese. Of the four teachers, one obtained his doctoral degree in Taiwan; the other three teachers graduated from universities in the USA. The duration of the interviews was between 1 and 2 h (Table 4.1). The questions for the EMI teachers are included in Appendix 4.

Teachers' and Students' Views on EMI

While this chapter focuses on lecture delivery, a brief discussion on teachers' and students' views on EMI provides the necessary context for the lecture delivery issues to be discussed. In terms of the teachers' viewpoints, the study found that teachers supported the department's decision for EMI, with several reasons impacting this view. Firstly, all faculty members agreed to support the EMI program, and

all teachers were expected to teach in English. This is an important condition because some of the engineering departments at the university tended to require only new teachers or junior faculty members to teach in English. Secondly, all the teachers were already using textbooks, class handouts, and presentation slides in English (as is the custom of most Taiwanese universities), so for teachers and students, the reading materials were the same as before.

The teachers also raised several concerns during the interviews. The EMI teachers reported that classes taught in English required more preparation time. The EMI curriculum involved more than just translating course materials from Chinese to English; the teachers also found it necessary to carefully review and revise existing teaching materials. When the class was taught in English, teachers needed to check comprehension, which meant that teachers usually slowed the pace of course delivery. As a result, according to the teachers interviewed for this study, teaching in English meant that they covered less material than they would have had in Chinese.

A major concern for the EMI teachers had to do with content acquisition. Reasons for this phenomenon, and suggestions to address the problem, were provided by the EMI instructors.

> *Students' comprehension is the most important, so reading and listening competencies are important for EMI. If they can read and listen well, they could understand the content much better.*

> *Even in Chinese-medium class, students often find the theories difficult. Using English may worsen comprehension. So the students may give up.*

> *To enhance comprehension, some universities in other countries conduct preview/ review sessions taught by TAs. So students can be more prepared before class or know what questions to ask during the lecture.*

The interview data revealed teachers' concerns about most of the graduate students in the EMI courses (Taiwanese and nonnative English-speaking international students), who had to overcome both content and language barriers. In regard to teachers' concerns about language problems, it is important to note that most EMI teachers believed that they should not be responsible for teaching students English. However, they were more than happy to talk about their experiences and study skills related to learning the disciplinary content or English.

Generally speaking, the Taiwanese student survey (Appendix 1, N = 48) showed a negative attitude toward EMI. While 75% of students agreed that there was a need for EMI courses (Question 1), 58% of students disagreed that English should be the medium of instruction for discipline-specific courses (Question 2), 69% of students disagreed that they could acquire core discipline-specific knowledge from EMI (Question 3), and 84% of students believed that EMI would lead to poorer intake (Question 4).

However, students have indicated benefits such as improved ability to use English to communicate professional terms, definitions, and basic concepts (70% agreement; Question 5). In addition, students agreed that EMI courses could help them improve their English listening (79% agreement; Question 6) and reading skills (65% agreement; Question 7). On English-speaking skill improvement and gaining

confidence in using English, the responses were not as positive (41% agreement, Question 8 and 46% agreement, Question 9, respectively).

Major challenges for students included understanding discipline-specific terms (71% agreement; Question 10), comprehending discipline-specific content (82% agreement; Question 11), and participating in class discussion (71% agreement; Question 12). The reason for the difficulties was mainly due to the students' English proficiency. Many students felt that their English proficiency was not good enough to understand discipline-specific content delivered in English (55% agreement; Question 13) and to participate in class discussion (65% agreement; Question 14).

Students indicated that they were more motivated and obtained better grades in courses delivered in Chinese (75% agreement, Question 15; 65% agreement, Question 16). In contrast, they usually spent more time previewing and reviewing for EMI courses (58% agreement, Question 17; 73% agreement, Question 18). Thus it is not surprising that 69% of students agreed that the university should offer EMI preparatory courses (Question 19).

From students' written responses, it seems that their expectations of EMI courses varied. While many students hoped to acquire better language skills to enhance their overall professional performance, some students strongly believed that professional knowledge and technical skills are more important than language training, and thus courses conducted in Chinese should be offered as well.

