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Creating Professionally Contextual Problem-based ESL Learning for Post-baccalaureate Level Education

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Abstract: In a recent publication, the authors and a colleague discussed at length the use of problem-based English Second Language (ESL) learning within the STEM (Science, Technology, Engineering and Mathematics) disciplines (2017). Earlier publications (2013, 2015) explored the uses of PBL in various English language learning (ELL) settings. With this publication and presentation, we incorporate essential elements from the multi-decade English for Occupational or Professional Purposes (EOP/EPP) literature, including content based instruction/content and language integrated learning (CBI/CLIL)) aspects, to propose that the ideas expressed in our earlier publications have potential for expansion and further development into a series of specifically crafted, problem-based English for Specific Purposes (ESP) curricula, tailored to the professional vocabularies of discrete post-baccalaureate programs and disciplines in a problem/project-based, content focused learning system. The paper will explore use of problem-based learning (PBL) in a multi-cultural STEM ESP situation. It is being developed with the purpose and objectives of including an overview of the key strategies for success in language acquisition focusing on ESP, and outlining exemplar programs that can actively engage learners in defined subject-matter contexts. This topic will be approached utilizing examples appropriate for a variety of cultures and ESP content areas including engineering, technology and the sciences. We believe the methods described below, however, have equal value in other disciplines with unique English language components, such as medicine, international law, finance and even the fine arts, each of which have a very specific and unique vocabulary and usage pattern.

This may be true of general conversation or reading in a specific language, it cannot be held necessarily true within the context of professional spoken and written communication within STEM disciplines, as well as those such as law, medicine, business, or even artistic or aesthetic fields, which have extensive disciplinary specific vocabularies. A professionally focused, contextual, problem/project-based ESP approach may serve to build the subject matter specific English language proficiency that is sought by post-baccalaureate students entering professional vocational disciplines.

Key words: ESL learning, STEM, PBL

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1. Introduction

There is an adage in the contemporary American education community that seems most appropriate in the situation we address in this presentation. It is: “To teach them, you have to be able to reach them”. In the multi-cultural STEM ESP environment, a language teacher must confront the confounding complexities imposed by a largely English Second Language (ESL) student population. Reaching that student group is a challenge that is difficult enough when teaching simple conversational English. It becomes considerably more imposing when ESP is the language being taught. It has been noted that retaining attention of professionally oriented students in general ESL class environments is a continuing problem, particularly in engineering programs. We propose to use PBL to overcome the attitudinal and indifference issues noted by sources cited in our previous article. Between problem base, and subject specificity, it should be possible to build and sustain interest in English language learning even for the STEM post-baccalaureate student population. Our proposal would be to employ subject matter experts to define the vocabulary needs to succeed in these disciplines in a post-baccalaureate environment, plus projects/problem sets that they would help to build. We will build and present a framework into which that vocabulary and those projects/problem sets can be introduced and reinforced in a problem-based learning setting, with essential grammar and structure elements also incorporated. We would be building a family of ESP courses to be included within the subject specific curricular settings, oriented toward preparing the professionally bound student to be functionally proficient in each profession’s English language expectations, and also professionally focused problem solving/project completion skills.

English is increasingly being adopted as a significant language of instruction in universities throughout the non-English speaking world, and particularly in Europe since the passage of the 2009 Bologna Accord on Higher Education Instruction. European universities have moved in this direction to sustain the educational mobility standards mandated in the accord, and to maintain their place as providers of education of professional quality. Similar actions are taking place in Asia and the Middle East, where English has become the principal language of instruction in most professional and post-baccalaureate programs, particularly in Medicine and in Scientific (STEM) disciplines. Of significant note is that most instruction in Medicine in China is now in English, attributed largely to the heavily Greco-Latinate root vocabulary of the profession which does not translate easily from English to Chinese, coupled with the globalization of medical information systems, dominated by English as the common language.

2. The Nature of the English Language Compounds the Problem

The near global reach of the British Empire in the 18th and 19th Centuries led to the early accumulation of many words in the lexicon not of European origins. This is not a new phenomenon. The word “khaki”, for example, is Hindi (from Sanskrit) meaning “dust” or “dusty in appearance”. It came into English during the Raj in India to describe the tan colored cotton field uniforms issued to local troops of the British colonial army elements. It ultimately became the common term in English for any tan hard finish cotton fabric, or even pants made from such fabric.

But other ESP focus areas may not offer so easy a path. This is particularly true in the science and engineering disciplines that have emerged in the late 19th and 20th centuries. The rapid development and global deployment of these science, technology, engineering and mathematical (STEM) disciplines has led to the

accumulation of new words in the English lexicon that are simply “grabbed” from the linguistic environment from which they were first observed. Thus the ESP vocabulary of these disciplines is, while not “filled”, at least sprinkled with terms that need specific explanation at first usage to provide clear understanding of the term, even to the native English speaker. ESP researchers in Asian nations have noted particular difficulties in this regard in recent publications (Hoa & Mai, 2016; Liu, 2016; Banditvilai, 2016), as will be discussed in greater detail below. The recent literature also contains methodological suggestions for increasing the effectiveness of ESP learning (Privas-Breaute, 2016; Kleanthos & Cordozo, 2016; Wu, 2014).

