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Index.

Foreword

Welcome to the Winter Edition 2012 of *The Asian ESP Journal*!

The authors of the six articles published in this issue come from China, India, Iran, Malaysia, and Taiwan. Two papers are authored by researchers from Iran.

The research studies reported in six articles cover a wide range, from a case study of the drafting and writing strategies adopted by a Hydraulics major student for publishing in international journals (Yi-Huey Guo), the use of a genre-based approach to the teaching of research article writing to a group of Chinese engineering graduates (Ping Huang), a study of the relationships between the use of metacognitive strategies and reading comprehension performance among EAP learners in Iran (Hossein Khani-Arani, Sajad Davoudi-Mobarakeh and Abbas Eslami-Rasekh), a language needs analysis of a group of underprivileged students of a Bachelor of Technology in India (Priya Kumari and Md. Mojibur Rahman), a study of the requirements and professional writing, written competence, and challenges with regard to engineers in the petroleum industry in Malaysia (Manvender Kaur Sarjit Singh and Sarimah Shamsudin), to an exploration of the dimensionality structure of the items in an admission test in an ESP context in Iran (Razieh Rabbani Yekta and Mansoor Tavakoli).

I hope you will enjoy reading the articles and recommend them to your colleagues and students to further disseminate the findings and enhance the impact of the research studies.

Last but not least, I would like to take this opportunity to express my heartfelt gratitude to the professional contribution of our Associate Editors and Academic Editors* whose quality review work has made the current issue possible. I also wish to thank our proof readers for their great work!

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THE ASIAN ESP JOURNAL

* Details about our Associate Editors, Academic Editors and proof readers can be found on
http://www.asian-esp-journal.com/asian-esp-journal-
beta/index.php?option=com_content&view=article&id=90&Itemid=53.

The Intertextual Distance in English Writing and Scientific Writing:

A Case Study on a Hydraulics Major Student's Drafting Strategies for

International Scholarly Publication

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Abstract

This study observes longitudinally a Taiwanese hydraulics major doctoral student's English manuscript drafting strategies by examining the intertextual distance in his English writing and hydraulics writing. The participant's use of mediated texts (such as native language, translation software, and unprofessional author's editing for English writing) widened the intertextual distance in his English text production, implying the significance of English writing proficiency in quality writing. As for his hydraulics writing, he developed an associative writing style by citing massive higher potential journal articles and adhering to expert models for theoretical framework use. These efforts, aimed for displaying his disciplinary membership, showed his

intention to diminish the intertextual distance between him and the international hydraulics research communities. By treating English writing and scientific writing as separate norm-developing processes, this study shows a new way of analyzing NNES scientific writers' English manuscript writing. The contribution of this study also adds to our knowledge of how a NNES novice scientific writer goes about preparing English manuscripts for international publication.

Keywords: writing for international publication, intertextual analysis, scientific writing, second language writing

1. Introduction

With the "globalization" and "marketization" of the academy (Flowerdew, 2008), publication in international journals has become not merely a "primary forum for the publication of research results" (Li, 2006, p. 161) but "a criterion for achieving academic promotion and competitive research funding" for academic individuals or institutions (Kamler, 2008, p. 283). Many think that international journal publication has a great impact on international research communities since regional/local journals attract limited readership (Duszak & Lewkowicz, 2008). Such an attitude is particularly seen in engineering and science fields in Asian tertiary institutions because more have started to require their doctoral students of engineering/science majors to have international scholarly publications as the qualification for the degree. This causes an increase in Asian doctoral students' manuscript submission rate since these institutions/academic programs tend to hold the view that only those with international scholarly publications are distinguished researchers. Among various international academic databases, the SCI journals, which are journals indexed by the Science Citation Index, are largely adopted by some Asian tertiary institutions (Li & Flowerdew, 2007) to be a main criterion for the assessment of one's research

ability and quality. In the present study, doctoral students of science and engineering majors in Taiwanese universities are required to have at least two SCI journal publications in order to be qualified for the doctoral degree. However, international journals are journals in English among which Anglo-American journals are the majority. This often poses some challenges for Taiwanese academic professionals, who are of non-native English speaking (henceforth NNES) backgrounds. They not only need to write the manuscript in good English but also need to be familiar with the registers of research articles (henceforth RA) in their own disciplines.

Many researchers have noticed NNES academic professionals' increasing need of English manuscript writing and started to research their related writing activities/strategies (Beck, 2004; Duszak & Lewkowicz, 2008; Godin & Gingras, 1999; Gosden, 1995; Martinez, 2005; Misak, Marusic, & Marusic, 2005; Sitar, 2004). Works most pertinent to the present study include Flowerdew's works (1999a, 1999b, 2000; 2008) and his later work with Li (Flowerdew & Li, 2007). Their studies provide the most thorough analysis of the group of Chinese academic professionals. They report that NNES writers such as their Chinese research participants are frequently criticized by journal editors/reviewers for incorrect use of grammar, poorly-written sentences, unclear presentation of ideas, and difficult-to-follow wordings (Li & Flowerdew, 2007). The occurrence of these has much to do with the writer's limited English writing ability (Englander, 2009; Mungra & Webber, 2010; Ward, 2009), the lack of professional English editing help (Li, 2006; Li & Flowerdew, 2007), and the influence of sociocultural value (ElMalik & Nesi, 2008; Kanoksilapatham, 2005; Sheldon, 2009; Swales, et al., 1998). As a result, some NNES academic professionals felt stigmatized by international research communities in their endeavors to publish internationally (Flowerdew, 2008). For example, some Korean scientific professionals who considered their limited English writing skills a barrier to the success of their

publication tended to feel disadvantaged in international scholarly publications (Cho, 2009).

In reviewing prior studies, we can see that researchers have mostly examined practices by NNES practicing academics while those of NNES research writers such as doctoral students have received less attention. Understanding how the latter group struggles with writing for international publication is much needed, for this helps writing instructors and NNES tertiary institutions to know the kind of writing instructions needed by this group of writers. Writers of this group are generally engaged in two writing situations: first, the need of using English language as the only accepted linguistic medium in the final version of their manuscripts, and second, the need to be familiar with current research topics and with the use of source texts preferred by international scholarly journals (since each international journal has its preferred rhetorical norms, aims, and scope, and cares about whether the author's work attracts the interest of international audience). Writing for international publications is a "hard, norm-developing process of interaction" (Gosden, 1995, p. 37) for many of the NNES academics, since they need to write for different groups of "academic public" (Kamler, 2008). Some of them do not use the same "linguistic medium" as they use (Li, 2006) and some do not even belong to the same locally-situated research community as they do.

This study contends that NNES' research writing be framed as two intertwined processes: one of learning to write in English and the other one learning the discipline-specific genre conventions of the RA, such as register and rhetorical structures. Upon entering the study program, doctoral students learn to adapt to genres and registers for a "fuller participation in a given community's activities" (Englander, 2009, p. 37). Take doctoral students of science/engineering majors as an example, they are engaged in varied forms of scholarly writing practices, including running computer simulations and writing different specialised genres such

as laboratory reports, term papers, dissertations, conference papers, and manuscripts. They are likely to select and organize source texts "in fits and starts, with pauses and flurries, discontinuities and conflicts" (Prior, 2004, p. 171), through which they learn to "take an authoritative stance in a field of expert others, and to assert their contribution to that field" (Kamler, 2008, p. 286). Writing in/for the academy is thus a "micro-political activity" (Kamberelis & Luna, 2004, p. 244).

The present study observes longitudinally the English manuscript writing process of one Taiwanese hydraulics major doctoral student. It looks specifically at the "intertextual distance" (Bazerman, 2004) of his hydraulics writing and English writing. According to Bazerman (2004), "almost every word and phrase we use we have heard or seen before" (p. 83). The history of the words/ideas used by the writer is thus traceable and the nature of his/her writing is intertextual. Studying one's intertextual construction is to study the purposes of his/her "borrowing" of textual chunks in writing and the situated meaning of those textual chunks in the context through which "some distance in time, space, culture, or institution" involved is shown (Bazerman, 2004). Examining the research participant's intertextual distance is to know how his varied use of intellectual resources in manuscript writing reflects the distance between him and the international hydraulics journal community and how such distance is affected by the Taiwanese hydraulics research community as well as Chinese language community he was engaged in. By means of case analysis, the study provides Asian ESP researchers and Taiwanese tertiary institutions that require their engineering/science doctoral students to have international scholarly publications with a better understanding of NNES novice scientific writers' progression into academic globalization.

2. The study

The present study, based on a 14-month-long observation of a single case's manuscript drafting process, follows a qualitative inquiry by examining how the research participant interweaves a wide array of source texts and transforms them into new knowledge for "scholarly literacy practice" (Li & Flowerdew, 2007, p. 102). More specifically, it investigates the ways he developed the research idea, collected bibliographical sources, conducted literature review, wrote hydraulics RAs, and dealt with English writing.

The researcher followed the model of "purposeful sampling" (Bogdan & Biklen, 2006) by finding a volunteered information-rich case through a friend's introduction. The volunteered research participant, Lin (pseudonym), was invited to participate in the research. He was a third-year doctoral student majoring in hydraulics in a Taiwanese university and working on his SCI manuscript writing during the course of study. He was conducting a project on the optimization of water distribution. To ensure anonymity of the student, information that can expose his identity is all removed in the reporting of the case, which includes the name of his university and the title of his research. Additionally, names of the authors cited in Lin's paper were replaced with pseudonyms.

In his academic program, doctoral students are required to have at least two international scholarly publications for the qualification for the degree. Among various international scholarly publications, his department accepts only journals indexed by the Science Citation Index. Prior to Lin's participation in the study, he had already started drafting his research paper in Chinese. His research emphasized the optimization of the water distribution system. In the project, Lin applied a proposed optimization model to a local dam.

The researcher collected the following data from Lin, including (a) his Chinese and English manuscript drafts, (b) the bibliographical sources he cited in the drafts, and (c) interviews with him. During the course of study, four interviews were conducted: two semi-structured interviews and two structured ones. Although Lin was aware of producing the manuscript in English since the SCI journals accept only English-medium papers, he still began drafting his manuscript in Chinese. His Chinese drafts were thus included as part of the data. The interviews focused on his development of a research plan, his use of bibliographical texts, and his comparison of Chinese/English drafting processes (such as the differences between registers in Chinese and English hydraulics writing, his search for English editing help, his self-positioning as a writer in Chinese/English writing, etc.). The length of each interview was between 40 and 80 minutes. Due to Lin's native Chinese language background, the interviews were conducted in Chinese, transcribed verbatim, and translated into English.

The study is framed by viewing writing as a social (Englander, 2009; Kamler, 2008) and interdiscursive practice (Kamberelis & Luna, 2004; Prior, 2004) where writers "vary tone or style to match their perceptions of audience expectations, but this variation is mediated by the writer's own understanding of language use, of the context, of social relations, and of aspects of identity she wishes to highlight" (Buell, 2004, p.100). This study discusses Lin's tone and style in hydraulics writing and English writing to show the situatedness of his intertextual distance in these two forms of writing practices.

The study is guided by the following research questions:

1. How did Lin's manuscript writing processes reflect his situated learning context?

2. What kinds of intertextual relations can be found in Lin's English writing and hydraulics writing? How do these shed light on a NNES novice writer's scholarly writing practices?

