

Reading in Engineering: Understanding Engineering Students' English Language Academic Literacies

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Abstract. Students' authentic voices on their acquisition of academic literacies at tertiary institutions may have been treated in partial and incidental ways by many educators and researchers alike. This paper is founded on the premise that explores students' actual academic literacy practices particularly in the complex nature of multilingual students having to negotiate and deal with English language literacies in their engineering disciplines. The study reported here details the reading practices of a group of engineering students in a Malaysian public university in the quest to meet the demands of their academic settings. The findings highlight the intricacies of the students' academic literacies which entail a variety of academic discourses and language use. The findings provide insights into the students' predicaments and concerns in dealing with the requirements of the engineering curriculum and the English language literacies at tertiary education.

Keywords: Academic Literacy, Literacy Practices, English-as-a-second-language (ESL), Engineering Students.

1. Introduction

English has become a global language, increasingly necessary for international intelligibility and information management (Crystal, 1997), especially in business, science, diplomacy, engineering, information communication technology and organisations with an international orientation. In regards to higher learning institutions, not only it is widely used as the medium of instructions but English is also largely acknowledged as the dominant language of academic publications, communication and technologies. The term 'academic literacy' or 'tertiary literacy' (Hirst et al., 2004) in higher education is simply defined as "the ability to read and write the various texts assigned [in university]" (Spack 1997, p. 3). Johns (1997) elaborates that academic literacy "encompasses ways of knowing particular content and strategies for understanding, discussing, organizing, and producing texts" (p. 15).

A search of the literature on the English language academic literacies has pointed to a substantial studies conducted worldwide (Ivanic, 1998; Leki, 2001, 2003, 2007; Spack, 1997) which primarily focused on the experiences of English-as-a-second-language (ESL) and non-native speakers of English (NNSE) students in English speaking countries where English is regarded as first language (L1) or target language. Arguably, research on NNSE students' English language academic literacies in an ESL context, particularly in Asia, is still scant. Generally, NNSE students within this region must operate in the environments where their mother tongue language or their L1 is used extensively in their communication with their teachers and peers, and yet they must read and write in English in most academic events. This is especially true in regards to the engineering students in this study who have to conform to various requirements in the engineering disciplines while coping with the English language which does not serve as their main language.

Borrowing Zamel & Spack's (1998) definition of academic literacies which "embrace multiple approaches to knowledge" (p. ix), this paper explores engineering students' multiple approaches to English language academic literacies where different languages and various discourses intersect within the engineering curriculum. This can help to construct an understanding of the students' overall learning. This study is important and germane as academic literacy practices are deemed to be "active, dynamic and interactive" in nature (Teacher Education Working Party, 2001, p. 4) which represent "particular views of the world, uses of language and ways of constructing knowledge within academic disciplines" (Curry, 2004,

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p. 51). Specifically, this paper reports the findings on the reading practices of a group of engineering students in a Malaysian public university in the quest to meet the demands of their academic settings.

2. Methods

Aligned with the central aims of this study, the qualitative case study is deemed the most appropriate method to investigate students' academic literacies given its descriptive, dynamic, and authentic nature. Multiple data gathering methods were conducted constituting primary data collated from focus group and individual interviews and supplemented by the written summary sheets fulfilled by the students, and non-participant observation field notes taken by the researcher. Added to these were the contextual data derived from the documentary resources, such as the course booklets, students' written assignments and results.

The key informants of this study were 21 third year students from the engineering faculty at a public university in Malaysia. These engineering students were chosen because they attained Band 2 in the Malaysian University English Test (MUET), which is the lowest level scored among engineering students at the university entrance. The purpose of MUET is to measure the English language proficiency of university students for entry into tertiary education as well as to gauge their ability to use English for academic purposes at higher learning institutions. According to the MUET descriptions, the score Band 2 is identified as "limited users" of the English language.

Generally, the researched students came from diverse majors in engineering studies including Chemical, Manufacturing, Electrical and Electronic, Mechanical, Civil and Structural Engineering and Architecture, and different ethnic backgrounds. The majority of them were Malays while three of them were Chinese. Nearly all of them came from a non-English-speaking environment, mostly located in the suburban and rural areas. The students' age ranges from 21 to 24 years old. It should be emphasised that for reasons of confidentiality in this study, the students are identified only by using alphanumerical codes (i.e. FG1a, FG4e)

In the tradition of qualitative research, the data obtained from the students were read reiteratively and analysed rigorously through an inductive process of identifying the recurring and salient themes. The similarities and differences of perspectives among the students were identified and explored from an interpretive paradigm to develop common themes, which are discussed below.