Teachers' Views on Instructional Language and Lecture Delivery

When asked about instructional language, teachers indicated that they tried to use English most of the time and believed that students' listening comprehension would gradually improve. According to teachers' estimates, students could understand 70% of the lecture materials. To help students better comprehend their lectures, instructors utilized the strategies outlined in Table 4.2.

To help students overcome the language barrier, teachers would engage students' attention through visual aids (e.g., PowerPoint slides, charts and graphs, etc.) and discussion of current issues that related students' experience to theories. An example of such teaching materials was using a story inspired by the fictional detective Conan of the Japanese comic stories: "*Conan is trying to identify the murderer who used the icicle to kill a person. He needs to calculate how rapidly the ice will melt…*" The teacher explained his strategy in the following:

> *I used many interesting examples (e.g., Pikachu from the Pokémon characters, the 007 Bond movies, famous Chinese Kung Fu stories) to explain a difficult concept. I designed a problem based on Pikachu in which students had to calculate the size of the ball Pikachu could carry. Students were very motivated to solve the problem.*

To enhance listening comprehension, teachers sometimes chose to switch between English and Chinese. Code-switching was most often observed when

Table 4.2 Examples of instructional language for various tasks

Tasks	What was said
Explain lesson aim	"We are going to focus on the second equation today."
	"We are going to review what we talked last time and then discuss rigid body today."
Define terms with demonstration or concrete example	Example: (Using a 3-D picture to explain "couplings")
	"This is an example. Get a disk here. We turn the table. This big one. We turn the table counterclockwise. Then, the small disk here. Both of them are couplings."
Remind students what they should already know, or relate the lesson to prior knowledge	"You can compare this equation with the one you learned before."
	"You must have heard of this before, right?"
	"Do you know positive definite?.....You can go back to check the book"
	"You learned about Newton and the concept of gravity in high school, so it is just like it."
Highlight important information	"Can I have your attention here?"
	"This should be highlighted"
	"This is very important for your exam"
Use signpost language	"Next"
	"Then"
	"The following is…"
	"Let's move on to..."

announcing that class was about to begin, trying to relate something to students' prior knowledge, checking comprehension, asking probing questions, building rapport, and getting students' attention. When teachers used Chinese, they would reassure international students that the information would be repeated again in English. In general, while all teachers used code-switching to some extent, each teacher had their own code-switching strategies.

> *[Code-switching] might help students' comprehension, but I think it is not good. Students may expect Chinese and ignore English. They would wait for the Chinese part. However, I still use English and Chinese in class. I think the complicated content should be explained clearly for them to understand better, so I use more Chinese for it.*

> *I think the better way is to use code-switching differently as students gain more experience. For instance, the EMI class in freshman year can adopt 40–50% of Chinese. 30% of Chinese can be used in sophomore year, and 20% in junior year and no Chinese used in senior year might work better.*

> *I tended to use more English in the beginning of the course, because the content is to review what they had learned in high school. However, I would use more Chinese in the latter sessions of the course which involves new knowledge. In order to make them understand, I use Chinese now often to teach difficult concepts.*

According to classroom observations, the situations where teachers used Chinese or engaged in code-switching were as follows (Table 4.3).

Table 4.3 Contexts when code-switching was used

Context	What was said	English translation	Comment
Announcing the start of class	上課了	It's time to start class	The teacher used Chinese to announce the start of the lecture
Relating something to students' prior knowledge	台南市	Tainan City	Both English and Chinese terms were used to enhance students' understanding
	曾文水庫	Tsengwen Dam	
	三聚氰胺	melamine;	
	921 地震	Taiwan's earthquake on September 21, 1999	
Checking comprehension	有沒有問題?	Any questions?	The teacher used Chinese to check comprehension. Then the teacher continued the lecture in English
	為什麼要這樣做呢?	Why did it happen?	
	老師有講過喔!	I have explained this before	
	Is it okay? (no response) 到底有沒有問題? 可以嗎?	Are THERE any questions? (with emphasis)	In this scenario, the teacher used English first and then, where there was no response, repeated the question in Chinese (with emphasis) to solicit a response
		Is everyone okay with what was said?	
Asking critical or probing questions	"所以這樣是對的嗎?"	So, is this correct?	To get students to think, the teacher usually used Chinese
	"這樣對嗎?這位同學"	Is this correct? (pointing at a student) This student [what do you think?]	
Building rapport	很累喔?昨天做甚麼?	You all looked tired. What did you do yesterday?	When students were unresponsive, teachers often used Chinese to reduce the social distance
Getting students' attention	T: 有人睡著了:	T: Someone has fallen asleep	When students didn't pay attention, the teacher might tell a joke in Chinese or call on a student to answer a question in order to get their attention
	S: 沒有 (some students woke up.)	S: We didn't (Some students woke up.)	
	情侶不要坐在一起, 會干擾別人上課。	(jokingly) Lovers should not sit together. You are distracting the rest of the students in the class	

