English-medium Instruction in English as a Foreign Language Computer Science Courses: Observation and Suggestion

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Abstract—English-medium Instruction (EMI) has attracted attention from diverse disciplines, ranging from humanity to natural science. Implementing EMI in Computer Science (CS) courses is not a technical change of the theoretical conceptualization; it involves changes in the practice-oriented instruction, individual confidence of communicating in English, and motivation to promote a better understanding of the academics. Since the wave of globalization cannot be stopped, it is the time to think differently to move beyond the paradigm to render EMI of and for CS education which can be articulated academically on intelligence, observation, investigation, and communication. The purpose of the study is to bring up insights for CS instructors for elevating teaching quality, building teacher confidence, and promoting student-teacher communication. This study wishes to provide a toolbox of techniques to CS instructors who manage to incorporate language and content to within EMI CS education.

Keywords—English-medium Instruction, English as a Foreign Language, computer science, scaffolding

I. INTRODUCTION

For those who wishes to get flying colors in the academic fields under the umbrella of English as a Foreign Language context, English has never lose its charm. English-medium Instruction (EMI) has attracted attention from diverse disciplines, ranging from humanity to natural science. Because of the compression of time and space, researchers and learners from different parts of the world will be able to exchange ideas promptly; therefore, the interdependence between policy makers and institutes in collaborating standardized lessons or assessment across the continents has become efficient. The concept of transferring universities as commodities prospers. Curriculum design is driven by the institute, while the market force of research is stretching and expanding its territory. When curriculum and teaching have to be executed and promoted around the world, English dominates over others. To put it differently, English-medium Instruction is no longer embedded in sharpening language skills, but treated as a tool to exchange information. These are how EMI works as a whole.

The objective of EMI is to use English as the one and only medium to teach non-native English speakers in academic settings. EMI instructors, under the expectations of the institution, should encompass sufficient linguistic proficiency and pedagogical insights as to scaffold the learning. However, not every eligible scholars are trained to teach an assigned subject area in English, and not every qualified educators are comfortable delivering a lecture in a language that is not his or her mother tongue. When an educator in a computer science class anticipates to manipulate English, the tool for passing information, it is suggested to hone it with a sophisticated equipment; that is, a communication skill.

II. APPLICATIONS OF EMI

A. Basque, Netherland, & Croatia

University of the Basque Country implemented Test of Performance for Teaching at University Level through the Medium of English (TOPTULTE) to filter EMI teacher candidates [1]. This screening process focused on candidate’s confidence, accuracy, and linguistic competency in using the target language. Support courses were provided at a later time to employ relevant EMI pedagogical techniques from body language to presentation skills. Feedback from the course was positive. Moreover, Delft University of Technology held a training workshop, a peer coaching consultation, and an

evaluation session dealing with non-verbal behavior and cultural issues for lecturers in engineering [2]. Exercises during the workshop were videotaped for inspection and future reference. The findings showed that English pronunciation, grammar, or fluency of the lecturers are of minor importance; instead, properly conveying and disseminating an idea from a content area was of marked significance. Likewise, Rijeka University undertook a research among faculty of engineering on their perception of EMI [3]. More than half of the respondents were willing to be trained for teaching in English. They believed that teaching engineering requires minimum cultural awareness and proficiency of English, since engineering ideas or concepts can be displayed by non-verbal diagrams or illustrations.

B. Spain, Japan, & Korea

A survey was conducted in a university in Spain to examine the effectiveness of EMI on categories of preferred training style, teaching duties, internationalization issues, and assessment from the lecturers [4]. The results indicated that EMI should exclude the teaching of the English language, but include the content itself. Those who were involved in EMI setting should possess sufficient English proficiency as to impart a lesson. Therefore, EMI is only suitable for those with high-proficiency language levels. Moving EMI prospects to Asia: over 30 per cent of the universities in Japan offer EMI programs; however, the practice of EMI is problematic [5]. Some schools had a hard time recruiting qualified professionals, others had difficulties fitting EMI into regular curricula, and still others were settling dispute with the stakeholders. With regard to the funding issue, administrative interference, and staffing deficiency, EMI programs in Japan are struggling to win the combat. In addition, students from major engineering universities in Korea completed a survey on EMI [6]. The results showed that students do not have sufficient English proficiency to understand the lecture in EMI setting, and EMI instruction has meager advances in improving English ability. In consequence, the majority of the participants thought that using their first language is more facilitative to understand the lecture and complete assigned tasks.