3. Results

3.1 The self-reliant style of learning

Lin's drafting process reflects a self-reliant learning style caused by the lack of school support. Without school-offered writing instructions and an academic advisor's supervision, he learned manuscript writing by reading self-selected writing models. Although his academic program required doctoral students to have at least two SCI journal publications prior to being qualified for the degree, neither the department nor the professors provided him with English manuscript writing instructions. With limited school resources, he selected several SCI journal articles to be his writing models and considered reading good models an efficient as well as the only way to acquire the register and genre. His department/school offered no peer review or English editing resources to students. In his academic advisor's laboratory, where he spent most of the time running experiments and computer simulations, he was the only full-time doctoral student. Other students working in the same laboratory were studying a Master's program and were less experienced in manuscript writing and scholarly publication. Lin could only judge the quality of his drafts by comparing his draft with his selected SCI samples. Such a self-reliant learning method implies the significant role the intertextual sources play in the shaping of his academic discourse use.

3.2 Intertextual distance in English writing

Lin's intertextual distance in English writing is widened and complicated due to his inability to write in English. Although he was aware of English language as the only accepted linguistic medium for international scholarly publication, his first draft was written in Chinese, not in

English. After completing his Chinese draft, he started to work on the English translation. Technically speaking, his English draft was his second draft.

However, due to his limited English writing skills, his English draft was partly written by the use of an English translation software program. When asked the reason for drafting in Chinese, he explained as follows:

> My native language is Chinese, not English. I have a hard time to write in English. I write in English mainly because I need to have the SCI journal publication in order to meet the school's graduation requirement. I tried to write some parts in English by myself and also used the translation software—Dr. Eye—for help. However, that is not an ideal translation since it is word-for-word translation. Many of its translated sentences are not grammatical. Rather, the sentences looked awkward.

Learning the drawbacks of the translation software use, he sought English editing help. Upon completing his English draft, he asked a Taiwanese friend to help him to edit and revise his English draft. The English editing help that Lin approached was also of non-native English writing background. He was not from Lin's field of study and did not have experience in hydraulics RAs, meaning that the friend was an outsider of Lin's disciplinary community. Lin approached this friend for English help mainly because he had studied in America before. He assumed that this friend should have better English proficiency and could revise his English.

Based on the stated situations, Lin's native language text and Dr. Eye's text served as intertexts of his English text production. The following excerpts show a transformation of Lin's writing across different intertextual sources. Excerpt 1 is his original text in Chinese; Excerpt 2 is the Dr. Eye text; Excerpt 3 is his friend's edited text.

Excerpt 1

本研究主要研究標的為供水量最佳化及輸配水幹管破壞之相關性，在水資源供需系統中含括各供水區域間輸配水網流系統、公共用水及農業用水之需求。本研究之模式將考慮輸配水系統管路維護成本之經濟效益最大化及系統供水量最

大化兩大目標。

Excerpt 2

What this main research of research is marked and fails to mix water and is done and in charge of the dependence destroyed for the supplying water amount optimization, supply and demand is it is it supply water area is it mix network of rivers flow system, public water and agricultural demand of water to fail each to draw together to include among the system in water resource. Research this way is it fail municipal water distribution system pipeline economic benefits to maintain cost maximize and the supplying water amount maximize two major goals systematically to consider.

Excerpt 3

The purpose of this research is to explore the relationships between the optimization of water supplying volume and the damaged pipes used for water distribution. The water supplying system includes the net flow system in each water-supplying region, public water use, and agricultural water use. This research hopes to maximize the economic benefits of maintenance cost on the water distribution system and the water supplying quantity.

Although Lin did not submit the manuscript to the journal during the course of study, he expressed his worry of future submission:

The English editing help friend told me that he had a hard time to translate my texts since they are too technical. I also heard from some former students that English journal editors are critical of our English. They require us to demonstrate perfect English just like native English writers. I am afraid that they may try to reject me because of my English quality.

The intertextual distance of Lin's L2 (second language) text production was widened due to his inability to write in L2. Given that his L2 text was a translation of L1 text, the influence of his L1 rhetoric, logic, and thought patterns on L2 text was explicit. Although L1 and Dr. Eye texts were used for the enhancement of L2 writing, his L2 text was technically produced by

unprofessional English editing help, who could only revise and translate based on limited understanding of Lin's Chinese draft. Lin's ideas failed to be translated precisely and fully in English. His complicated route of L2 text production showed a widened intertextual distance underlying his initial writing plan (i.e., the one presented in Chinese draft) and his final one (i.e., the one presented in English draft). Although such a distance somehow limited his L2 text production, his research work might not be transformed into English without the borrowing of these mediated texts as articulators.

3.3 Intertextual distance in hydraulics writing

The intertextual distance of Lin's hydraulics writing shows a novice's endeavors for a fuller demonstration of disciplinary membership in the international hydraulics journal community. His hydraulics writing is in line with Li's (2006) earlier finding that scientific writers doing applied research generally follow the rhetorical pattern of "model-implementation," which is to propose one theoretical model and demonstrate it as a form of implementation (p. 166). According to Lin, he followed similar research procedures like other hydraulics researchers:

> I started my project by collecting SCI journal articles centering around similar research topics. Next, I tried to correlate these bibliographical texts for the organization of information. After that, I would select one prior model as the major theoretical framework and several other ones as my supplemental models out of my collected SCI references. Then I tried to establish a newly-proposed model by modifying the authoritative professional's prior model. The next step was to apply the newly-proposed model to my intended case of study by running computer program simulation. Finally, I presented the simulation results by transforming them into word description.

All of the above elements were arranged into the introduction, literature review, research methodology, case discussion, and the conclusion sections in his manuscript. Lin's source texts mainly came from two parts: higher potential SCI journal articles and local journal/conference

proceeding articles. He began by searching "higher potential" SCI journals, which were the ones to which he or his professors were interested in submitting their articles, or those they tended to cite. After locating the journal search, he continued to narrow down the search to articles of similar topics.

However, not all SCI sources met his need since his research was an applied research that featured the case of a local dam in Taiwan. Most SCI textual sources did not provide information about his specific case so that an extended search of local source texts was necessary. His local source texts were local journals and conference proceedings published in Taiwan, which meant that they were Chinese-medium texts. Although these local texts were not on the SCI journal list, they provided detailed or relevant information that met his need. Among 68 textual sources cited by Lin in the manuscript, 55 were SCI texts and 13 were local texts, implying that a massive use of SCI texts is necessary in writing for international publications.

He organized these bibliographical texts by comparing and summarizing and cited them in the literature review section where he highlighted the effectiveness of prior researchers' model use. Citing these SCI source texts enabled him to directly relate his research work to the international research community to which he built a sense of belonging and showed his disciplinary voice. However, in view of the rhetorical structure of his literature review, it was found that his bibliographical sources tended to be arranged randomly without an orderly and coherent fashion. He mainly used "indirect quotation" and "mentioning of a person, document, or statements" (Bazerman, 2004, p. 88) to cluster these source texts, which made his literature review look like a hodgepodge of summarized points. The following example, extracted from his literature review, showed such a rhetorical structure.

Excerpt 4

Moore et al. (1991) adopted the net value method to analyze the optimized reset policy of pipe nets and found the number of damaged pipes before the reset. They proposed the net value method for the determination of pipe reset. Taylor et al. (1998) established a model to calculate the life cycle of pipes. In their model, the property of effective life cycle can be reset under allowable expense. In Wright (1987) and Wright & Parker's (1982) studies, a similar method that verifies the aging of pipes for priority installation of new pipes was used. It aimed to assess whether the reset, installation, or parallel pipes can solve the pressure shortage problem in the water distribution system. Lloyd et al. (1992) determined the reset need from the pipe length. They also limited the pipe's water power in the constraints for the attainment of cost minimization in the water distribution system.

As we can see in Excerpt 4, Lin lacked a smooth transition among Moore's, Taylor's, Wright's, and Lloyd's studies. Although the lack of transition is partly related to his limited English writing skills, as well as those of his English-language editor friend, it is also affected by his unawareness of the value of reviewing the literature in academic research. He explained this as follows:

> As a matter of fact, I do not understand why we must review literature in the research article writing. I somehow feel that my research is not related to other people's research. Everybody's research is different and that is why I do not know how to put them together for a synthetic discussion.

Even though he questioned the value of literature review in hydraulics RA, he maintained that selecting a good expert model was important for his project. Among various models on the optimization of water distribution, one was selected to be his theoretical framework. He held the view that a good optimization model shapes the research direction and leads to sound research findings. The following excerpt appearing in his research methodology section describes his purpose in the use of expert models.

Excerpt 5

This study adopts the optimization models proposed by Clark & Chen (2002) as a base,

including their every-ten-day optimization model and the whole-time-domain-optimization model. Their models investigate the optimal distribution of water resources and drinking water system. We hope to open a new page for research on (1) the optimization of water supply and (2) the optimal use of water resources.

Although Lin employed Clark and Chen's (2002) optimization models to be the theoretical frameworks, this did not mean that he could apply them directly to his intended case of study. A modification of their models based on program code writing was necessary. The reasons were that (1) their models might not completely fit his case and (2) there might be a plagiarism concern if he applied their models directly to his case of study. Nevertheless, Lin also pointed out that their models might not be his only option even if theirs were selected for use: "I feel that many optimization models are similar. The reason they are considered different is that they are proposed by different scholars". His modification of Clark and Chen's (2002) models was thus practical in that it saved him time and effort in creating a new optimization model. This implies that the optimization models for optimal water use were highly intertextual so that they could be borrowed for the use in different research contexts.

Following these premises, Lin's hydraulics RA writing reflects explicit "intertextual representation" (Bazerman, 2004) aimed for diminishing the intertextual distance between him and international hydraulics research community. He developed a hodgepodge style of rhetorical structure in literature review writing, and he adhered to "higher potential" SCI journal articles and expert models for the scaffolding of his research plan. His explicit intertextual representation showed his attempts to diminish the distance across temporal, spatial, cultural, and institutional influence. In other words, he tried to diminish the time and space distance by directly mentioning prior researchers' work (e.g., their names, publication years, and model use) even if he could not see the correlation between his research work and prior researchers' publications and had them

listed incoherently and in a disorderly manner. His attempts to diminish cultural and institutional distance between his locally-situated Taiwanese academic program and the international SCI journal research communities could be found in his adherence to relevant SCI sources, expert models, and the depiction of his knowledge contribution that appeared in the end of his paper. This is shown below.

> Excerpt 6
>
> The greatest contribution of our study is the minimization of the maintenance cost on water supply pipes under normal water supplying condition. The findings allow us to know the relationship between the water supply volume and the probability of pipe destruction. We can even apply it to the construction of pipe change, pipe maintenance, and pipe repair, meanwhile the cost can be controlled well with no worry about the over-budget concern.

Lin maintained that the contribution of his research was bidirectional: theoretical and pragmatic. He regarded his modification of expert models as a kind of "theory development" since his modification made prior models more applicable. He also considered his results practical because he offered technical solutions to the optimal use of water. By means of these attempts as discussed thus far, he built a closer intertextual relation between himself and his target research community.

4. Discussion

In view of Lin's self-reliant learning context, part of these findings accord with O'Neill's (1997) results that students are less prepared for publication activities due to the "credit system" of school science that emphasizes classroom activities rather than publication-centered professional laboratory activities. O'Neill explained that doctoral students are less prepared for manuscript writing and scholarly publication since they are trained to produce artifact-like class papers

instead of grant proposals/manuscripts. Producing a text "recognized and accepted as an appropriate example of the genre of the RA by members of the academic discourse community" (Prince, Blicblau, & Soesatyo, 1999, p. 4) was thus a challenge for Lin. A lack of "exposure" and "practice" (Reynolds & Vogel, 2007) caused him difficulty in writing for "academic outlets such as conferences and journals" (Nolan & Rocco, 2009, p. 268). Owing to his situated writing situation, he constructed varied drafting strategies to deal with English writing and hydraulics RA writing: some of these shortened the intertextual distance between him and his research community and yet some widened the distance, which intervened in his demonstration of disciplinary voice.

