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Creating a Space for Teaching Problem Solving Skills to Engineering Students through English Language Teaching

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***Abstract*—**The complexity of teaching English in higher institutions by non-native speakers within a second/foreign language setting has created continuous discussions and research about teaching approaches and teaching practises, professional identities and challenges. In addition, there is a growing awareness that teaching English within discipline-specific contexts adds up to the existing complexity. This awareness leads to reassessments, discussions and suggestions on course design and content and teaching approaches and techniques. In meeting expectations teaching at a university specified in a particular discipline such as engineering, English language educators are not only required to teach students to be able to communicate in English effectively but also to teach soft skills such as problem solving skills. This paper is part of a research conducted to investigate how English language educators negotiate with the complexities of teaching problem solving skills through English language teaching at a technical university. This paper reports the way an English language educator identified himself and the way he approached his teaching in this institutional context.

***Keywords*—**English Language Teaching, Teacher Agency, Problem Solving Skills, Professional Identities.

I. Introduction

ENGLISH is undeniably a global language and serves as the medium of interactions for various purposes in various fields. In Malaysia, English holds a second language status. Nonetheless, the language is commonly used only in urban areas or when interactions or events involve international participations. Otherwise, English language is viewed as a foreign, or to certain extent, "alien" language. In Malaysian education, English language is a compulsory subject at both school and university level. In school, students learn English for at least 9 years, starting from year 3 (10 years old) at primary level to form 5 (17 years old) at school level. Despite the lengthy years of learning the language, the proficiency level on English language among undergraduates at higher institutions still needs to be improved.

Teaching English in higher education has its own, continuously discussed, complexity. Research on teaching English in higher education included theoretical perspectives to teaching language, teaching approaches and practices, and the challenges in higher education [1]-[4] and the way English language educators position and identify themselves in their institutions [3, 4]. In addition to this, there is also a growing awareness about the complexity of teaching English within discipline-specific contexts. This awareness leads to reassessments, discussions and suggestions on course design and content [5]-[6] and approaches and techniques to teach [7]-[9] for a second/foreign language setting. Research on the way English language educators identify themselves and negotiate with the complexities of teaching English in a discipline-specific educational setting can contribute to the existing body of literature on teaching English in higher education in second/foreign language settings.

Engineering is a discipline which demands engineers to work effectively in a workplace with teams of diverse individuals to solve both common and complex problems [10]-[12]. A study conducted by Tong [13] reported that problem solving skills was rated as one of the most important skills in engineering industries in Malaysia. As such, future Malaysian engineers not only need to be equipped with English language abilities and communication skills to enable them to communicate globally, but also problem solving skills.

II. Overview of the Study

This study investigated the way an English language educator negotiated with the complexity of teaching English at an engineering-based university in Malaysia. The investigation involved examining the way an English language educator contextualised and identified himself in his educational context, the tensions that emerged and his approaches to teaching in his attempts to address the engineering industrial demands for communication skills in English and problem solving skills among future engineers in a second language setting.

This study was conducted at a university in Malaysia where the primary focus was engineering disciplines. The university was located in a suburb where the use of English was very limited outside English language classrooms. In ensuring the standard and quality of future engineers produced by higher institutions in Malaysia, the Board of Engineers Malaysia (BEM) holds the authority to control and monitor the structure of engineering education. For engineering accreditation purpose, Engineering Accreditation Council (EAC) was

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formed by BEM and manuals containing requirements and programme outcomes an engineering programme in Malaysian higher institutions need to comply were developed. As the education at this university focused on engineering fields the policy and structure of engineering academic curriculum were monitored largely by BEM. In addition to BEM, all programmes in higher institutions in Malaysia also need to conform to the quality control supervised by the Ministry of Higher Education. The responsibility for developing and enforcing the quality control framework was given to the Malaysian Qualifications Agency (MQA). Thus, this university needed to comply with the requirements outlined by two separate authorities.

The data for this study were collected and analysed based on the conceptual framework adapted from Tudor's [2] ecological perspective of English language teaching, Borg's [15] teacher cognition and Fanghanel's [16] filters to pedagogical constructs. Tudor [2] posits that teaching is not only about applying knowledge and skills learnt in teacher education but also about the interactions of various human and contextual factors. In his review of literature on teacher cognition, Borg [14], [15] argued that beliefs, knowledge and the way teachers think about teaching have impacts on their classroom practices. In elaboration to Borg's teacher cognition framework, Fanghanel [16] proposed that the way teachers conceptualise, approach and relate to teaching and learning are filtered by several internal and external factors. In this paper, the data obtained from documents, an individual semi-structured interview and stimulated recall protocols were analysed and later discussed. The human and contextual factors emerged from the analysis included the way the participant thinks about the institutional context he is in, the English language course he is teaching, the language needs of his students and student factors which included students' attitude towards English language courses and their English language proficiency level.