To reduce the burden on students related to concerns about their English language proficiency, and to encourage participation, teachers allowed students to use Chinese to ask and answer questions. As long as students were willing to speak in class, either language was acceptable. When this happened, teachers would translate the questions from Chinese to English for the international students. In regard to performance assessment, according to teacher interviews, the examination questions were always written in English, but students had the option to answer in Chinese. On assessment, teachers expressed the following:

> *It is fine with me [that students used Chinese to answer my questions], because it is not an English class. The content is the most important. When they can answer me, even in Chinese, it means that they understand it.*

> *Although the test is written in English, students don't really need to use descriptive English words in the exams. Most are formulas and equations. There are more symbols and numbers. So language is not the problem for assessment.*

Students' Views on Instructional Language and Lecture Delivery

In general, the survey results (Table 4.2) revealed that students viewed the instructional language as a barrier. With English as the primary language, the classroom environment was less conducive to learning (84% agreement; Question 20), and the classroom language lowered students' willingness to participate in class (80% agreement; Question 21). The surveys indicated that teachers should use more Chinese at the beginning of the term and then gradually increase the use of English in class (81% agreement; Question 22). Of the students surveyed, 94% indicated that it would be helpful if teachers repeated the content in Chinese (Question 23) and used charts, tables, and examples (75% agreement; Question 24). In general, students believed that teachers' instructional methods were more important than how well they spoke English (77% agreement; Question 25) and that teachers' communicative and presentation skills were more important than oral skills (82% agreement; Question 26).

Students' written responses showed that EMI teachers should have clear pronunciation and speak at a moderate speed. Regarding delivery of the lecture, the students indicated that teachers should be able to vary their tone and speed and keep the lecture lively. On content presentation, it was also important for teachers to organize information graphically and to present abstract ideas from simple, basic concepts to more complex topics. A good teacher is one who regularly checked students' levels of attention and understanding. To aid comprehension, students suggested that teachers provide examples or be able to express complex ideas with simple words, phrases, and sentences.

EMI Students' Language Training

On language training of students, the teachers believed that academic writing was important for graduate students, and thus the university should offer more writing workshops. An ideal program would involve systematic training that began in students' undergraduate years so that students would be able to produce journal papers in English when they started their graduate studies. While EMI teachers believed that students needed language training, they also indicated that training should be done through students' self-study or be provided by English teachers. The following responses were collected from the teacher interviews. Note that teachers have expressed different views regarding how English teachers could help students learn vocabulary.

> *English teachers can teach them how to listen for the key words in a lecture, how to take notes, and how to ask questions.*
>
> *[On teaching engineering vocabulary] English teachers could only teach pronunciation, but students still can't understand the meaning of the terms. As a result, it may not be helpful.*
>
> *If English teachers can also teach them the vocabulary related to the professional content, it'd be helpful. It is not necessary to explain a lot about the words, but let them get familiar with the sound and the words. When they see or hear the word in the EMI class, they could quickly pick up the words.*
>
> *"Students' listening ability is also important. If their listening is enhanced in the English class, it means they are better prepared for EMI classes. English teachers can introduce various materials for self-learning such as movies, online courses, and YouTube videos.*

The student survey showed that there is a need for language training (69%; Question 19), and their written responses indicated training needs in the areas of English listening, speaking, reading, writing, presentation skills, and disciplinary vocabulary. The students expressed a desire to be able to think and speak in English fluently without fear and without an internal voice translating from Chinese to English. Specific skills they hoped to learn from EMI courses also included the ability to quickly understand content delivered in English, how to use technical vocabulary, and how to express one's professional knowledge in English.