First, his limited English writing ability complicated his English text production, which widened the intertextual distance between his L1 and L2 texts. This may intervene in his scholarly publication. As shown, he needed to rely on mediated texts for English text production, meaning a strong intertextual influence of his Chinese thought patterns on his English writing. The fact that his English text was mainly a translated product of his Chinese text indicated his limited English writing proficiency as a factor that distanced him from producing an English text with ease. His anxiety about his poor English writing as an intervention in future manuscript submission accords with Flowerdew's (1999a) findings on NNES academic professionals' concern for their L1 influence on L2 writing as an "intervention" in international scholarly publication. Flowerdew remarked that such an intervention does not disappear if their English use cannot be changed to "a permanent basis" (p. 259) like their L1 use.

Additionally, the fact that Lin's English editor friend did not possess hydraulics knowledge (so that he failed to translate Lin's research work precisely) may cause manuscript reviewers to misinterpret Lin's research. In scientific writing, "precision" plays a significant role:

precise interpretation of data and precise description of research topic information can affect readers' understanding of the researcher's work (Reynolds & Vogel, 2007). A paper consisting of poorly-written sentences is more likely to lead to readers' misinterpretation of experimental results. In other words, sound research findings are possibly misinterpreted by reviewers due to the author's inadequate expression of ideas precisely. As a result, the writer's submission outcome can be affected. Lin's widened intertextual distance in English writing sheds light on one important lesson: if international scholarly publication continues to be the writing task in which he needs to be engaged, he needs to improve his English writing ability.

Compared with the intertextual distance widened as a result of his inability to write the manuscript directly in L2, Lin's hydraulics writing shows a novice's attempts to diminish the intertextual distance between his own and academics' research works. The closer intertextual relation he attempted to create enables him to show disciplinary membership in the international hydraulics research community. As shown earlier, he followed methodological procedures similar to those used by other academic professionals, explicitly cited SCI source texts, modified academic professionals' models, and clearly stated the contribution of his research work. Such an explicit intertextual representation allows prior texts to be used for the scaffolding of new research, leading to contribution to knowledge. The effort he made in diminishing intertextual distance accords with Li's (2006) earlier finding that doctoral students tend to rely on academic professionals' established frameworks for scaffolding in lieu of working on a "rarely-treaded path" (p. 174). Li termed this a novice's "wise" use of "secure framework" (p. 174). Similarly, since Lin's primary goal was to have his paper published successfully, choosing a "secure framework" that enabled him to reduce the risk of being rejected was worthwhile for him.

Another point that needs to be noted is Lin's development of a "conflicting rhetorical

structure" (Corbett, 1998) in literature review writing. According to Corbett, novice writers are often perplexed by their rhetorical move between "contradictory rhetorical practices of their native and adopted cultures and the opposing ideologies on which these practices are based" (p. 1). Eventually, they may develop an unconventional rhetorical structure (termed by Corbett as a "conflicting rhetorical structure") to solve the problem of idea contradiction (known as "rhetorical conflicts"). In case of Lin, a gap showing rhetorical conflicts between his prior Chinese hydraulics class paper writing and his SCI manuscript writing emerged in his literature review writing. Without being trained to review the literature for the research gap in the hydraulics courses he took, he failed to perceive the significance of the literature review in research article writing and held the view that everyone's research was different, assuming that reviewing the literature was of little substantial value. When he was faced with the need to include a section of literature review in his SCI manuscript, he could only write associatively by clustering the source texts into a hodgepodge of summarized points instead of integrating them into a comprehensive discussion. Such a conflicting rhetorical structure of literature review is in fact not uncommon to novice writers. Baer (1994) described novice writers as follows: they "write associatively, following the model *and then*. They report, as it were, everything that comes into their mind concerning a particular topic, hence the term *knowledge telling*" (p. 2-3). Lin's associative writing style can be viewed as a kind of conflicting rhetorical structure developed for solving the rhetorical conflicts encountered in literature review writing. Although his explicit display of rhetorical conflicts—writing associatively by clustering the source texts into a hodgepodge of summarized points—contradicted experienced writers' favorable use of "implicit cues[1]" for the showing of "disciplinary expertise" (Dressen-Hammounda, 2008), we

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[1] According to Dressen-Hammounda (2008), experienced writers' favorable use of implicit cues can be found on their use of "low-level textual cues" such as technical terms, indicating a researcher's engaged activity without

see his efforts to connect his research work with authoritative professionals' ones.

Even though there are differences in the quality between his and experienced writers' papers, both share the same objective: they are oriented towards the attraction of broader readership in the international research communities. The aim of claiming/establishing/achieving disciplinary membership is the same. Therefore, the "rhetorical conflicts" Lin encountered in hydraulics RA writing is solvable with the growth of hydraulics knowledge and mastery of hydraulics writing. As Kamler (2008) states, "writing is a form of discipline-specific social interaction embedded in institutions and social structures" (p. 286), Lin established a closer intertextual relation in writing to interact with the international research community in hydraulics. Throughout his "process of scholarly apprenticeship" (Flowerdew, 2000), we learn why working on international scholarly publication may be "a truly high-stakes game" for NNES novice writers (Li & Flowerdew, 2007, p. 102).

5.   Conclusion

This study observes longitudinally the manuscript drafting processes of Lin who was required by his school to work on SCI journal publication as the qualification for the doctoral degree. It proposes the need to divide NNES doctoral students' English manuscript writing into English writing and discipline-specific RA writing as separate norm-developing processes of interaction for investigation. By comparing/contrasting the intertextual distance underlying Lin's hydraulics writing and English writing. This study has gained a better understanding of Asian novice scientific writers' progression into academic globalization.

The study address Lin's development of varied rhetorical strategies in hydraulics RA writing for the shortening of intertextual distance between him and the international hydraulics

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mentioning the name directly, or the revelation of "researcher implication" (p. 240).

research community. He acknowledged the significance of producing reader-oriented texts for disciplinary membership in the international hydraulics research community. In contrast to the shortened intertextual distance in hydraulics RA writing, his limited English writing proficiency complicated his English text production, which widened the intertextual distance between his L1 and L2 texts which may intervene in his demonstration of disciplinary voice in English. This finding accords with prior studies that an improvement of his English writing proficiency is necessary for those planning to publish internationally.

By separating English writing from scientific writing as varied norm-developing processes, this study shows a new way of analyzing NNES scientific writers' English manuscript writing. This study also adds to our knowledge of how Asian novice scientific writers go about preparing English manuscripts for international scholarly publication. With an increase of Asian doctoral students' submission rate in international journals, a better understanding of their English manuscript writing processes is necessary. The study recommends that future researchers include other perspectives such as the writer's submission result and his/her revising strategies on a long-term observation basis in order to better inform scholarly writing practices.

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A Genre-based Approach to Teaching Chinese Engineering Graduates Writing Research Articles

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Abstract

Academic English writing has become essential because of the fast development of Chinese economy. Although ELT in China tried different ways to promote academic English communication, College English teaching in China has been critically commented upon recently, because of the learners' ill-structured academic research article writing in English. Through an action research course, this study aims to promote Chinese engineering graduates' academic research article writing skills in Chongqing University, southwest part of China. Through a combination of qualitative and quantitative research, questionnaires, interviews and students' assignments were used to investigate whether the genre-based approach to teaching Chinese

Engineering graduates' academic writing through interactive learning was feasible. The results showed that first, the genre-based approach can be a good model because participants can understand the function of the academic research article well and the patterns from each move of the research article can help the graduates' writing effectively; second, participants' improvement in their writing and speaking for academic purposes is obvious through interactive learning by means of QQ[2]; and third, the time to run this course is essential because the graduates' research experiences may help them better understand research article writing. This article concludes that the genre-based approach, coupled with appropriate interactions, can enhance students' motivation in writing and speaking for academic conference publications.

Keywords: genre-based approach, QQ interactive learning, research article, action research, Chinese engineering graduates

1.   Introduction

In China, since the open policy to the world in 1978, more and more scholars have travelled back and forth for academic purposes. For example, academics need to share their ideas with scholars from different parts of the world both in speaking and writing. Chinese academics have to publish their articles for several reasons. Firstly, they need to share ideas with both national and international academics. Secondly, the Chinese Educational Ministry expects academics to publish articles if they want to get promoted as lecturers, associate professors and professors, and the higher the promotion they want, the higher the quality of articles they need to publish. Writing a good academic article is necessary for academics in different disciplines to exchange their academic ideas with others in the world. Sharing their academic ideas can be done through

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[2] QQ is a kind of software, like MSN and Skype, through which students and the teacher may chat and share ideas

international conferences, journal articles, books and the Internet. In addition, Chinese graduates are expected to write and publish journal articles during their three-year study. Therefore, struggling to write an academic research article in China may have less to do with writing competence than with being able to take up a deferential academic speaking position. However, Chinese graduates, particularly engineering graduates, find this process particularly difficult because either they have just graduated from the Bachelor's degree without any publishing experiences, or they lack training in writing academic research articles, or language competence.

This difficulty in writing good English academic research articles for conferences or publications is not uncommon in China, particularly in the Southwest part of China, in which the researchers' English is poorer than their counterparts in the Eastern or Southern part of China. Take Chongqing University in the Southwest part of China as an example. At present, postgraduates and graduates as well as the academic staff are encouraged to publish articles both in international journals and the core national journals, or submit abstracts to international conferences. As a TESOL practitioner, I was often asked by researchers from other disciplines to check whether they have written appropriate research articles or whether there are language problems in their writing. As a result, I have become interested in examining effective ways of teaching engineering graduates how to write academic journal articles in English. From reviewing Swales' (2004) book on genre structure, I attempted an action research course in order to improve the students' academic writing. This study aims to answer the following two research questions:

1. To what extent do engineering graduates in China understand the functions of the academic research article in English?

2. Can an interactive learning methodology be used to improve engineering graduates' research article writing and to enhance their motivation in writing research articles?

2. Literature review

2.1 Genre analysis and academic writing

Swales (1990) describes genres as 'communicative events' which are characterized both by their 'communicative purposes' and by various patterns of 'structure, style, content and intended audience' (p. 58). Then Swales (2004: 61–67) summarizes how genres function as 'metaphor, frame, standard, biological species, families, institutions, and speech acts'. The concern for both social function and form is common (e.g., Bhatia, 1993; Flowerdew, 1993; Hopkins & Dudley-Evans, 1988; Nwogu, 1991; Swales, 1990; 2004; Weissberg & Buker, 1990). Some studies have explored the textual structure of the research article (e.g., Nwogu, 1991; 1997; Kanoksilapatham, 2005) and others the structural organization of different sections of research articles, including Abstract (e.g., Hyland, 2000; Samraj, 2005; Lores, 2004), Introduction (Samraj, 2008; Swales, 1990), Results and Discussion/Conclusion (Brett, 1994; Holmes, 1997; Williams, 1999; Yang & Allison, 2003), and the Method section (e.g., Bruce, 2008; Swales, 1990; Lim, 2006). Different types of academic works have been the subject of detailed analysis (e.g., Bunton, 1999; Kwan, 2006; Samraj, 2008), ranging from textbooks (Hyland, 2000; Moore, 2002) to academic writing produced by students, especially in their PhD theses or dissertations. The same is true for the Chinese scholars who attempted to conduct analysis of different written genres (e.g., Ge & Yang, 2005; Ju Yumei，2004; Han, 2001; Qing, 2000; Zhang, 2002). Analysis of research articles, particularly those in established international journals, shows that the research article is a genre that embodies stringent academic requirements in terms of both textual organization and

linguistic choices. Working on the assumption that the research article, like the research article abstracts, has four moves: Purpose, Method, Results and Conclusion (PMRC), this study was conducted to guide engineering graduates to write the research journal articles, with reference to Swales (1990) and Swales & Feak (1994).