C. Theoretical framework

Learning and teaching obstacles are ineluctable; however, when learning has to be enacted, Vygotsky’s [7] Zone of Proximal Development (ZPD) theory and Krashen’s [8] i+1 hypothesis should be taken into consideration under the framework of EMI.

According to ZPD theory [7], if the cognitive workloads of the learner is reduced, new information can be internalized. Plenty of background knowledge, or schemata, has to be infused in the beginning of teaching to have desirable learning outcomes. It is efficient to apply ZPD with peers during cooperative learning sessions. When assistance or guidance is provided by the instructor, a task is likely to be successfully achieved by the learner or the learner groups. As learners grow independent of solving learning problems by themselves, supervision can be tapered off. This scaffolding process is like teaching someone who does not how to swim with a pool float, instead of asking the person to jump into the water in the first swimming lesson.

Similar to ZPD theory, Krashen’s i+1 hypothesis [8] stresses that comprehensible inputs are important during learning periods. When information has to be learned, the instructor will use familiar items to explain an unfamiliar one; that is, to incorporate old information with the new one. Learners will progress one step further to their current competence in their learning experiences, because their background knowledge serves as the best scaffold for successful learning. With regard to ZPD theory and i+1 hypothesis, learning cannot be accomplished without prior experiences.

III. EMI COMPUTER SCIENCE COURSES IN TAIWAN

EMI has a rapid grow in the field of business in Taiwan in order to attract foreign scholars and learners to conduct research, as well as keeping up with the trend of globalization. Unlike business discipline, EMI in the field computer science does not gain intense attention. Therefore, the purpose of the study is to bring up insights for CS instructors for elevating teaching quality, building teacher confidence, and promoting student-teacher communication. This study wishes to provide a toolbox of techniques to CS instructors who manage to incorporate language and content in the academic field. Attention is centered on the dilemma of CS instructors, then move on to what and how to teach in EMI CS courses, and suggestions will be provided at the end of this section.

A. Dilemma

Many instructors in tertiary education in Taiwan have the common experience of being asked “how to teach computer science in English which is not my mother tongue?” more frequently than being asked to explain an algorithm. This is particularly so in EFL context in which English is a foreign language for both of the instructors and learners. English has nonetheless to be used as the major medium of instruction in CS; for this reason, the instructors might think having perfect English is immeasurably crucial. It occurs to many university CS courses in Taiwan that both the lecturer and the majority of the students share the same first language. Abided by the name of “English-taught course” as a top-down prerequisite of the institution, some instructors may underwent a time code-switching from Mandarin to English during the course session. They may lead their lectures by reading aloud a research paper in English, or by reading the words on the computer slides in English. For example, in a programming language class, when a specific term such as “polymorphism” or “inheritance” has to be explained, the instructor might be aware of mispronounced words, awkward grammar, or inappropriate collocation in the delivery of the target language. Since CS instructors are non-language specialist, they may think this is how EMI CS courses look like. They have noticed that no matter how sound their syllabus may have met the requirement of the department, they were defeated by their language ability.
B. EMI CS courses: what & how

Besides having solid objectives for CS courses, adding a touch of viable teaching strategy will do no harm. Three teaching strategies will be discussed and recommended for EMI CS courses in the following section.

- Lexical enhancing strategy: Since vocabulary is the fundamental element of a language, it is recognized as the vehicle of carrying successful communication. Specific terminology or register from the genre of CS should be highlighted and taught before any EMI exercises. Instructors may provide learners with the opportunity of guessing in the beginning. Vocabulary exercises include (1) predicting the meaning of vocabulary from context; (2) guessing the meaning of vocabulary from etymology or morphology (such as “polymorphism” or “inheritance”); (3) applying word map or word association of related words; (4) using collocation, synonym, or antonym; (5) focusing on high-frequency words; (6) providing a list for easily-confused words. These strategies may familiarize learners with new vocabulary, along with expanding their vocabulary sizes; and hopefully, their vocabulary retention can be longer. They might experience less painful process in the follow-up reading texts or lectures. However, if learners have a difficult time getting meanings across, the instructor should provide instant assistance. Explicit vocabulary instruction benefits EMI learners [9]. With a view to make sure that the learners are cognitively disposed to comprehending the text, having proper vocabulary strategies serve as the springboard to activate learners’ schemata.