Instructional Language Framework

Based on the literature review and information collected from this case study, it is clear that lecture comprehension is a priority for both EMI teachers and students. The following information on instructional language and lecture delivery strategies is provided for the reference of instructors if they are interested in enhancing their skills in delivering lectures. Information presented in this section includes types of instructional language in school science (Table 4.4), classroom management language (Table 4.5), and context for code-switching (Table 4.6). Tables 4.4 and 4.5

Table 4.4 Types of instructional language in school science

Types	Purposes/tasks	Example of language
Doing science	Describe purpose of experiment (e.g., to test hypotheses)	*We are doing this experience to see…*
	Describe lab procedures (e.g., record observation and methods)	*I want to begin/start with; the second step is; next*
Presenting science: telling the scientific story	Describe phenomenon	*The same thing was observed with…*
	Classify scientific knowledge	*Here's the taxonomy for fault handling techniques.*
Explaining events scientifically	Give sequential explanation (explaining a sequence chronologically)	*The life cycle begins with…; After 6 days…; Four weeks later…*
	Give causal explanation	*The phenomenon is caused by…*
	Give theoretical explanation	*This can be theorized as…*
	Give factorial explanation (explaining multiple causes)	*The defect is traceable to multiple causes.*
	Give consequential explanation (explaining multiple effects)	*This phenomenon is believed to be the consequence of…*
	Conduct exploration	*What are some possible explanations for this?*
Challenging science	Present scientific argument	*One of the major problems with this is that…*
	Present an alternative	*Let us look at this in a different way…*
	Give an exposition (arguing for a point of view)	*This is more plausible because…*
	Lead a discussion (two or more points of view)	*What are some possible explanations for this…*

were compiled based on the teaching categories and various purposes discussed by Scott et al. (2006) and Veel (1997). Instructional language in the science classroom consists of four types: doing, presenting, explaining, and challenging science. The classroom management language table is divided to two parts: language used at the beginning of the course and those used in each class. The contexts for code-switching were developed based on Poon (2013), Li (2008), and findings from the classroom observations of the current study.

On code-switching, the contexts and how students' mother tongue is used are summarized in Table 4.6. The contexts include checking comprehension, asking questions, building rapport, getting students' attention, activating students' prior learning, and making announcements.

Table 4.5 Class management language

Types	Purposes/tasks	Example of language
Class management: at the beginning of the course	Introduce course goals	*You'll learn how to…*
		You'll be able to…
	Describe course context: student profile and the role of this course in the curriculum	*There are no prerequisites. This course serves as a prerequisite for X course*
		This is an elective course
		You'll need…to complete this course successfully
	Describe course content: concepts, themes, skills developed	*We'll be covering…*
		The course is divided in the following parts
	Introduce textbooks and other learning materials	*The textbook is…*
		There's also a collection of short reading texts
	Introduce the syllabus	*Let's talk about the schedule of our course*
		We'll start with…
		In week 2, we'll start talking about…
		Toward the end of the course I want to…
	Explain grading policies	*The grading policy is as follows:*
		A percentage system is used in this class
		The midterm and final examinations account for X percent
	Introduce self and TA	*My name is… I'm the instructor of this course*
		We have two teaching assistants for the course
	Provide office hour and contact information	*My office hours are…*
		Email me at…; my office is located at…
Class management: for each class	Make announcements	*The class will not be meeting this coming week. The class will resume on Monday*
	Greetings	*Welcome; it's good to see you all today*
	Review previous lesson	*We'll begin by reviewing the main points from last week*
	Start today's class	*What we'll do first is…*
		I want to start with…
	Conclude each class	*Here's what I have for today; thank you for your participation*
	Summarize today's lesson	*Before we end today's lesson, let's quickly go over the main points discussed today*
	Assign homework	*Before next class, you should finish…*
		Submit your report to Moodle
	Give quiz/exam information: coverage and format	*The questions will be multiple choice, short answer…*
		The midterm exam is open book

Table 4.6 Contexts for code-switching in lecture delivery (English + Chinese)