2.2 Interactive learning

Interactive learning means that a person can be guided to use the genre approach in writing and speaking while pursuing their academic subjects, respond to questions using computer input devices such as a keyboard, mouse, touch screen, or voice command system, solve problems, complete challenging tasks, create knowledge representations, collaborate with others near him or her or at a distance, or otherwise engage in meaningful learning activities. Many researchers (Gass, 1997; Gass & Madden, 1985; Gass & Varonis, 1994; Long, 1981; Pica, Young, & Doughty, 1987) have studied interactive learning. Interactive environments have many functions, including entertainment, commerce, and scientific visualization (Morell, 2004). This study on interactive learning focused on QQ software to guide students to learn the academic writing format through preparing writing portfolio and present what they write orally by simulating an international academic conference, through an action research course.

3.   Methodology

3.1 Action research

In this study, action research is essentially interpretive or critical research with qualitative and quantitative procedures. Action research has been adopted by many TESOL practitioners in the classroom research. Many experts (e.g., Johnson, 2003; Burns, 1999; Nunan & Lamb, 1996;

Nunan, 1992; Carr & Kemmis, 1983) used action research in their study of second language teaching in different aspects. Most of their researches are based on Kemmis and McTaggart (1988: 5); that is, action research is regarded as 'a form of collective self-reflective enquiry' to 'improve the rationality and justice' of participants' social or educational practices, and also their understanding of these practices. The participants in the action research can be 'teachers, students, principals, parents and other community members — any group with a shared concern' (p. 5). In China, action research is not a common methodology. According to Wu (2005), foreign language teaching in China has experienced a kind of reform, where teachers need planning, conducting, analysing and reflecting but they do not have the skills (Liu & Dai 2003; Wang, 2002; Rainey, 2000; James, 1999; Gao &Wang 2003).

This study, enlightened by Burns (1999:35), followed the following steps: 1) planning: developing an action plan for gathering data and collecting data by using initial data-gathering techniques related to the action; 2) implementing by changing and modifying teaching approaches based on continuing data analysis; 3) analyzing: exploring what was done through the implementation by examining the outcomes of the changes; 4) reflecting: comparing the data, revising the implementation and planning the action again; 5) observing: noticing and reflecting on the outcomes of the changes; 6) reporting: verbalising and theorising the processes and outcomes; and 7) writing: documenting accounts of the research (see Figure 1 below).

Planning
- Conducting need analysis through Q 1
- Writing syllabus design
- Selecting material
- Preparing lessons

Implementing
- Lecture
- Giving assignments
- Conducting Q 2
- Conducting group interviews

Reflecting
- Comparing participants' achievements through assignments
- Comparing data from group interviews and questionnaires

Analysing
- Collecting all data from assignments, both questionnaires, and case studies
- Interpreting all data

Figure 1: Action research cycle

This study, through an action research course, aims to improve Chinese engineering

graduates' academic research article writing skills in an academic English course in Chongqing

University. Data from a pre- and psot-qestionnaire, group interviews and students' assignments were analysed to investigate whether the academic writing course was effective. This study combined qualitative and quantitative research approaches, using 'action research' to examine how the Chinese engineering graduates can improve their academic research article writing based on the genre-based approach. The course lasted for eighteen weeks of teaching and learning.

3.2 Participants

The following participants were involved in this action research:

● I, as a teacher researcher, who conducted this course so that all data could be collected effectively;

● 88 respondents responded to Questionnaire 1, with 52 respondents from different universities of China;

● 36 engineering graduates were engaged in this action research course, 10 female and 26 male, aged from 23 to 27 from different disciplines of engineering in Chongqing University.

3.3 Instruments

The instruments used in this study were questionnaires and interviews.

3.3.1 Questionnaire 1 and 2

There were 2 questionnaires in my study: Questionnaire 1 (88 respondents, including 36 participants) was conducted for needs analysis (see Appendix 2) and Questionnaire 2 (see Appendix 3) was conducted after this action research course (for 36 participants) to check the

results of the study. Burns (1994) suggests that when respondents misunderstand the questions, the rate of returns may be lower. I developed some strategies to enhance return rates. Firstly, I consciously designed specific questions in simple language (Moser & Kalton, 1971). The questionnaire began with personal, factual details, and the questions were numbered and divided into coherent sections with specific topics. The length of the questionnaire was five pages (Bernard, 2000). To ensure the questionnaire's maximum effectiveness, (see Fowler, 1993, p. 102), I pre-tested a draft of the questionnaire with two respondents before delivering all questionnaires, so as to know whether the instructions were clear or not.

3.3.2 Interview

The purpose for interview in this study was to identify more information of students' understanding of writing research journal articles. In this study the semi-structured interview was used because it can 'allow a greater flexibility of coverage' than structured interviews and 'tend to produce richer data' (Burns, 1994, p. 279) without being totally unstructured. Bernard (2000) notes that semi-structured interviews include 'the freewheeling quality of unstructured interviewing' (p. 191). The interview questions in this study were designed to elicit long responses (Spradley, 1979). A set of general areas for discussion was used, but participants were encouraged to introduce any information or interpretation that they felt appropriate either in English or Chinese. Initial questions were mostly open-ended and descriptive within a framework provided for participants to reflect on their personal experiences. Based on individual responses, follow-up questions were used to prompt participants to clarify or support their comments with specific examples (see Appendix 1). I invited two of my colleagues to conduct the two group interviews respectively from the middle and the end of the course, following the

structured interview questions I designed for them, but they could follow up their questions according to the participants' feedback. Before conducting the group interviews, I asked my colleagues to select the interviewees randomly.

All data from interview were collected and coded based on the combination of the theory of Freeman (1998), Richards (2005) and Merriam (1998). Therefore, when coding the data, the following steps were taken.

1. Every line of the transcript was numbered for ease of coding themes. All the transcripts and underlined words were read carefully. The researcher tried to be open to the ideas the informants gave.

2. All the transcripts were highlighted when key phrases and ideas were repeated, resulting in 250 underlined words and phrases. Then all the transcripts were read again and each theme or concept was given a descriptor.

3. The process was repeated with all the transcripts from the group interview and the teacher's journals. It was found that the more times these transcripts were read, the more topics/themes could be found. All the key words were written for short in the margin.

4. Similar mentions were categorized into the same descriptor. The researcher reread and re-categorized these themes, putting similar or related key words together and naming them so that they became the final categories of my analysis. At the same time, the link between the themes was checked with the underlined key words in the transcripts.

3.3.3 Participants' assignments

In order to avoid bias and provide easy comparison, three assignments were selected from each participant in writing a research article abstract:

1.   Participants' first assignment (writing an abstract) helped me assess the background of participants' academic writing ability (36 copies);

2.   Participants' ninth assignment (practising writing abstract for their final course paper) helped me identify how much they were learning about writing journal article academically(36 copies);

3.   Participants' final course paper (in which their abstracts were selected) helped me examine how much progress participants made overall in the action research course.(36 copies)

When coding, I began by numbering each copy of the participants' first assignment, ninth assignment and their final course paper. Then 1 of the 3 papers was selected, and thus 12 samples were obtained respectively from the first assignment, ninth assignment and the course paper.

4.   Action research course

4.1 Planning of action research course

4.1.1 Needs analysis

The purpose of the needs analysis was to identify participants' initial understanding of writing academic research articles through Questionnaire 1 (see Appendix 2) prior to this action research course. There were totally 88 valid questionnaires returned: 36 from participants in the action research course and 52 from other graduates who were working in different companies all over China. Such data was collected through different kinds of graduates' English courses which were provided in different parts of China. Based on the needs analysis, an action research course was prepared. The results showed that fewer students' understood the procedures of research journal article writing.

4.1.2 Action research course goals

After needs analysis, the course goal was designed:

- to guide participants to write for academic purposes based on my informed understanding of the move structure;

- to help participants understand the nature and function of the academic research article; and

- to help participants practise writing each part of the journal article, following the move structure.

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4.1.3 Materials selection and development

It is believed that authentic materials were essential in this course and thus this study planned to have participants compare academic research journal articles by providing them with original articles from international academic journals. The articles were selected as samples from the project "Study on Establishment and Comparison of English-Chinese bilingual corpus for academic genre", sponsored by Chongqing Social Science Fund.

4.2 Implementing of action research course

This course took 18 weeks, two periods a week. In order to address the participants' learning needs revealed by needs analysis, in particular participants' lacking experience in writing for academic purposes, the lessons were designed in such a way that participants were guided to write for academic purposes based on the genre structure (Swales, 1990) so as to help participants understand the nature and function of the academic research article (see Figure 2).

1. Course Preparation	2. Implementing (main activities)
1) Arousing interests by linking participants' experiences with the contents in academic writing through interactive learning; 2) Discussing participants' assignments, arousing interactive learning in class	1) Giving lectures, focusing on Swales & Feak 's (1994) genre-based approach; 2) Discussing and imitating writing each part of the academic article; 3)Comparing and contrasting samples between Chinese journals and international journals; 4) Interactive learning between the teacher and participants through chatting QQ software, feedback of writing parts and interactive discussion on line.
4. Rethinking	3. Reflecting:
1) The teacher's revising and updating new information through QQ; 2) Teacher's preparing for the new lesson based on the analysis and comparison of each lesson and feedback from students after class.	1) Participants' interactive learning by discussing and revising each part of their own articles; 2) Participants' writing assignments.

Figure 2: The lesson cycle

4.3 Analysing

The Analysing part mainly contains data from each unit. The data were from participants' learning process for academic research purposes. Participants' assignment from each unit, classroom discussion and participants' interview would be analysed. The results were carefully analysed and became samples or evidence to improve or develop my next step of AR cycle.

4.4 Reflecting

The final stage, 'Reflecting', was conducted to reflect on what the course had meant to the participants; how much progress participants had made; and the extent to which the participants' outcomes reached the course objectives. Therefore, the main focus of this stage is as follows:

- Reflection from questionnaires 1 and 2

- Reflection from group interviews

- Reflection from participants' assignments

5. Results and discussion

5.1 Comparison of Questionnaire 1 and Questionnaire 2

This action research course has achieved the course goals: 1) to guide participants to write for academic purposes based on the genre structure; 2) to help participants understand the nature and function of the academic research article; and 3) to help participants practise writing with guided genre structure.

Since this action research course was conducted by the research/author, 36 questionnaires were delivered and 36 valid respondents were returned. Table 1 shows the participants' attitudes towards their understanding of the move structure, and summarizes participants' progress before and after this course. Before this AR course, fewer participants (33.33%) understood the process of writing an academic article, whereas 100% of the participants did after the AR course. The abstract is very important for a researcher who tends to publish or read for research purposes. However, fewer participants (33.33%) knew how to write it before the AR course while 97.22% did after it. Table 1 also shows that most participants better understood how to write the academic article, though they may not know how to write some parts well, such as discussion

(2.78% before AR course, and 27.78% after AR course), and research method (8.33% before AR course, and 55.56% after AR course).

Table 1: Participants' attitudes towards their understanding of move structure before and after AR courses (n=36[3])

Time Aspects	Before AR course	After AR course (n=36)
the structure of the whole article	33.33% (12)	100% (36)
Abstract	33.33% (12)	97.22% （35）
Introduction	36.11%(13)	91.67% （33）
literature review	8.33% (3)	75.00% （27）
research method	8.33% (3)	55.56% (20)
Results	25% (9)	94.44% (34)
Discussion	2.78% （1）	27.78% (10)
Conclusion	36.11%(13)	88.89% (32)
Reference	11.11% （4）	83.33% (30)

5.2 Reflection from interviews

In this action research course, participants were interviewed twice, namely in the middle class and at the end of the action research course. There were 7 participants in the first interview. The second group interview was conducted at the end of the course, with 12 participants.