3. Results and Discussion

This section discloses the findings on the students' reading practices pertaining to the central role of reading, the relevant texts applicable and the language used in the students' academic endeavour. It is found that the engineering students' learning practices and experiences did not occur in a vacuum; instead they involved an execution of a complex combination of academic literacies.

With reference to educational texts, it is apparent that the roles of reading varied considerably in the students' context. Accommodating to the engineering course requirements, the students reported having a great deal of reading diverse texts written in English to suit several purposes such as to obtain required information for accomplishing their assignments; and to understand new concepts and technical procedures, to create and produce new inventions amid preparing themselves for examinations and class assessments.

For the engineering students, particularly those in the Mechanical, Chemical and Electrical courses, their reading practices entailed searching for supplementary resources to complete their assignments and projects. However, for these students, their references were practically associated with numerical concepts and technical details extensively appeared in English. Since the emphasis of the course content and evaluations was placed on calculations, therefore, reading for calculation procedures was broadly a commonplace for these students. For instance, FG2c consistently highlighted, "We have a lot of calculations to deal with, everything must involve calculation."

Generally, for the majority of the engineering students, reading plays an explicit role in getting the main idea and key points of their subject matter. It is indeed the vital component acquired in all engineering courses. These reading practices also assist the students' preparation for the on-going as well as the final assessments. The vast majority of the participants stated that they relied heavily on their lecture notes when preparing for their class tests and final examinations. This is primarily due to the accessibility and

practicality offered by the notes which contain comprehensive information of the course content written in summarized or point forms. FG4b disclosed that the students do not require much effort to study for the examination because “lecture notes are convenient because of the points given.”

Except for other significant roles of reading, mainly for preparing for examinations and fulfilling the requirement of their course assignments, the actual role of reading in the engineering courses was seemingly less obvious. Because of the considerable amount of calculations embedded in their content subjects, only a portion of written verbal reading was carried out by these students. The majority of the students reported that in their reading, they hardly read fully and/or they normally skipped the explanation and the theoretical part in their textbooks as more attention was paid to comprehending the calculation procedures and concepts. Indeed the bulk of their reading practices were confined to reading for straightforward explanation and instructions related to calculations. In discussing a chapter in one of their textbooks, the students indicated that “This is about the theory, we barely read this. We do not read this part at all. We want to know the direct information” (FG2a).

Apparently, the majority of the engineering students claimed that it was a struggle, which delayed or sometimes impeded them from obtaining sufficient information as they had to spend a great deal of time reading them. Reading could sometimes be an excruciatingly slow process for the students when the texts were dominated by “scientific language” (FG4b), “advanced language” (FG4a) or “complicated language, and we cannot find the words in any ordinary dictionary” (FG1e). To be able to comprehend the entire texts, they often needed to stop reading and look for the meanings of the unfamiliar words they came across by consulting either the dictionary or e-dictionary (computer dictionary). Most of the time, they referred to the Malay-English dictionaries for the explanation on the unfamiliar words. In essence, their reading was frequently disrupted by the searching-for-meaning process. Hence, for some students, their reading practices have turned out to be taxing and time-consuming tasks particularly with regards to preparing for the examinations. This is especially true because of the extended hours they needed to spend trying to make sense of their reading while frequently checking on the meanings of unfamiliar words in the dictionary, thus stretching their preparation time. Expressing his concerns, FG4d stated that “To be able to understand our readings, we have to check the meanings in the dictionary first. It is very slow. While other students have already finished, we are still struggling with our readings.”

Notwithstanding their diverse choices of dictionary, the students reported insufficient and occasionally absent explanation of most scientific terminologies and words in these dictionaries. A student explained that

Because the engineering language is so unique, sometimes we could not find the words in the dictionary. If we were to translate the words, the sentences would sound weird and that the whole idea did not make sense at all, so, we become more confused (FG4d).

Eventually, the failure to identify the meanings and comprehend the texts dampened their spirits to read further. In some cases where the reading articles were deemed difficult, students read only the sentences which they thought were important while disregarding the trivial parts. Nonetheless, they admitted that they still relied heavily on dictionaries to help them understand their readings. On occasions where dictionaries were not available, they discussed the meaning with their friends, whom they perceived were more proficient in English, until they reached full sense of what they were reading.

On further probing into their reading predicaments, the students explained that their existing problems in English added up to the trouble in comprehending the concepts in their readings. This has made them even more confused, and thus resulted in more frustration in reading. According to a student, to be able to understand a text profoundly, it often took more than an hour to read just ten pages. Unfortunately, most of the time, when reading became frustrating especially when the text was too long to manage, the majority of the students simply quit reading. This was confirmed by the following statement; “If the language is too advanced to understand, which I do not understand at all, then, I give up” (FG4a).