Contexts	Functions of Chinese
Checking comprehension	Ask "Any questions?" or "Do you understand?" in Chinese
Asking critical or probing questions	Ask "Does this sound right?" or "Why did this happen?" in Chinese
Building rapport	Ask "You all look tired. What did you do last night?" in Chinese
	Interrupt lecture by sharing teacher's own English learning experience
Getting students' attention	Used to get students' attention
Activating students' prior learning	Mention a local city or a famous event in Taiwan (e.g., the 921 Earthquake)
	Repeat some technical words or terms in Chinese because students learned the Chinese equivalents in high school
Making announcements	Announce that the lecture is about to begin
	Announce important information such as examination dates and assignment due dates
	Announce grading policies

Positive Features, Challenges, and Pedagogical Implications

The current study has identified several positive features associated with the EMI program. As mentioned throughout this chapter, both EMI teachers and students shared the same learning goal: they all considered content knowledge acquisition to be the primary goal of EMI courses. Thus, teachers and students all agreed that training in English academic reading and listening is important. The study also shows that instructors in the EMI program take their teaching very seriously and have employed different strategies to help students cope with language difficulties in order to acquire content knowledge. As a result, students have reported improvement in both their reading and listening.

The study also points to several challenges. Firstly, students have indicated limited comprehension due to the language barrier. They have problems understanding discipline-specific terms and comprehending technical content. In addition, students have indicated that teachers should use Chinese more often and gradually increase the percentage of English as the course progresses. In the EMI classrooms observed in this study, it was found that code-switching was a common strategy and different approaches were adopted by EMI teachers. For instance, some teachers believed in using more Chinese at the beginning of the course, when students were new to EMI, and then gradually using more English when students have had more exposure to English lectures. Other teachers have used more English at the beginning of the semester when the content was relatively easier and used more Chinese for later when difficult concepts were presented. While code-switching may help explain difficult concepts and reduce students' anxiety, it is overall difficult to determine how much Chinese should be used in an EMI program.

This study reveals several pedagogical implications for EMI teacher training. To be more effective in EMI classrooms, it is important for lecturers to understand the

nature of language use in university classrooms. Teachers need to be aware of the difference between written and spoken language and the use of discourse markers so that they can present textbook information more informally. EMI teachers can benefit from English presentation training materials that cover topics such as the use of voice, body language, and discourse markers.

To enhance delivery, speakers need to be aware of how to combine multiple modes of expression: speech, writing, image, and body language (Morell, Garcia & Sanchez, 2008). Effective strategies include explaining the ground rules for the class, maintaining an appropriate speed of speaking, using visual aids and guiding students' note-taking, reformulating questions and waiting longer for an answer, paying attention to feedback from the listeners (verbal and gestural), and varying the format and dynamics within a lecture.

Although EMI teachers are not language teachers, it would be helpful to understand the process of lecturing from the students' perspective and how L2 affects students' listening comprehension. In Taiwan, most EMI courses do not ask students to meet English-proficiency requirements, and thus almost all EMI instructors must work with students of mixed levels. Thus it is important for lecturers to look out for signs that their students are having problems understanding the lecture, give examples that are appropriate to students' various backgrounds, and create a relaxed atmosphere where students are not afraid to ask questions (Lynch, 2015).

EMI teachers can benefit from collaborating with language teachers who are familiar with students' listening comprehension problems and who can provide training to students. From the students' point of view, a major difficulty for students is the lack of control over the speaker's lecturing style (Lynch, 2015). If the lecturers are native speakers of English, a general consensus is that teachers often speak too fast. If the instructors are nonnative English speakers, students may need to deal with understanding different accents. In an EMI study of a Swedish university, it was found that in general students were less able to follow EMI lectures and take notes; similarly, fewer questions were asked and answered than would have been the case if the lecture was in the students' first language (Airey & Linder, 2006).

Finally, for personal development, EMI teachers can improve oral skills by joining speech clubs such as Toastmasters International or working to enhance their lecturing skills by viewing online open course lectures. Moreover, EMI teachers can share their own English learning experience with students as a way to encourage students to become independent learners of English.

Summary

This chapter reported on findings from classroom observations, teacher interviews, and student surveys in three graduate-level environmental science courses in order to understand the instructional techniques used by EMI teachers. Based on prior research and a case study, this chapter compiled a list of language issues related to EMI classes, suggested strategies to improve lecture delivery, and proposed ways in which EMI teachers can improve their own and students' English proficiency.