Interview data analysis indicates that most of the participants thought they were aware of the structure of academic journal articles. Most participants thought that this genre-based approach could be an effective way to learn how to write research articles by learning patterns from each move. Participants were motivated to learn how to write research articles through interactive learning. They built up their confidence in communication with other participants in

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[3] In order to easily compare, the data before this AR course in Table 1 include only 36 of the 88 participants.

class with their own subjects. For example, they were provided authentic samples to discuss interactively in class and through QQ chatting with the teacher, as shown in following examples.

Example 1

DY: *I like the way the teacher taught in academic writing, because I*

        can not only learn the structure of the academic writing, but also I

        can interact with other classmates and the teacher through QQ

        and email. ... (Group interview, 2 July 2008)

Example 2

LHD: *... At the beginning of this course, the teacher divided us into*

        several groups based on of own disciplines, we were provided

        much time to discuss guided topics, this is very effective for us

        to interact with other colleagues. ... (Group interview, 2 July

        2008)

    Examples 1 and 2 indicate that participants like the interactive learning through QQ chatting because of its directness and face–to-face online discussion. Example 3 represents most participants' ideas about what they had learnt with the genre-based approach.

Example 3

HY: *I like the patterns you gave us…they are helpful…*

Researcher: In what ways?

HY: *Well, in the past, though the teacher taught us how to write, I*

                  felt still difficult to write…but now, I know there are some

                  moves in each part of the section in an article…so it might be

                  easier for me to start now…(Group interview, 2 July 2008)

GJ: *…these patterns in each move are helpful, particularly in the*

                  abstract…it is clear for me to know how to write an abstract

                  now… (Group interview, 2 July 2008)

        Some participants believed that the genre-based approach made them understand more clearly what the research method is, as Example 4 shows.

Example 4

GJ: I think the method is helpful.

Researcher: *What do you mean by the method?*

GJ: *…I mean the method in the four moves. Now I know more*

                  clearly that the research method is very important in a

                  research. I found the foreign scholars wrote this part more

                  clearly, reasonably and objectively than we Chinese authors.

                  (Group interview, 2 July 2008)

As shown in the data analysis of Questionnaire 2, participants, though aware of the importance of research methods, find it difficult to construct and write this part because they had no or little research experience, as Example 5 illustrates.

Example 5

HXY: *Research method is the most difficult part for me to write*

               because my supervisor has not asked me to do any research...

HY: *...I don't know what to describe...It seems I need more*

               literature review...

HXY: *...I agree with her... before I attend this course, I haven't had*

               experience in reading research literature... (Group interview, 2

               July 2008)

5.3 Interview analysis

Analysis of the interview data shows that participants enjoy the action research course. Four main themes are identified (see Figure 3):
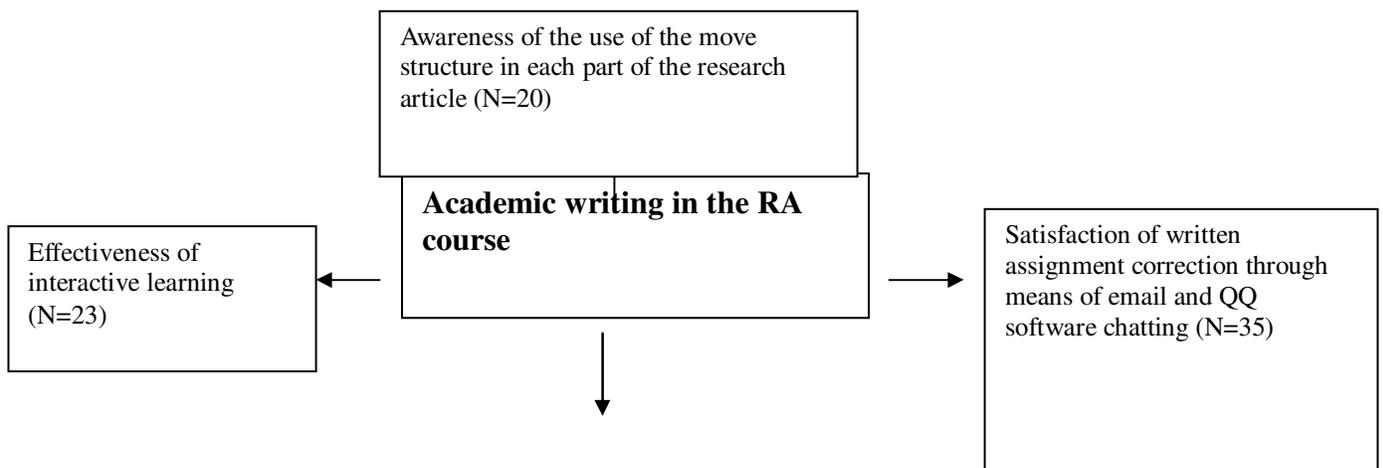
Figure 3: Items of descriptors from interview

5.4 Participants' assignments

Participants' assignments were collected from three periods during the AR course: the first assignment, the ninth assignments and AR participants' course paper. Due to the limited space of this paper, participants' assignment for writing the abstract was selected.

Table 2 presents the comparison of the three types of data using the criteria, based on previous literature reviews of research article abstracts based on genre structure: four moves in the article abstract: research purpose (obligatory move), research method (obligatory move), results (obligatory move) and conclusion (optional).

Table 2: Comparison of participants' three types of assignments for writing article abstracts

Moves	First assignment (n= 12)	Assignments in ninth lessons (n=12)	AR participants' course paper (n= 12)
Moves 1-4	–	33.33% (4)	58.33%(7)
Moves 1-3	–	50% (6)	33.33% (4)
Move 1,2,4		16..67% (2)	8.33% (1)
Move 1,2	–	8.33% (1)	–
Moves 1,4	8.33% (1)	–	–
Move 1	8.33% (1)	–	–
No moves	83.33% (10)	–	–

Table 2 shows that there is a significant difference between the participants who had attended the course and those who had not. In the first column, it is clear that, of the 12 participants' assignments, 83.33% did not know how to write an academic article abstract. What they wrote were the words copied from the original paper or a summary (see Table 3). Only one abstract had a four-move structure and another one Moves 1, 2 and 4. In the second column, the percentages in writing well-structured article abstracts were higher. Four (33.33%) participants wrote four moves, and six others (50%) the first three moves. This means that participants who attended this course had a stronger awareness of how to write academic papers with a four-move structure. Most importantly, no participants copied sentences from the original paper. In the third column, the percentages of four-move article abstracts (58.33%) are higher than those (33.33%) in the second column and much higher than the first column.

In order to illustrate how individual participants made progress in the action research course, I created a portfolio for each of the participants from the beginning and tried to encourage participants to interact with each other and with the teacher/researcher through email. I kept observing three cases in this study: two male participants, of whom one was from biological and medical college, and the other from engineering, and one female participant who was from economics.

YWH, a male Master's degree student in Grade 1, majors in mechanical engineering. He had had no research background and had submitted no articles for publication before attending this course. YWH's first abstract was only a summary with many language and logical mistakes. The structure of the article abstract is not clear, though he tried to make this abstract cohesive. In the final assignment, YWH's understanding of the article abstract structure is much clearer

through email communication with the teacher and discussions with his classmates (see Table 3). In his final assignment, there are four moves, with the introduction part containing two steps, background and the research purpose. The method move is included in the research purpose. The result and conclusion move is found in this abstract, though the result move is not clearly explained.

Therefore, this participant's academic writing has improved in two main aspects: the rhetorical abstract structure improved with the use of moves through interacting learning with his classmates and the teacher. On the other hand, his language expression also improved by using more appropriate words in each move.

Table 3: YWH's progress in writing article abstracts

First assignment before the course	Final assignment
In the past two decade∧, emerging work production systems ∧pervaded a diverse number of U.S. manufacturing enterprises in a attempt to progress quantum leaps in quality and productivity and to give customers a variety of products with different options. Because of the worker is at the heart of the application of lean production strategies, this article deals with human performance in a lean production environment. First, an overview of a lean production model is presented. Second, the evidence on human performance in a lean production environment is described and appraised. Third, a research framework is described to determine optimum human performance practices in a lean production setting.	In the past two decades, emerging work production systems have pervaded a diverse number of U.S. manufacturing enterprises in an attempt to achieve quantum leaps in quality and productivity and to offer customers a variety of products with different options. This study aims to design the human performance evaluation system framework by analysing the principles and results of lean production the lean production philosophy in order to determine optimum human performance practices in a lean production setting by reviewing the lean production model. The result shows that one must look deeper into this issue to chart the best human performance practices required to achieve and sustain work productivity, quality, and safety. How to build the necessary human performance evaluation system is finally suggested and discussed.

5.5 Discussion

The purpose of this study is to examine whether the genre-based approach can be an effective way to teach engineering graduates how to write research articles by using the genre-based instruction. Two research questions were mainly answered:

1.   To what extent do engineering graduates in China understand the functions of the academic research article in English?

2.   Can an interactive learning methodology be used to improve engineering graduates' research article writing and to enhance their motivation in writing research articles?

5.5.1 Participants' understanding of functions of academic research article writing

This study finds that explicit instruction of the generic structure may be one of the effective ways of guiding participants to write effective research articles, as shown in Tables 1 and 2. The engineering graduates are found to understand the nature and communicative functions of different parts of the academic research article in English: 100% of the participants understood the generic structure of the academic research article.

Besides, most participants learnt how to write each part of the research article, but they still need more practice in doing research and conduct literature review. As shown in Tables 1 and 2, only 55.56% (N=20) of the participants knew how to write the research method section. Examples 4 and 5 provide evidence that we should do more research on how to guide students to write research method section (c.f. Bruce, 2008; Swales, 1990; Lim, 2006). This can be evident of Lim's (2006) investigation into the Method section. Since the Method section often functions as a bridge that binds a particular research method with the previous research procedures, the engineering students must be guided to read the related previous literature under their supervisors' help.

In addition, the Chinese engineering graduates need more productive skill training rather than receptive learning. As shown in Table 1 (and Example 4), only 58.33% of the participants could write complete academic journal article abstracts. Although my experience, through interactive learning, proved that engineering students made greater progress in academic writing (see Tables 2 and 3), there is much work to be done in the future. The Chinese College English needs improving and the Chinese TESOL practitioners must think more about how to keep up with the rapid development of the Chinese economy. Only when the author has had a clear understanding of the research theory and analytical framework that they can write a better article. Therefore, I suggest that it be better that the academic research article writing course is run after participants have some experiences in research.

5.5.2 The efficiency of improving participants' writing through interactive learning

This study also finds that an interactive learning methodology can be useful and effective to improve engineering graduates' research article writing and build up their speaking confidence. The data revealed that making full use of the new media, such as email and QQ software, can facilitate the engineering graduates' improvement in research article writing, as Examples 1 and 2 show. Example 6 is another illustration:

Example 6

HLL: *Through QQ, I could communicate more directly with the teacher. This saved both our time. ..* (Group interview, 2 July 2008)

DW: *The class discussion built up my confidence…before this class, I often felt reluctant to answer the teacher's questions, but this time through group*

discussion I can first learn from other students and I feel more confident in

sharing my ideas in class…. (Group interview, 2 July 2008)

However, this type of interactive learning may cost the teacher much more time than in the regular writing course. This needs further research, for example, using teaching assistants may decrease the teachers' workload. Besides, this course is essential because the graduates' research experiences may help them understand more of research article writing, because very fewer graduates were involved in their supervisors' research when they started their graduates' English course.