So long as the terms in question are nouns, the situation is relatively manageable, with a good glossary, without any etymological components required. When we begin to incorporate English words that have identical spelling for their noun and verb forms, or where the past tense of a verb is also used as an adjective, for example, the situation becomes far more complicated. One example comes immediately to mind. The word is “structure”. As a verb it means “to construct”, “to build” or “to arrange”. As a noun it means “an object that is built or constructed”. The past tense of the verb, “structured”, can also be employed as an adjective, as in “a structured vocabulary”. This is but one example of a common English word whose meaning is defined by its usage.

Add to this the fact that there are not clear and easy translations for many words from English to many languages, including modern European ones. A single English word may require multiple words or even a phrase to provide a clear understanding. Thus we see that the eclectic, complex character of English makes it more difficult for the conversational ESOL learner, and the specialized ESP learner in the Sciences is frequently, confronted with vocabulary not of traditional Germanic or Latinate origins, adding to that difficulty. Addressing these issues requires a very carefully planned CBI/CLIL approach where problem-based learning methodologies, combined with subject specific lexicons, based on careful needs analysis, can be employed.

2.1 First Let Us Consider CBI/CLIL

Context Based Instruction (CBI) or Content and language integrated Learning (CLIL), as it is commonly referred to in Europe, is a second or subsequent language (L2) teaching methodology that prepares students to acquire language while using the context of whatever subject matter may be chosen. The technique is not subject specific, and can thus be employed across any curriculum. It allows the L2 learner to simultaneously complete two academic tasks, specific subject matter mastery and learning a language, within the natural context of that language’s intended usage. Educators have realized that in order to successfully complete a content related academic task, L2 learners have to master both English as a language form (grammar, vocabulary etc.) and how English is used within the specific content related activity.

The benefits of this approach are:

1) Learners explore content of specific academic interest, and are simultaneously engaged in appropriate language-dependent activities. Languages are not learned through direct didactic instruction, but rather acquired “naturally” in intended use.
2) CBI supports contextualized learning; learners are taught useful language that is embedded within relevant discourse contexts rather than as isolated language fragments (vocabulary lists, verb declensions, etc). Thus, students make greater connections among the language, it normal use, and what they already know.
3) More complicated materials can be delivered within its real life context for the students to grasp, which leads to intrinsic motivation to continue the language learning process.
4) CBI is very amenable to active learning modalities such as design learning, task based learning, project based

learning or problem based learning, which strengthens its utility at the secondary and post-secondary learning levels.

5) CBI provides substantial flexibility and adaptability in a curricular setting and can be employed based on demonstrated students' interest while achieving specific curriculum outcomes.

The CBI classroom is learner rather than teacher centered. In such classrooms, students learn through doing and are actively engaged in the learning process. They do not depend on the teacher to direct all learning or to be the source of all information. Central to CBI is the belief that learning occurs not only through exposure to the teacher's input, but also through peer input and interactions. Accordingly, successful students in the CBI classroom assume active, social roles that involve interactive learning, information gathering and sharing, and the co-construction of learner outputs based on real, natural content understanding.

CBI also has substantial motivational power in language and subject matter learning. When students are motivated and interested in the material they are learning, they make greater connections between topics, have greater understanding of elaborations within learning material and discourse regarding it, and can recall information better. Because CBI is by its nature student centered, one of its goals is to keep students interested and motivation high by generating stimulating content instruction and materials.

2.2 Problem-based Learning (PBL): An Explanation

PBL has its origins in medical education in Canada, and thus has roots in a discipline where ESP is an integral part of the educational process. It quickly attracted attention and usage in the English-speaking medical education community, and from there spread into post-secondary settings in the United States and other Anglo-phone nations. Problem-Based Learning is a flourishing approach to learning that is extremely useful in promoting critical and analytical thinking, and in addressing the rapid technological changes and dynamic workplace of the 21st Century (Nicolaides, 2012). PBL is founded on an unconventional pedagogical model when viewed alongside the conventional didactic one and it offers greater benefits to the quality of student learning (Greening, 1998). The similarities to the case study methodologies employed in the business education community were also quickly recognized. The advantages of PBL over the case method were quickly recognized, since the frequently complex case development process could be avoided by focusing on an unstructured problem in the abstract, without the need of the detailed background, setting and circumstance development that cases involve. This is also the case relating to the science field and further attention is being devoted to exploring active learning methodologies for language learners in the scientific curriculum (Caspary & Boothe, 2016). In addition, PBL is pluralistic and learner-centered as opposed to the more traditional didactic, teacher-centered ELL approaches.