It is apparent that for these students reading posed a challenging task and they complained of failure to comprehend when the load was too great. Even so, for readings that they could handle, a student reported that he still had to read them twice to understand them. Hence, he often had the extra burden of having to

read even straightforward material twice to understand it. Furthermore, another student affirmed that he normally “read a paragraph 2-3 times to get the key points, to understand and to highlight them” (FG4b).

The discretion of selecting the most relevant reading resources that suited their own individual needs and level of proficiency relied upon the individual students. It is noticeable that when the reading became extremely demanding, the students had no other alternative but to opt for articles written in the Malay language. Owing to constraints on their time and proficiency in English, the students deliberately chose simpler reading resources, specifically those printed in the Malay language. As one student said “It takes time to read the materials. But if I do not have enough time, I will definitely find the most convenient resources, like the ones written in Malay” (FG4e).

In the process of struggling to understand their course materials, the students established new strategies for learning unfamiliar subject matter and for acquiring the language of that subject matter. Conforming that learning strategies are exploited by learners to assist the process of acquiring knowledge by making it easier, faster and pleasurable, Oxford (1990) indicates that learning strategies help learners develop second or foreign language competence in many ways. As manifested in the findings, several learning strategies were employed by the students to comply with the expectations of their disciplines. Embedded in the students’ academic literacies was the dependency on peers’ assistance in comprehending the difficult words in their readings. Peer discussion was also conducted as a source of reference mainly to help clarify concepts drawn from their reading resources written in English.

Table 1: Summary of findings on reading practices of the engineering students

Reading resources	Language used	Roles	Reading difficulties
Reference books	English & Malay	To comprehend architectural principles To comprehend calculation procedures To design new inventions	Dealing with unfamiliar words Understanding complex language structure Managing lengthy explanation Managing long texts
Internet journals	English	To understand technical details To complete course assessments	
Academic magazines	English	To comprehend architectural principles To design new inventions To complete course assessments	
Textbooks	English	To comprehend calculation procedures To gather main ideas To prepare for exams	Nil
Lecture notes	English & Malay	To comprehend calculation procedures To gather main ideas To prepare for exams	Nil
Dictionaries	English – Malay	To obtain the meaning of words in English	Nil

The translation strategy adopted by the students also merits commentary. The findings reveal that the students relied heavily on dictionaries to aid their comprehension, construction of utterances as well as composition of assigned work due to their familiarity with their first language and deficiencies in English. Interestingly, the students acknowledged the fact that thinking was cognitively executed in their mother tongue language and subsequently translated into English to comply with the requirements of the academic. In such circumstances, the students employed organisational patterns from their L1 which sometimes resulted in ineffective communication (Andrade, 2009). Furthermore, the actual practices of memorising key points, main ideas, procedures, definitions and concepts in the preparation for examinations were also noticeable in the context of the research students. These strategies were found to be universal practices among Malaysian students as confirmed in the studies carried out by Ismail (2008), Lee et al. (2010) and Thang (2003). Lee et al. explain that students resorted to memorisation or regurgitation of lectures notes when under pressure to study or prepare for assessments. Further, Thang maintains that it is a disturbing fact that memorisation, which is frequently associated with rote learning among Malaysian students, may be the

result of the exam-oriented and teacher-centred approach extensively exercised in schools. Thus, this limits the students' abilities for creative and critical thinking. Recognising the students' tendency to focus on keywords as a means of circumventing their linguistic problems, Bruna et al. (2007) maintain that this practice may obscure the students' ability to make meaningful connections between various scientific processes and mathematical operations.

In short, the findings discussed above accentuate on the dominant reading practices performed by the students in the academic context. It is apparent that these reading practices were primarily conducted with the central aim of comprehending and gathering new knowledge pertinent to numerical and technical details in the students' quest to fulfill the requirements of their courses. Furthermore, various types of reading resources were also utilised and the choices of exploiting these resources were deliberately made based on the conveniences offered by them. In actual fact, virtual resources were highly preferred because of their ease of access and lecture notes were very much favoured due to their user-friendly and precise nature. In addition, these reading practices involved a substantial amount of English while some blend of English and Malay were also manifested. Furthermore, the findings on reading practices also revealed the students' difficulties in handling some of the reading materials. A summary of students' reading practices is shown below.

4. Conclusion

This study has approached the issue of the English language academic literacy competencies and practices from the perspectives of the engineering students engaged in the acquisition of knowledge at the tertiary level. In doing so, it has drawn attention to dimensions of the students' reading practices and experiences in the English language. The findings depict a rich and multifaceted picture of the students' experiences and struggles along their academic pathway. The findings provide insights into the students' predicaments and concerns in dealing with the requirements of English language literacies at tertiary education. This study suggests that English language literacy learning is complex and highly contextualised particularly in the multilingual context of engineering education such as in Malaysia.

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