Appendices

Appendix 1: Results of Student Survey (N = 48)

	Question	Strongly disagree 1 (%)	Disagree 2 (%)	Agree 3 (%)	Strongly agree 4 (%)
1	I believe there is a need for EMI courses	6	19	50	25
2	I believe English should be the medium of instruction for discipline-specific courses	25	33	35	6
3	I can acquire core discipline-specific knowledge from EMI courses	23	46	27	4
4	I believe English as the medium of instruction will lead to poorer student intake	2	15	44	40
5	Through EMI courses, I learned to use English to communicate professional terms, definitions, and basic concepts	4	25	60	10
6	EMI courses can help improve my English listening abilities	6	15	56	23
7	EMI courses can help improve my English reading abilities	6	29	46	19
8	EMI courses can help improve my English-speaking abilities	17	42	31	10
9	Because of EMI, I have gained confidence in using English	21	33	38	8
10	In an EMI course, the biggest challenge for me is understanding many discipline-specific terms	6	21	46	25
11	In an EMI course, the biggest challenge for me is comprehending discipline-specific content	4	15	40	42
12	In an EMI course, the biggest challenge for me is that, due to insufficient oral and listening skills, I am unable to participate in class discussion	6	23	46	25
13	My English proficiency is not good enough to clearly understand discipline-specific content delivered in English	10	35	40	15
14	My English proficiency is not good enough to actively participate in EMI classroom discussion	6	29	40	25

(continued)

	Question	Strongly disagree 1 (%)	Disagree 2 (%)	Agree 3 (%)	Strongly agree 4 (%)
15	I am more motivated when I study in courses delivered in Chinese	2	21	23	52
16	I obtain better grades in courses delivered in Chinese than in EMI	0	33	23	42
17	I spend more time *previewing* material for my EMI classes than regular classes in Chinese	8	31	31	27
18	I spend more time *reviewing* material for my EMI classes than regular classes in Chinese	6	19	31	42
19	I agree that the university should offer EMI preparatory courses	10	19	50	19
20	If the teacher teaches in English, the classroom atmosphere would be less conducive to learning	2	13	46	38
21	I believe that EMI courses reduce students' willingness to speak out in class	2	17	38	42
22	To be more effective, EMI teachers should use Chinese as the main medium of instruction at the beginning of the semester, and then gradually increase the use of English in class	0	19	46	35
23	I think it would be very helpful if teachers repeat the content in Chinese	0	6	31	63
24	I think it would be very helpful if teachers use charts and tables, or give examples in English	4	21	42	33
25	I think a teacher's instructional methods are more important than how well they speak English	4	19	35	42
26	I think a teacher's communicative and presentation skills are more important than their English-speaking skills	2	17	44	38

Appendix 2: Classroom Observation Checklist

Faculty member evaluated: _____ Date: _____
Evaluator: _____ Course: _____

Category		**Response**			**Comments**
Opening		**Yes**	**No**	**N/A**	
1.	Open lessons/units with review and/or questions such as, "What do you know about…? Have you ever…? Remember last week we…?"				
2.	Use strategies that capture student attention and interest (e.g., jokes, fun talk)				
Classroom English		**Yes**	**No**	**N/A**	
1.	Code-switch when students don't understand				
2.	Strategy to define terms				
3.	Strategy to give comprehensive examples				
4.	Use "signpost language" (e.g., signaling cues) to guide the class through the lecture.				
5.	Apply transitions between activities/points				
6.	Use clear instruction to explain classroom process				
7.	Encourage students to ask question				
8.	Use appropriate words to end the class.				
Delivery		**Yes**	**No**	**N/A**	
1.	Speak with confidence and authority (Ex. lecturing and/or answering to students' inquiries)				
2.	Communicate a sense of enthusiasm for the subject matter				
3.	Adjust voice volume, refine the pitch, alter the rhythm and tempo, and control the timbre to emphasize key point				
4.	Consistently interact with students (e.g., Q&A, jokes…) and encourage classroom discussion				
5.	Restates questions and answers				
6.	Ask critical and probing questions				
7.	Restate questions and answers				
8.	Apply appropriate activities for thought provoking and encouragement of critical thinking				
9.	Consistently remind students the skills they are learning or using				
10.	Visual-aids are clear, legible and effective				
11.	Lecturing time is appropriate and make changes according to students' attention span				
12.	Responds to nonverbal clues of confusion boredom, and curiosity (e.g., jokes, tasks)				
13.	Key points are emphasized by using body language, eye contact, gestures, intonation, or pace control as needed				