- Schemata activating strategy: When “JAVA programming language” has to be studied, the instructor may first activate learners’ background knowledge of the programming language. Learners can first work as a group, brainstorm and predict what are they going to learn in writing programming language, such as if-else statements, for-loop, while-loop, polymorphism, inheritance, data structures, or algorithms. The instructor may provide hypothetical questions or dramatic examples to trigger learners’ brain from ticking over. After the brainstorming stage, readings can be distributed. It is suggested that the reading can be broken up as puzzle games. Each group will only get several paragraphs from the entire reading text. The learners will be asked to rephrase or summarize the reading to each other; at the end, each group will report their findings and reorganize the paragraphs into a correct order. With this strategy, the coherence and relations of each paragraph can be learned and identified. In a sense, the learners will not have too much burden on finishing a complete text; so that they may have less complaint about the reading load. At the end of the learning phase, they may realize the challenges encountered during the design of a program; together with identifying scenarios and design decisions that may cause problems. The role of the instructor in this stage is to soften the reading up for the learners and monitor if any group is falling behind.

- Scaffolding strategy: The purpose of scaffolding is to minimize the information gap. For learning to progress, scaffolding is crucial in EMI classrooms when learners are first introduced to a topic, for example, Network Resource Allocation. Instructors will need to provide the learner with a proper gadget, the know-how, to accomplish a new task or to finish a new experiment. Texts could be modified into something more accessible, practices could have alterations to provoke dynamic classroom interactions, experiments could be adjusted as to accommodate intelligent levels, and assignments could be adapted to cater diverse learning needs. For example, in a programming language class, if the concept of “polymorphism” is too difficult for the learners, the instructor may prepare different tasks to acquaint learners with the topic. Partial solutions or hints can be offered to the problems in the tasks. Graphic organizers can be displayed to have a visual framework of the task. The difficulty and density of the tasks may be multiplied gradually. However, if learners would be able to finish a task independently, scaffolding can be removed [10].

C. Suggestions for non-native speakers of CS instructors

Applying EMI in CS courses does not mean preparing computer slides and placing students in groups. If EMI is to be successful, instructors have to put their focal points on “communication”. EMI CS instructors might be facing communication difficulties during class hours, not just in terms of verbal communication, but also in terms of non-verbal communication. All the linguistic and paralinguistic messages can be sent both intentionally and unintentionally; yet, how can the goal of communication be achieved? The Following paragraphs underpinned two communication strategies:

- Non-verbal communication: When an important concept is introduced, direct learners’ attention by using gestures (such as pointing to the board), facial expressions or eye contact. Adding vocal effects, such as decreasing the volume, rising the tone, or using of silence, are other practical ways to grab attention [11]. Non-verbal communication is very likely to complement verbal communication, the importance of it should not be overlooked.

- Verbal communication: Verbal production is crucial to engage learners in EMI courses [12]. As non-language specialist, how can CS instructors deliver ideas fluently and clearly? It is suggested to use grading language, for example: (1) simple sentences. They are easier to understand and picture than relative clauses; (2) high-frequency words. They are words people encounter regularly, so that a mutual understanding can be reached with less effort; (3) repeated keywords. If well-chosen keywords are repeated constantly, marked impressions of words will be retained; (4) examples. When a concept is difficult to explain, use examples to
concretize the meaning to demonstrate a vivid picture of the concept. Verbal communication takes a great part of EMI CS learning, and it has to be practiced. To sum up, instructors are suggested to initiate positive communication strategies by providing explicit directions, and furnishing classroom discussions with constructive feedback through verbal and non-verbal communication strategies.

IV. CONCLUSION

Implementing EMI in CS courses is not a technical change of the theoretical conceptualization, it involves changes in the practice-oriented instruction, individual confidence of communicating in English, and motivation to promote a better understanding of the academics. Since the wave of globalization cannot be blocked and stopped, it is the time to think differently to move beyond the paradigm to render EMI of and for CS education that can be articulated academically on know-how, intelligence, observation, investigation, and communication. A successful EMI CS instructor first and foremost is a professional who teaches in accordance with the objective, value, and philosophy of the subject; instead of resting the goal on building up English vocabulary sizes or correcting individual accent or pronunciation. Although the influence of mother tongue will affect the cognitive style, language aptitude, and communication strategies of the instructors, it is indispensable to boost teaching competence by comprehensible inputs. This study has provided suggestions for communication skills for CS instructors, hoping that it may be resulted in promoting the efficacy of instruction. Teaching strategies may serve as a mirror to better reflect the content knowledge, and make instructors better aware of their role in the classes. It may be deduced that the implementation of EMI CS courses in Taiwan will be fruitful.

Within the definition of EMI, there remains an enormous diversity and practicability of teaching strategies and research goals. It would have been interesting to explore possibilities and effects of other teaching strategies or insights on EMI CS courses. It remains to be seen how the applications may be put into practice in the future. If the development of EMI in computer science can be further justified, it will propel more researchers forward along a path of fulfillment.

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