6.   Conclusion

Generally speaking, this AR course has fulfilled its desired teaching goals in this context, The participants' progress provided strong evidence that through learning the generic structure, participants are able to construct their academic research article structure. In addition, a few teaching and learning methods are found to be effective: interactive learning through group work according to participants' disciplines, creating participants' assignment portfolio, and interactive learning between the teacher and participants through QQ software. This practice can be expressed in two ways: on one hand, using the genre-based instruction, the teacher can use patterns taken from sample articles; on the other hand, integrating writing with speaking can motivate participants to write and speak for their own academic purposes, which made this course more active and purposeful.

Lack of research experience on the part of the participants has made this AR course difficult. I therefore pose the question: How can they write or be required to write an academic

paper or communicate academically without knowing their own research project? My study may draw the Chinese educators' attention to this issue. This study may have some implications for EAP pedagogy because the findings would be helpful to EAP practitioners to think and try in their own areas following the framework of genre approach.

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Appendix 1

Interview 1 (during the course)
1. Could you tell me your feelings about the course?
2. What do you think of the way the teacher teaches?
3. Can you say something about the materials the teacher uses?
4. What do you think of the move structure the teacher uses in this course? Do you understand it? In what ways? Can you explain more about this?

Interview Two (after the course)
1. What did you learn from the course?
2. In what ways did you acquire the writing skills? Can you give examples?
3. What method did the teacher use? In what ways do you like (or dislike) them?
4. Can you describe your role in this course? Are there differences from other courses you attended before? Why do you think so?

Appendix 2

Questionnaire 1

Dear participants：

Thank you for taking part in this questionnaire survey, which aims to investigate your publishing experiences for the past five years. I would be very grateful if you could answer these questions and return them to me as soon as possible to help me find out more about the problems brought about by writing academic research articles in English.

I. Basic information

Age： _____ Gender：

Education： ___ Job title

Profession:

Place you are from

II. Questions

1. Have you ever before written an academic research article?

€Yes __ €No

If the answer is affirmative, what did you write this article for?

2. What language did you write for publication?

€English €Chinese

3. In an academic research article, what following sections should be included? (please arrange them according to their importance)

1) title _____
2) conclusion _____
3) methodology _____
3) introduction _____
4) literature review _____
5) abstract _____
6) key words _____
6) background _____
7) reference _____
8) data analysis _____
9) new words _____
10) topic sentences _____
11) summary _____
12)suggestions _____
13) Reasons for writing _____

14)others (please specify)_____

4.   Have you ever before published any articles in any journals?

€Yes __   €No

If the answer is affirmative, what journal did you publish your article?

5.   You think that publishing an academic research article is very difficult.

A. very much agree   B. agree   C. disagree   D. very much disagree

5. Why do you think that writing for publication is difficult? (optional choices, please order
        following according to its importance: A= very much agree; D= very much disagree)

1) I have no research experience, nothing to say	A	B	C	D
2) I have no experience in writing academic articles	A	B	C	D
3) I read fewer literatures	A	B	C	D
4) I have had no academic writing class before	A	B	C	D

Others (please specify)

6. I think the following sections are the most difficult parts to write (optional choices, please
        order following according to its importance: A= very much important; D= very much
        unimportant)

1) abstract	A	B	C	D
2) introduction	A	B	C	D
3) literature review	A	B	C	D
4) method	A	B	C	D
5) discussion	A	B	C	D
6) conclusion	A	B	C	D
7) reference	A	B	C	D

Others (please specify)

7. Have you experienced in writing for academic research conference?

€Yes   €No

1) If the answer is affirmative, what is the most important part for a participant to write for the
        conference?

2) If the answer is affirmative, what kind of conference did you attend?

€ international conference   €domestic conference

8. If you were offered a chance to learn writing skills, what would you prefer to learn?

9. What parts does the abstract may contain according to your own knowledge?

10. If you are given a chance to learn academic English, what will you expect to learn?

Appendix 3

Questionnaire 2

1. What is an academic research journal article? How many parts do you think it contains?

2. What is the academic journal abstract? How many steps do you think it contains?

3. What is an introduction? How many steps do you think it contains?

4. What is a literature review? How many steps do you think it contains?

5. What is research method? How many steps do you think it contains?

6. What is result in an academic journal article? How many steps do you think it contains?

7. What is discussion in an academic journal article? How many steps do you think it contains?

8. What is conclusion? How many steps do you think it contains? How many steps do you think it contains?

9. what is reference? How do you write for your research article reference?

Investigating Associations between Metacognitive Strategies and Reading Comprehension in EAP in Iran

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Abstract

The current study was conducted to investigate the possible relationship between Iranian EAP learners' metacognitive strategies and reading comprehension. 33 students at Kashan University majoring in Mining participated in the study. To measure their metacognitive strategies, the Metacognitive Awareness of Reading Strategies Inventory (MARSI) (Mokhtary & Reichard, 2002) was used. Moreover, a sample reading test extracted from *English for the Students of Mining (Exploration)* (Moshiri & Roshan Zamir, 2009) to measure students' reading comprehension was used. Correlational analysis between MARSI results and test performance revealed a significant relationship between the metacognitive strategies used and reading comprehension. This indicates that students who are aware of metacognitive strategies have better language proficiency.

Keywords: Metacognitive strategies, Strategy awareness, EAP students, Reading comprehension

1. Introduction

Successful reading comprehension does not occur automatically (Bazerman, 1985; Pressley & Afflerbach, 1995) but rather depends on directed cognitive effort, or metacognitive processing. Such processing can include strategies such as planning learning, monitoring the process of learning, and evaluating how successful a particular strategy is (Ellis, 2008). During reading, metacognitive processing is expressed through strategies, which are "procedural, purposeful, effortful, willful, essential, and facilitative in nature" (Alexander & Jetton, 2000, p. 295), thus

making reading a skill of significant value in language learning. Most readers can read different texts independently, but it is important to know what strategies they apply to comprehend the material. This is even more important in English for Academic Purposes (EAP).

In EAP programs in Iranian universities, most teachers employ reading-based methods focusing on text analysis (Atai, 2002; Hayati, 2008), which supposedly provide students with the strategies and skills required for comprehending academic and technical texts. Atai (2002) observed that the textbooks in Iran follow a rigid distribution of instructional exercises and activities with focus on reading comprehension and Hayati (2008) concluded that most of ESP class time is spent either on reading texts or discussing topics, with only slight deviations from the textbook. From their observations, it can be inferred that EAP teachers in Iran rarely involve students in different metacognitive strategies like planning learning and evaluating the efficacy of a particular strategy.

This lack of attention to strategies among teachers in Iran is particularly problematic because, generally speaking, in many first language studies, the use of various strategies has been found to be effective in improving students' reading comprehension (Baker & Brown, 1984; Brown, 1980; Palinscar & Brown, 1984). Some studies have also investigated reading strategies used by successful and unsuccessful language learners. For example, Carrell, Devine and Eskey (1988) suggested that a successful use of reading strategies was dependent on "awareness" (p. 129) of, and flexibility in, the use of these strategies according to the purpose of the task or the problem to be solved. However, few studies have investigated language learning strategies use, particularly metacognitive strategies use, by Iranian EAP learners and their relationship to reading comprehension. This study is intended to address this need by considering the

relationship between metacognitive strategies use and language comprehension among Iranian mining students.

2. Literature review

The goal of this research is to investigate the relationship between metacognitive strategies and reading comprehension. For ease of exposition, we first examine the literature on learning strategies in general and metacognitive strategies in particular. Then, we discuss reading comprehension and finally consider the possible relationship between the two.

2.1 Learning strategies

According to Akbari and Hosseini ,2008, p.146), Rubin first introduced the concept of language learning strategies to the field of second/foreign language learning.

Hence, there is uncertainty about the precise definition of learning strategies and some scholars like Ellis (2008) tried to collect different definitions in order to synthesize this construct, leading to the following set of characteristics:

1)   Learning strategies are both general and specific approaches, actions, and techniques used to learn L2.

2)   They are problem-oriented, meaning they are used by L2 learners to solve a problem.

3)   Learners are aware of the strategies used and they can identify them when necessary.

4)   They involve linguistic and non-linguistic behaviors.

5)   Linguistic behaviors are applicable to both L1 and L2.

6)   Some strategies are behavioral, others mental; some observable, others unobservable.

7)   Mainly, strategies contribute to L2 learning indirectly. However, some strategies such as

memorization may contribute directly.

8)   L2 learners use strategies differently depending on the kind of task they are engaged in and their individual preferences.

However, as researchers' understanding of psychological and cognitive aspects of L2 learning developed, the list of definitions of learner strategies continued to grow, making a complete listing impractical. As a result, scholars (O'Malley & Chamot, 1990; Oxford, 1990) classify different learning strategies One of the models which has received wide support is the one offered by Oxford's (1990). Her model is like a hierarchal taxonomy with the distinction between direct and indirect strategies, along with sub-categories (see Table 1).

Table 1: *Oxford's Taxonomy of Learning Strategies* (Adapted from Oxford, 1990)

Direct	Memory strategies
	Cognitive strategies
	Compensation strategies
Indirect	Metacognitive strategies
	Affective strategies

Among the strategies listed above, we are going to concentrate on those which are considered to have a significant, positive, direct effect on cognitive strategy use, specifically global reading strategies, problem solving strategies, and support reading strategies (Purpura, 1997), which some believe, are strong predictors of L2 proficiency (Dreyer & Oxford, 1996; Oxford, Judd & Giesen, 1998).

2.2 Metacognitive strategies

Flavell (1976) appears to have first proposed the concept of metacognition (Memnun & Akkaya, 2009). He defines metacognition as an "individual's knowledge about his/her cognitive process, and employing this knowledge to inspect cognitive processes" (Flavell, 1976, p. 232). Schmitt (2002) refers to metacognitive strategies as those processes language learners consciously use to monitor and manage their learning. These strategies help language learners set learning goals, check their progress, and evaluate their learning performance (Schmitt, 2002). Other researchers (Akın, Abacı & Cetin, 2007, p. 672) regard metacognition as thinking of thought or "cognitions about cognitions" with regulation of cognition representing a basic component of metacognition. According to Sánchez-Alonso and Vovides (2007), language learners who are aware of their metacognitive strategies are effective language learners and succeed in managing their learning process. Cubukcu (2009) points out that the metacognitive strategies learners use consist of metacognitive knowledge, metacognitive monitoring, and self-regulation and control. Metacognitive knowledge refers to cognitive strategies that language learners use to regulate their knowledge acquisition, such as memory strategies (Cubukcu, 2009). Metacognitive monitoring refers to strategies language learners use to control and monitor their learning process (Cubukcu, 2009). Finally, self-regulation refers to strategies used to manage the whole learning process (Cubukcu, 2009).

Other researchers (Birjandi, Mirhassani & Abbasian, 2005) summarized metacognitive strategies using the acronym CAPE, which stands for centering, arranging, planning, and evaluating the learning process, emphasizing learners' metacognitive strategies and claiming learner success or failure results from the presence or absence of these strategies. Birjandi, et al. (2005) explained that language learners who use metacognitive strategies can easily determine what they need to do and how to manage their learning as they can identify their learning needs

and effectively control and monitor them. Graham (1997) emphasizeed the significant role metacognitive strategies play in individuals' educational progress, adding that those language learners who do not use metacognitive strategies are actually learners "without direction" (O'Malley, Chamot, Stewner-Mazanares, Russo, & Kupper, 1985, p. 561). Using metacognitive strategies, learners can control and monitor their progress themselves (Wang, Spencer & Xing, 2009). Paris and Winogard (1990) believed metacognitive strategies transform a passive learner into an active learner, helping them to go beyond the limitations imposed by the instruction in order to control and manage their learning process through personal appraisal and management (Wang, et al., 2009). Senay (2009) asserted the crucial role of metacognitive strategies and further believes that using these strategies, language learners set goals for their own learning and consequently become effective and independent learners. He also claims that metacognitive strategies contain three basic skills; planning, monitoring and evaluation. According to Visser, Ashton & Vernon (2006), there is a close relationship between intrapersonal intelligence and metacognition, with individuals with high intrapersonal intelligence being aware of what they know and what they don't know. This means they are generally aware of their needs and using metacognitive strategies can self-direct their own learning and accurately judge their relative strengths and weaknesses.