(continued)

14.	Modify instruction, pacing, and/or materials to accommodate special needs of students (e.g., reteaching, small group pullouts, supplementary materials, cooperative learning with cross-skills grouping, individualized instruction)				
15.	Have appropriate delivery pace and allow time for note-taking				
16.	Offer authentic application				
17.	Engineer effectively pair/group discussion				
18.	Help quieter students interact with others				
19.	Intervene and monitor progress of students (e.g., asking questions or checking their understanding)				
20.	Apply a variety of and appropriate resources				
Classroom atmosphere		**Yes**	**No**	**N/A**	**Comments**
1.	Active and lively student participation				
2.	Warm, open, and accepting				
3.	Use student names				
4.	Opportunity for students to provide feedback				
5.	Treat students with respect				
6.	Positive reinforcement				
7.	Inviting and responding				
Use of technology		**Yes**	**No**	**N/A**	**Comments**
1.	[instruction] Effectively incorporating a variety of instructional technologies (e.g., PPT, blogs)				
2.	[material] Use of technology to provide relevant knowledge (e.g., Youtube, MOOCS, Open University)				
3.	[interaction] Use of email, learning platform(e.g., Moodle), or social network (e.g., Facebook, Twitter) to communicate with the class				

Appendix 3: Student Survey: Open-Ended Questions

1. After taking EMI courses, have you seen any changes in your English skills such as in listening, speaking, reading, and writing? What has caused the changes?
2. After taking EMI courses, what skills should you have gained that are different from courses delivered in Chinese?
3. Before enrolling in EMI courses, what skill training is needed for students?
4. What should be the learning outcome from an EMI course?
5. After taking EMI courses, what do you think are necessary skills or teaching techniques that will make EMI teaching more effective?
6. Other comments.

Appendix 4: Teacher Interview Questions

Part 1: Structural Questions

1. What do you think about EMI education?
2. What is the major obstacle in the promotion of EMI (e.g., too costly to operate, no comprehensive policies, different stakeholders, no qualified teachers, no guidelines, no standard level of English for EMI teachers)?
3. What is the main challenge in EMI teaching (e.g., no sufficient teaching resources, not enough qualified teachers, problems for exams and assessment)?
4. Do you expect English teachers to support EMI education at NCKU?
5. Can Chinese help you in EMI classes? When would you switch to Chinese?
6. What are your views regarding English as the medium of instruction in Taiwan?
7. What are your suggestions/alternatives regarding English as the medium of instruction at NCKU?
8. How did students in EMI classes respond to the implementation of the classroom language policy?

Part 2: The Skills a Student Should Possess in an EMI Class

The seven skills are as follows: How to ask questions? How to increase T-S and S-S interaction? How to work in group? How to be more confident in using English? How to explicitly and analytically express opinions? How to describe a scientific concept? How to read a mathematical formula or a chemical formula?

What other skills do you think students should possess in an EMI class?

Part 3: Specific Questions

Language and Interaction

1. Based on your teaching experience, how does classroom interaction change as the medium of instruction changes? Are EMI classes more interactive or less interactive?
2. Do you think making the classroom interactive is important? If yes, what skills do you utilize to make the classroom more interactive? If not, what are your reasons?
3. If you asked questions in English, and your students used Chinese to answer you, what would you think?
4. In the very first class of the semester, do you need to spend some time preparing students for classroom language?

Skills

5. What skills might help to enhance students' understanding (e.g., how to begin a sentence, how to draw a connection between one point and another, how to define technical terms, how to ask questions, how to lead a group discussion…)?
6. In classroom observation, we noticed that teachers rarely read aloud the whole formulas you have written on board. Do you think engineering students need to know how to describe a formula? Is it an important ability for them?

Assessment

7. How do you assess your students? By exams, papers, projects, or another method?
8. Do you prepare bilingual exam papers?
9. Is language choice a factor that influences students' grades?
10. Do you think the learning of academic subjects is improved by EMI? Does it lead to deeper understanding? If so, by which groups of students? (All students? Only international students? Only home students?)

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