III. Conceptualising English Language Teaching

When analysing the documents containing the criteria and requirements for engineering programmes in Malaysia outlined by BEM, it was concluded that English language courses need to be specific for an engineering field. Nonetheless, when analysing the learning outcomes and the design of the English language courses, none of them clearly addressed communication skills for engineering contexts and problem solving skills. The discussion of the analysis raised the issue about the transmission process which involved disseminating, interpreting, filtering and the transforming engineering accreditation outcomes from the macro level (the University) to the micro level (the English language department). This transmission process resulted in a disconnection between the learning outcomes and the syllabus of the English language courses and the programme outcomes outlined by the EAC. As a result of this process, English language courses appeared to be stand alone courses and were not identified as part of the engineering academic curriculum.

In providing English language learning for engineering students, three courses were set up. One of these courses is the Communication in English course which was located in the second semester of the first in an engineering curriculum. The Communication in English course was situated at a location where engineering students had not yet been taught the engineering fundamentals. Therefore, contextualising the Communication in English syllabus or tasks into engineering could limit students' understandings of the activities and tasks conducted in an English language course and hamper their language learning process. On the other hand, by not contextualising the syllabus or tasks, the Communication in English course appeared to be in isolation and does not address one of the programme outcomes outlined by EAC.

The transmission process and the location of an English language course not only affected the way the English language courses were developed, but also disconnected the way an English language educator conceptualise teaching English at this university from the expectations outlined in the EAC manual. This transmission process deprived an English language educator of opportunities to "interpret the ambiguities and gaps in critical ways that open up moments and spaces for transformative pedagogical interventions" [17]. Therefore, English language educators would not fully conceptualise and relate to teaching English for this institutional context. English language educators are a group of people or actors who implement policies or work to fulfil requirements impose on them by the institution they work with at micro level [18, 19, 20]. To enable them to work towards addressing these policies or fulfilling these requirements, English language educators need to be given the spaces to play agentive roles and a broader perspective of the institutional contexts [17].

In this study, the findings showed that opportunities to interpret the programme outcomes outlined by EAC or the spaces to play agentive roles were not made available to the English language educators. The absence of these opportunities could limit English language educators' understanding of their institutional context. Thus, teaching English for engineering and teaching problem solving skills was absent from their instructional practices.

IV. Professional Identities and Approaches To Teaching

Professional identity is "complex, personal and shaped by contextual factors" [21]. This suggests that the way English language educators identify themselves depends on the way they perceive and contextualise their educational contexts.

One of the participants, Mat, underwent teacher education to teach English for general purposes in schools. He believed in student-centred learning and preferred students to challenge knowledge delivered to them in class. Despite this belief, he conformed to the language needs of the students according to

the educational setting he was in. In other words, his teaching approaches corresponded with the way he conceptualise his institutional context.

Mat taught in schools for two years before joining this university. He reported that the teaching and learning process in school environment aimed at students' achievements in examinations and the education system became exam-oriented. The syllabus was identified as a set of instructions that needed to be followed and teaching. This contextualisation of the school environment resulted in the employment of teacher-centred approaches and the use of drilling as one of the teaching strategies to familiarise students with examination format and ways to address examination questions was dominant. His instructional practices focused on teaching about the language and grammatical knowledge. In this environment, Mat demonstrated the identity of "bounded professionals" who perform roles within clear and structured functions and job descriptions [22].

Within the context of this university, Mat conceptualise teaching and learning differently. For him, a syllabus is a set of guidelines with a set of learning outcomes that need to be addressed. In addition, undergraduate students were adult learners who should be responsible towards their own learning and their own academic achievement. As a result to this conceptualisation, student-centred approaches were employed. His instructional practices emphasised the process of learning. Students' language needs were addressed through the process of completing tasks rather than focusing on language structure specifically. Therefore, the space for students to learn the English language in context was created. Mat reported that he was able to construct his instructional practices in ways he believed would be realistic and effective for his student learning and the learning outcomes of the course and the objectives of given tasks were addressed. Unlike in school, he positioned as a facilitator that he had the power and freedom to address the content and the learning outcomes of the English language course in his own way. In other words, he identified that he had the space to exercise teacher agency and teacher autonomy in this institutional context. In this context, Mat demonstrated the identity of "cross-boundary professionals (who) actively use boundaries for strategic advantage and institutional capacity building" [22]. The discussion about the approaches to teaching for two different educational settings emphasised the importance of understanding the institutional context an educator is in.