PBL is not new. Stepien and Gallagher suggest that, "it has been a major success since the 1970s. PBL turns the instructional setting topsy-turvy, shifting the learning environment from a teacher centered to a learner centered one. In the place of covering the curriculum, learners probe deeply into issues searching for connections, grappling with complexity, and using knowledge to fashion solutions" (Stepien & Gallagher, 1993). Yew and Goh (2016) focus on the process and impact on learning provided by Problem-based learning, and examine its effectiveness, concluding that "studies comparing the relative effectiveness of PBL are generally consistent in demonstrating its superior efficacy for longer-term knowledge retention." According to Stover (1998) PBL "will increase retention of knowledge, help students transfer concepts to new problems, enhance students' interest in the content and enhance self-directed learning".

Realistic problems are the key to the use of the PBL model. But what are the characteristics of good problems? Duch (1996) lists some of the characteristics of good problems as:

1) "An effective problem must first engage students' interest and motivate them to probe for deeper understanding of the concepts being introduced.
2) Good problems require students to make decisions or judgments based on facts, logic and/or rationalization.
3) Cooperation from all members of the student group is necessary in order to work effectively through a good problem.
4) The initial questions in the problem should have one or more of the following characteristics; they should be: open-ended; connected to previously learned knowledge; but avoid controversial issues that will elicit diverse opinions.
5) The content objectives of the course should be incorporated into the problems, connecting previous knowledge to new concepts and connecting new knowledge to concepts in other courses and/or disciplines."

PBL is a multilevel approach to learning that incorporates relevance and complexity while strengthening critical and analytical thinking, and provides an opportunity for self-assessment and continuous improvement. PBL guides exploration, and students who learn using this model develop a sense of self-esteem and ownership for their work. Through the use of this model, opportunities abound for linguistic development coupled with acquisition of content area knowledge. Scott (2014) focuses on a multilevel analysis of Problem-based learning design characteristics and "proposes and tests a multilevel of PBL design characteristics reporting findings that reinforce the importance of problem design characteristics and effective team facilitation while raising new questions about team-level characteristics".

The key to the success of English language acquisition through PBL is to utilize selected constructive problems purposefully designed to address the desired learning outcomes. These problems are often influenced by social and contextual factors. Most students already possess conceptual knowledge in their native language. Cummins (2000) states: "Conceptual knowledge developed in one language helps to make input in the other language comprehensible". Careful lesson planning is necessary in terms of language learning and content knowledge. When using the PBL model, content is introduced in the context of real world problems. The learners' acquisition of knowledge is achieved through a combination of learning strategies that are self-directed, independent, and collaborative, while also emphasizing interpersonal communication skills and providing ongoing reinforcement.

2.3 Problem-based Learning in an ESOL Environment

Kosel (2002) points out that use of PBL is relatively new in the field of language teaching and learning. According to Gvarsjancic (2001), the teaching approach was introduced with the desire to integrate language and content study to facilitate autonomous learning. He contends that the idea to use PBL in language learning was developed by a Leonardo da Vinci pilot project for the year 1999/2000 entitled Teaching English for Technical Purposes — TENTEC. Gvardjancic (2001) says the following about the results:

> "The results of the project showed that it was especially appropriate for teaching languages across the curriculum for some reason. Firstly, there is the question of motivation. ESP teachers sometimes find it difficult to motivate their technically or professionally oriented students for language learning. Even carefully designed curricula, which follow needs analysis, do not always meet the real interests of young student population. Updated textbooks soon become boring and obsolete since new information is easily accessible on the internet. So, a real-life problem raises motivation. Secondly, and closely connected with the question of

> motivation, is the significance of teaching languages across the curriculum. Languages at tertiary level are often treated as second-rate subjects. This situation is reflected in students' attitude towards language as a faculty subject which they consider a necessary evil but not linked to what they believe to be their genuine study program. This situation can be changed. Working closely with "subject teachers", language specialist becomes involved with the faculty programmes, while the students feel they can combine their professional knowledge and their knowledge of language".

Kosel (2002) enumerates the following as some of the advantages of PBL approach in teaching English across the curriculum:

> 1) "A real problem raises motivation, much more than a preselected sequence of information from a course book.
>
> 2) In the model, students can integrate their professional knowledge and their knowledge of English.
>
> 3) The model makes them better equipped with functional skills needed for their professional careers and thus makes them more competitive on the job market.
>
> 4) Individual and social learning are combined.
>
> 5) English is learnt while doing something else, which goes together with the slogan "Learn by Doing."