Metacognitive strategies have the lion's share of the self-directive process, which is important in problem-solving activities (Memnun & Akkaya, 2009). It is claimed that strategic language learning which includes metacognitive strategies results in self-regulatory learning, which is a desired goal for all language learners (Doughty & Long, 2003), as self-regulating learners are active participants in the learning process and can easily differentiate between what they know and what they don't know, resulting in greater learning achievement. Last but not least,

metacognitive strategies are recognized as the main predicators of academic performance. Cubukcu (2009), for example, asserted that those language learners that consistently monitor, control and manage their learning can easily review and retain new information.

2.3 Reading comprehension

Reading was traditionally assumed to be a passive process in which readers took data from text. Later, cognitive-based approaches to reading deemphasized this idea and claimed that reading comprehension is interactive in nature. According to Chastain (1988), reading comprehension is meaning-driven, holistic and top-down. Grellent (1982), believed that skilled readers do not limit themselves to words and sentences; instead they start with a general understanding of a text, then move to more specific details. Other researchers (Weaver, 1972, Strickland, 1988) believed that proficient reading comprehension involves both top-down and bottom-up processing.

Below we present three dominant models of reading comprehension.

2.3.1 Bottom-up processing

 In bottom-up processing, readers are regarded as passive receivers of information in the text. They therefore extract meaning from the text and the goal of reading is to reproduce the meaning embedded in the text (Chastain, 1988). Here, reading is regarded as a decoding process where readers reconstruct the author's intended message through recognizing the letters and words that form a text. In this view, meaning exists in the text itself. Bottom-up processing is also called data-driven, by which is meant readers principally make use of data from the text they are reading (Carrell, 1984).

According to this model, readers extract meaning through a number of stages; they move from words to sentences, then to paragraphs and so on in order to understand the intended meaning of the text. Bottom-up processing, however, does not account for the role of readers' prior knowledge in facilitating reading comprehension.

2.3.2 Top-down processing

According to proponents of this model, meaning is the product of the reader's interacting with the text as inside-the-head factors determine meaning (Chastain, 1988). This view asserts that reading comprehension rests on the reader's knowledge base and reader background knowledge influences comprehension. This is referred to as top-down processing or conceptually-driven processing. Anderson's (1984) contrast of top-down and bottom-up processing is summarized in Table 2 below.

Table 2: Bottom-up vs. Top-down models of reading comprehension

Bottom-up model	Top-down model
Reading is made up of separate skills.	Reading is an integrated process.
Reading has a hierarchical skills sequence.	Reading has no sequence of skills.
Applying reading skills leads to meaning.	Reading is meaning-centered.
Reading is a passive process.	Reading is an active process.
Reading is a precise process.	Reading is an inexact process.

This model relies heavily on the reader's background knowledge at the expense of ignoring lexical and grammatical forms and tends to de-emphasize the decoding dimension of reading comprehension. It is believed that this model works better for proficient readers than less proficient readers.

2.3.3 Interactive processing

With the emergence of cognitive theories of learning, a great shift occurred from bottom-up processing to interactive processing. Interactive processing is a model in which both textual information and reader background knowledge combine in the extraction of meaning (Widdowson, 1979), making reading a dialogue between the reader and the text (Grabe, 1988), as readers rely on both top-down and bottom-up processing. Here, good readers are assumed to be good decoders and good interpreters of texts. Generally speaking, this model subsumes both top-down and bottom-up processing, so readers make use of their background knowledge, the context and also pay attention to accurate recognition of words and letters (Carrell, 1988).

2.4 Metacognitive strategies and reading comprehension: Discussing their relationship

Brown (1980) lists metacognitive strategies involved in reading comprehension, as follows:

1) clarifying the purposes of reading

2) identifying the important aspects of a message

3) monitoring ongoing activities to determine whether comprehension is occurring

4) engaging in self-questioning to determine whether goals are being achieved

5) taking corrective action when failures in comprehension are detected

According to Dhieb-Henia (2003), metacognitive strategies play an important role in helping readers to plan and monitor their comprehension while reading. Moreover, Carrell (1998) believes reading comprehension will be successful if readers meet two basic criteria: Firstly, knowledge of cognition which is related to which strategies readers use, when and how they use them and secondly, metacognitive strategies which refer to the regulation of cognition. This

second process refers to monitoring, planning and transferring of reading comprehension. Other researchers (Sporer, Brunstein & Kieschke, 2009) believe reading comprehension is correlated with several cognitive and metacognitive strategies and point to factors such as a) activating background knowledge, b) summarizing the text and c) asking questions to get the main ideas of the text as crucially important to reading comprehension.

Smith (1979) emphasizes the cyclical process of reading comprehension. He claims that reading is not a linear process in which readers simply extract the intended meaning from the text, but it is a process through which readers constantly form hypotheses, test hypotheses and further make use of their prior knowledge to reach their desired goal.

Many other studies have paid considerable attention to what skillfully proficient readers do and the strategies they use while reading. They all point to strategic awareness and monitoring of comprehension as important to skillful reading. This strategic awareness and monitoring are referred to as metacognition, or self-control activities readers use to monitor and improve comprehension. Metacognition, according to Auerbach and Paxton (1997), "entails knowledge of strategies for processing texts, the ability to monitor comprehension and the ability to adjust strategies as needed" (pp. 240-241). Such metacognitive awareness, as claimed by Sheorey and Mokhtari (2001), is influenced by previous experience, beliefs and culturally specific practices. They believe proficient L2 readers can easily compensate for their weakness in English proficiency by increasing strategy awareness and usage of reading strategies, meaning they know what strategies to use and how and when use those strategies, while poor readers are indifferent to reading strategies and skills.

Meneghetti, Carretti & De Beni (2006) make a distinction between poor comprehenders and good comprehenders. They believe poor comprehenders have an average IQ and usually

encounter great difficulty in understanding the meaning of a text. They also believe poor comprehenders experience difficulty when they want to make inferences and have problems making links between old and new information. Semantic inconsistency is another realm to which poor comprehenders pay little attention and are thus less sensitive. They further claim that poor comprehenders rarely use reading strategies (Meneghetti, et al., 2006) and conclude the ability to evaluate textual complexity, detect text structure and monitor comprehension are all important factors which discriminate good and poor comprehenders. Moreover, Golinkoff (1975) believes poor readers read all types of texts in the same manner. According to Van Keer and Verhaeghe (2005), skillful readers try to master both cognitive and metacognitive strategies that facilitate reading comprehension and thus do much more than word, phrase or sentence-level processing, and therefore proficient reading assumes active participation on the part of the reader who independently manipulates and arranges the reading process. Thus competent readers use metacognitive strategies while reading to achieve better understanding of a text, including self-control, estimation, forming inquires and the ability to make a connection between the text and prior knowledge (Aksan & Kisac, 2009).

Furthermore, metacognitive knowledge is necessary for self-directed learning, as successful reading comprehension results from the metacognitive strategies readers utilize while reading (Cotterall & Murray, 2009). Dhieb-Henia (2003) points out that "poor readers did not lack cognitive strategies but rather they failed to use them metacognitively" (p. 391), so effective reading is related to the metacognitive awareness strategies readers' use while reading. Paris and Paris (2001) remarks that successful reading comprehension entails using several strategies while reading. Brand-Gruwel, Aarnoutses & Boss (1997) enumerates the basic features poor comprehenders have, including; insufficient knowledge of strategies, lack of control and

regulation of the reading process and finally when confronted with difficulty, they do not struggle to improve their situation. Malcolm (2009) believes skillful and less skillful readers are differentiated in the frequency and variety of strategy use. She claims that more skillful readers tend to use strategies more frequently and in a more varied manner than less skillful readers. Cogmen and Saracaloglu (2009) claim note-taking, highlighting and inferencing are significant actions good readers usually take. Moreover, El-Kaumy (2004) claims planning, self-monitoring, and self-evaluation are the three features that best characterize effective metacognitive strategy use, arguing reading comprehension strategies are activities that let readers control and monitor their reading. Other researchers (e.g., Eilers & Pinkley, 2006) claim metacognitive strategy use promotes reading comprehension level. Senay (2009) emphasizes planning, monitoring and evaluation as important actions readers should take while reading, claiming readers should have a precise plan for each reading activity and should learn to monitor and evaluate their reading activity. To summarize, many studies have noted the significant influence metacognitive strategy use has on reading comprehension.

2.5 Research questions and hypotheses

This study aims to investigate how metacognitive strategy use influences the reading comprehension of Iranian EAP students majoring in Mining; the following research questions will be addressed:

1. Is there any significant relationship between metacognitive strategy use and the reading comprehension of Iranian university students in an EAP context?

2. Is there any significant difference between Iranian male and female EAP learners in the way they utilized metacognitive strategies?

Based on those questions, the following hypotheses are suggested:

H01: There is a significant relationship between metacognitive strategy use and reading comprehension of Iranian university students in an EAP context.

H02: There is a significant difference between Iranian male and female EAP learners in their application of metacognitive strategies .

3. Method

3.1 Participants

Thirty-three students (18 females and 15 males) majoring in *Mining* who were studying at *University of Kashan* took part in this research. They were all studying in the final year of the programme in Mining (Exploration) and were aged 18 to 23.

3.2 Instrumentation

In order to measure students' metacognitive strategy use, we used the Metacognitive Awareness of Reading Strategies Inventory (MARSI) (Mokhtary & Reichard, 2002). The questionnaire contained 30 items categorized into three sub-skills; global reading strategies, problem solving strategies and support reading strategies. We also used a sample reading test extracted from *English for the Students of Mining (Exploration)* (Moshiri & Rooshan Zamir, 2009) to measure reading comprehension.

3.3 Procedure

All 33 students were first asked to answer a sample test of reading comprehension taken from their EAP book, *English for the students of Mining (Exploration)* (Moshiri & Rooshan Zamir, 2009, see Appendix A). The test contained content-specific passages related to mining which were followed by multiple-choice items. In order to measure their metacognitive strategy use in their reading, they were asked to answer the Persian translation of the Metacognitive Awareness of Reading Strategies Inventory (Mokhtari & Reichard, 2002, see Appendixes B & C), which contained 30 Likert scale questions to assess how students planned and monitored their reading. Students completed the reading comprehension test before the metacognitive strategies questionnaire in order to avoid sensitizing students to the questionnaire. Using SPSS, we then examined the test results and questionnaire answers to search for correlations between the two, using the Pearson correlation test, which revealed a significant relationship between metacognitive strategy use and reading comprehension among the learners involved in this study. We then additionally investigated how the metacognitive strategy sub-categories each correlated with reading comprehension.

4. Results and discussion

Table 3 summarizes the statistical results of the Pearson correlation of the comprehension test and the metacognitive strategies use inventory.

Table 3: Correlation between metacognitive strategies and reading comprehension

		Strategy	Glob	Prob	Sup	Reading
Strategy	Pearson correlation	1.000	.786	.700	.783	.512**
	Sig(2-tailed)	.	.000	.000	.000	.002
Glob	Pearson correlation		1.000	.298	.389	.373
	Sig(2-tailed)		.	.093	.025	.032
Prob	Pearson correlation			1.000	.406	.413
	Sig(2-tailed)			.	.019	.017
Sup	Pearson correlation				1.000	.387
	Sig(2-tailed)				.	.026
reading	Pearson correlation					1.000
	Sig(2-tailed)					.