In spite of the disconnection from the engineering demands as outlined in the EAC manual, Mat identified the need for English for engineering fields and to teach problem solving skills. In relation to teaching English for engineering fields, he reported that the incorporation of engineering issues or content into his instructional practices was impractical. Apart from the location of the English language course as discussed earlier, the need for knowledge in engineering fields to enable him to provide effective learning environment was also a concern. Limited knowledge about these engineering fields caused the use of content and issues related to engineering were avoided. Therefore, the space for English for engineering contexts was absent.

In relation to teaching problem solving skills, Mat's instructional practices provided the space for problem solving activities. He exposed students to problem solving process and expected them to undergo this when performing given tasks or activities. The process included problem representation, identifying possible solutions, defining a plan for the selected solution, implementing the plan and evaluating the plan [23-25]. It was noted that the stages in the process need not be in sequence and not all the stages need to occur in one lesson [26].

A task was normally broken up into several learning session and only parts of the problem solving process were observed in a particular learning session. In Communication in English course, one of the tasks was conducting interviews. This task was broken up into 2 learning sessions and one practical session. The practical session was conducted outside of English language schedule. For the first session, the teaching and learning process could not be observed as the data collection for this study had not begun. Nevertheless, information about this session was extracted during the stimulated recall protocols.

The first session involved gathering information, preparing interview questions and planning the procedure to conduct interviews. The description for this session suggested that the problem representation stage took place. Once the interview questions were prepared, the students emailed these questions to Mat so that he could facilitate the language used and the appropriateness of the questions. This was the space where English language teaching occurred. When giving feedbacks to the questions prepared for the interviews, Mat refrained from giving definite "correct/incorrect" feedbacks. Instead, he prompted with "Why is this question relevant?", "What information do you intend to obtain from this question?", "Maybe, this is what you mean" or "Maybe the way for you to write it is this". These prompts were intended to instigate students to think about the appropriateness of the questions and the language used. Questioning and prompting is important in a problem solving process to assist students to elicit and index information [27]. The communication to discuss the interview questions occurred through email. Once the questions were finalised, the students went through the practical session in which they performed the interviews. This practical session was performed outside of the English language timetable. The email communication and the practical session provided evidence that the space for language learning and teaching problem solving skills was created within and outside the time allocated for this course. Furthermore, the communication through email represented evaluating the plan stage, in this case evaluating the interview questions.

When the second learning session was conducted, students had completed the task of performing the interviews. During this session, Mat extracted information about the way his students had conducted the interview. The questions and

prompts he used instigated them to evaluate the success or the failure, the strengths or the weaknesses of their interview sessions. This process represented evaluating the plan stage. While the problem solving stages were not explicitly introduced to the students, the problem solving process itself was evident and provided guidelines for students to follow when performing other tasks. Mat's instructional practices provided evidence about the way problem solving skills were taught through English language teaching.

In relation to teaching English, there was tension between the need to address students' low level of English language proficiency explicitly and providing opportunities for students to use the language in context. Students' low proficiency level appeared to reduce their confidence level in using English which limited their interactions during teaching and learning sessions. Due to their low confidence level, students refrained themselves from using English language for fear of being laughed at by their classmates when making language errors. Students' low confidence level in using the language could impede interactions or discussions in the classroom which was the key element to perform the problem solving process in class. To help reduce students' low confidence level, language structure and grammatical knowledge were addressed implicitly. In this way, students felt comfortable to produce the language and less tensed about language accuracy.

In summary, Mat's conceptualisation of this institutional context led to the implementation of student-centred approaches to teaching. Students were perceived as adult learners and were responsible to their own learning. As a result of this conceptualisation, Mat positioned himself as a facilitator who should provide authentic learning environment. Although his conceptualisation of teaching English was disconnected from the demands from engineering industries, he identified the need for teaching English for engineering fields and teaching problem solving skills. While the space for teaching English for engineering fields was not available due to concerns about the locations of the English language courses and limited knowledge of engineering, the space for teaching problem solving skills was created.

V. Conclusion

The transmission process of the programme outcomes and the requirements of the EAC affected an English language educator's understanding of the institutional context he was in. This limited understanding of his institutional context influenced the way he conceptualised, approach and relate to teaching and learning at this university. Therefore, the need to create a space for teaching English for engineering and for teaching problem solving skills was seen as additional efforts in an English language educator's instructional practices. The transmission process which included disseminating, filtering, interpreting and transforming of the requirements in the EAC manual also resulted in the design and content of the English language courses were for broader contexts rather than for a specified engineering field. Thus, English language courses appeared to be isolated from the structure of engineering curriculum. English language educators need to have the opportunities to gain access to and interpret the requirements outlined in the EAC requirements with supports and guidance from engineering faculties. This could allow them to understand and conceptualise teaching English for this university. In addition, the knowledge and pedagogies required to address the EAC programme outcomes and equip future engineers with the ability to work in a team and communicate in English effectively in order to solve problems throughout their career could be identified.

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