Problem-based learning can be used to actively engage learners and bridge the gap between English language learners and their subject matter. Methodology rooted in inquiry can be particularly effective for teaching science and mathematics (Stoddart et al., 2002), and can enhance comprehension for primary grade learners up through the specialized focus of higher education coursework. The PBL paradigm asks students to take on an active role in their education, where the learning becomes everyone's responsibility. "When students are driving the problem posing and decision making, it has been found that these inquiry-based methods personalize the project, increase relevance, and create ownership" (Johnson & Kean, 1992).

3. Focus on STEM ESP

As noted above, the eclectic character of English has added numerous words to the lexicon with origins remote from the language's Western European roots. This phenomenon is evident throughout the language, and has been of particular impact in the STEM communities, as they become increasingly global in character, and have begun to rely upon English as a common medium of information exchange. The teaching of English as a "foreign language" has reached global proportions, with special schools teaching ESOL appearing literally in every corner of the planet. The demand for teachers of ESOL has increased dramatically at the same time.

What has become increasingly evident is that traditionally trained ESOL teachers may not be able to fully prepare post-baccalaureate non-English speakers in the STEM fields, each with their own specialized lexicon. This issue has been commented upon as applies to engineering students in Saudi Arabia (Alqahtani, 2015, p. 93), Taiwan (Wu, 2014, p. 122), and Viet Nam (Hoa & Mai, 2016, p. 155), and may be generalized as particularly true in Asian countries, where vocabulary issues and passive learning styles impede ESOL learning situations. Boothe and Vaughn (2011) note that, often, a lecture in STEM fields is difficult for English language learners to follow coherently. They can become lost in the didactic dialogue that may be too fast paced for them, and thus have little opportunity for reinforcement of language skills. Contemporary researchers have proposed numerous methods to overcome these problems. These include the avatar/spectactor process proposed by Privas-Beaute (2016, pp.

40–52), corpus building as proposed by Wu (2014, pp. 120–127), blended learning as proposed by Banditvilai (2016, pp. 220–229) and collaborative vocabulary building through blogging as outlined by Kleanthos and Cordozo (2016, pp. 225–229), among others. It is our proposal that the use of PBL within CBI/CLIL methodologies, as outlined above, and especially those proven to have positive impact in other ESOL arenas, may be of particular utility in building ESP proficiency among non-English speakers within the STEM communities, particularly at the post-baccalaureate levels.

4. Integration: PBL of ESP within a CBI/CLIL Environment, Why and How?

Krashen (1981) advocates the use of a natural approach to strengthen new language acquisition. PBL supports his research and surpasses traditional language acquisition methodologies. Students are required to make connections as group communication is strengthened. By applying language skills to the workplace, students develop survival skills for the working environment, increase their workforce marketability, and prepare themselves for lifelong learning.

The CBI/CLIL-PBL model ensures that language skills are strengthened by experience with a broader scope of disciplines at the same time. “Collaboration and hands-on learning will lower the affective filters that Krashen cautions will deter students from successful language learning.” By combining language with new professional content knowledge using PBL, language skills are reinforced through group dynamics, workplace reality, and content area knowledge. Language learning and logical thinking are linked to future endeavors and tied specifically to the students’ fields of work.

There is a significant need to strengthen English language skills, recalibrate expectations, and better position non-native English speakers and professionals who are employed in English language settings. Expertise in their discipline is greatly appreciated, yet the greatest positive impact is realized when ESP is successfully coupled with performance in their occupation. The result is a significant shift in workplace expectations and needs. CBI/CLIL coupled with PBL makes the adjustments to collaborative and innovative activities more workable. English language learning, solutions to problems, and innovative advancements are realized simultaneously. Coupling strong subject matter and language learning strategies eliminates disconnects between content knowledge advancements in the workplace and English language competency challenges. The greatest positive impact in both areas is apparent as long as PBL activities are properly aligned to the learner’s occupation.

5. Conclusions and Recommendations

One conclusion we reach is that the problem definition, and then systematic solution seeking emphasis of these disciplines lend themselves uniquely to the CBI/CLIL-PBL approach to learning the unique English of the fields, and that the scholars and practitioners in these fields will be the ultimate beneficiaries.

Several of the authors referenced have noted that there are attitudinal and learning style issues that impede effective ESP learning. They have noted:

- indifference to use of English, in spite of globalization of disciplinary communications;
- vocabulary weakness with little interest in building term knowledge to a critical mass associated with effective written or verbal exchanges within a professional setting;
- student passivity in academic settings that reflects cultural reluctance to confront authority figures, even in the face pressures to adapt;

- and, conversational pace inhibiting clear understanding of both theoretical and practical considerations.

It is also our conclusion and suggestion that the use of a problem-based approach in CBI/CLIL learning situations, especially those in STEM and other fields, will help to overcome these obstacles to learning, and contribute to greater facility in English by the professional learner, within and without the area of specific emphasis.

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