As Table 3 shows, the Pearson correlation coefficient is 0.512 regarding the relationship between metacognitive strategy use and reading comprehension, with significance at the $p < .01$ level, thus indicating metacognitive strategy use positively correlated with reading comprehension in this research. This suggests readers who apply metacognitive strategies in their reading of content-specific subjects achieve better understanding of the texts they read. Since the metacognitive strategy use questionnaire included three sub-skills, we also checked for correlation between subsections of the questionnaire with scores on the reading comprehension test, investigating how global reading strategies, problem solving strategies and support reading strategies correlate with reading comprehension. The correlation between global strategies and reading comprehension was 0.373, with significance of $p < 0.05$. Problem solving strategies and reading comprehension correlated at 0.413 with significance of $p = 0.017$. Finally, the correlation between support reading strategies and reading comprehension was 0.387, $p = 0.026$.

Finally, since we aimed to investigate whether gender affected the relationship between metacognitive strategies and reading comprehension, we compared the performance of males and females. Table 4 provides the results of this comparison.
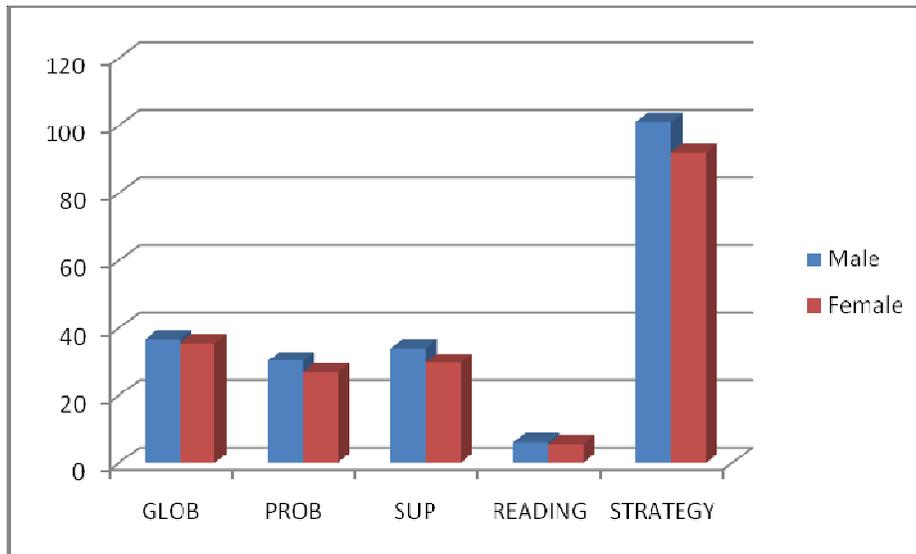
Figure 1: Comparison Regarding Strategies Used between Males and Females

Table 4: Independent sample t-test comparing males and females

		Glob	Probe	Sup	Strategy
Male	Mean	36.67	30.33	34.07	101.20
	Std. deviation	6.88	4.59	4.23	10.72
Female	Mean	35.50	26.89	29.78	92.17
	Std. deviation	7.16	5.03	6.50	14.85

None of the differences were significant ($p > 0.05$)

Regarding the results of the independent sample *t*-test comparing males and females, there was not a significant difference between them in the way they utilized metacognitive strategies. Although our male participants used more metacognitive strategies while reading, the difference between the two groups was not significant, indicating no difference between males and females in metacognitive strategy use in reading.

In summary, metacognitive strategy use appears to positively influence the reading comprehension of Iranian EAP learners majoring in mining. In other words, readers who use metacognitive strategies in reading comprehension understand better what they are reading through planning and monitoring. As the EAP students who were aware of metacognitive

strategies demonstrated increased comprehension, there may be a case for learner training in metacognitive strategy use in the classroom.

5. Conclusion

This study investigated the relationship between metacognitive strategy use and reading comprehension among Iranian EAP students. It concludes that metacognitive strategy use positively correlated with EAP reading comprehension. In other words, readers who applied metacognitive strategies in their reading achieved better understanding of the texts they read. This suggests teaching strategy use to advanced EAP students may empower them to read with greater flexibility in their specialty area as learners who use metacognitive strategies when reading may improve their potential to read and understand a text. Furthermore, EAP teachers may want to encourage metacognitive strategies use among students while reading. One means of raising EAP learners' awareness of metacognitive strategies for reading content-specific passages is a think-aloud demonstration modeling strategies appropriate for academic reading. While the students involved in this research demonstrated that metacognitive strategy use correlated with reading comprehension, caution should be observed in generalizing these results to other contexts, as these results were obtained from a small sample of 33 students, so it is necessary for more studies with larger samples and in other contexts to verify that this relationship between metacognitive strategy use and reading comprehension is consistent across learners of English as a second language.

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Appendix A.

Reading Comprehension Sample Test Extracted from *English for Students of Mining*

Drilling for Geologic Information

Drill-Hole Patterns and Sequences
The patterns and methods in an exploration drilling program depend primarily on the intended use of the data. In reconnaissance, drill holes are likely to be isolated and are often drilled to investigate a stratigraphic sequence or to probe beneath an unconformity or thrust fault. Topographic relief and accessibility may dictate the site and type of equipment. If information is needed on a certain geologic contact in gently dipping beds, the site may have to be the topographically lowest site available.

Even though reconnaissance drill holes are located for geologic orientation rather than for target organization, they still are part of a sequence in drilling that may eventually make them part of a target-oriented pattern. In the Gas Hills uranium exploration program in Wyoming, Davis (1973) followed the sequence and pattern that he recommends for similar programs involving a search for sandstone-type orebodies. The first holes, reconnaissance holes, are drilled 10-15 km apart; they are located to penetrate formations of potential interest and to provide generalized structural data. If at a spacing of 2-5 km. at this stage trends are sought in favorable host rock, alteration zones, and accompanying geophysical and geometrical patterns. 'Fences' or lines of holes at a relatively close spacing (100-200 m) and with the fence lines at intervals of 1-2

km. ultimately, when uranium orebodies are to be out-lined, fences of drill holes may be at intervals of only 30 m., with holes 10 m. apart.

A reconnaissance-to-detail case history in which drilling was used to find stratigraphic guides to sandstone-type uranium ore has been described by Bigotte and Molinas (1973). The French atomic energy commission (CEA) began subsurface investigations in the Arlit area. Niger, by drilling fence lines at intervals of 3.2 km with holes spaced at 800 m. on the basis of a paleogeographic map made from the reconnaissance drilling information and indications of uranium mineralization in the three of the holes, CEA geologists narrowed the search to a target area. Further drilling was done on an oriented grid with holes concentrated in a smaller area and at decreasing intervals of 800, 400, 200 and 100m. a more detailed paleogeographic map was then prepared and used to develop the emerging picture of a major orebody underlying 2.3 km of barren rock. Detailed drilling within the orebody was eventually done at a grid spacing of 25 m.

A general practice in following trends of geologic ore control or of geophysical or geometrical anomalies from reconnaissance drilling to target drilling is to place the first fence lines across the trend, using inclined holes to miss a steeply dripping tabular orebody. A vertical hole might also follow a encouragement in the first fence line additional holes are drilled to determine the width of mineralization; these are offset holes, still in the fence line but drilled a short distance from the best of the original holes. The next fence line might be 100 m or a kilometer away at a distance indicated by the apparent geologic control or length of anomaly. The hole spacing and inclination are based on the width and attitude of the mineralization found in the first fence line. More fence lines are drilled at greater distance until the entire length of the favorable zone is delimited. Finally, short fence lines of holes are drilled between the best of the preliminary fences and more holes are drilled between the best of the holes in the fence lines until the target area can be confirmed or a zone of weak mineralization can be soundly damned for having caused so such trouble.

A) After reading the text, choose a, b, c or d which best completes each item.

1) The intended use of the data is a primary necessity. ……….

a) To the type of the equipment to work with

b) For an exploration drilling program

c) If the lowest site is not available

d) When the topographic relief shows a thrust fault

2)The French atomic energy commission exploring for uranium in Niger. …………

a) didn't make use of any paleogeographic map

b) began drilling holes at intervals of 3.2 km.

c) increased the fence intervals to wider spaces

d) narrowed the search to a smaller target area

3) Additional holes will be drilled at a spacing of 2-5 km if ………… in the part of a region.

a) the reconnaissance necessitates more search

b) the favorable lithology is found

c) the potential interest is not provided

d) the first holes do not penetrate formations

4)Reconnaissance holes are drilled ………….km apart.

a) 10-15

b)2-5

c) 1-2

d) 2-3

5)Vertical holes. ……………

a) are dug to intersect planar zones at a high angle

b) might miss steeply dipping tabular orebody

c) might follow a thin, steeply dipping vein without indicating its actual thickness

d) all of the above

6)a map showing hills, valleys, etc., by shading or other means, not by contour lines is called………….. map.

a) geographic

b) a relief

c) paleogeographic

d) a lithographic

7)A kind of rock forming the walls of a reef or lode is called ………… rock.

a) barren

b) host

c) tabular

d) planar

8)In the mining parlance, …………… means a line of holes.

a) a grid

b) a bed

c) a fence

d) a pattern

9)the first lines, ……………… holes, are drilled 10-15 km apart.

a) offset

b) reconnaissance

c) vertical

d) fence

10)The descriptions of the features such as rivers, valleys, and roads of a place or a district is called. ..………

a) topography

b) paleography

c) lithography

d) geography

Appendix B

Metacognitive Awareness of Reading Strategies Inventory (MARSI) Version 1.0

Kouider Mokhtari and Carla Reichard © 2002

DIRECTIONS: Listed below are statements about what people do when they read academic or school-related materials such as textbooks, library books, etc. Five numbers follow each statement (1, 2, 3, 4, 5) and each number means the following:

- **1** means "I **never or almost never** do this."
- **2** means "I do this **only occasionally."**
- **3** means "I **sometimes** do this." (About **50%** of the time.)
- **4** means "I **usually** do this."
- **5** means "I **always or almost always** do this."

After reading each statement, **circle the number** (1, 2, 3, 4, or 5) that applies to you using the scale provided. Please note that there is no right **or wrong answer** to the statements in this inventory.

TYPE	STRATEGIES	SCALE				
GLOB	1. I have a purpose in mind when I read.	1	2	3	4	5
SUP	2. I take notes while reading to help me understand what I	1	2	3	4	5
GLOB	3. I think about what I know to help me understand what I	1	2	3	4	5
GLOB	4. I preview the text to see what it's about before reading it.	1	2	3	4	5
SUP	5. When text becomes difficult, I read aloud to help me understand what I read.	1	2	3	4	5
SUP	6.I summarize what I read to reflect on important information	1	2	3	4	5
GLOB	7. I think about whether the content of the text fits my reading	1	2	3	4	5
PROB	8. I read slowly but carefully to be sure I understand what I'm	1	2	3	4	5
SUP	9.I discuss what I read with others to check my understanding.	1	2	3	4	5
GLOB	10. I skim the text first by noting characteristics like length and organization.	1	2	3	4	5
PROB	11. I try to get back on track when I lose concentration.	1	2	3	4	5
SUP	12. I underline or circle information in the text to help me	1	2	3	4	5
PROB	13. I adjust my reading speed according to what I'm reading.	1	2	3	4	5
GLOB	14. I decide what to read closely and what to ignore.	1	2	3	4	5
SUP	15. I use reference materials such as dictionaries to help me understand what I read.	1	2	3	4	5
PROB	16. When text becomes difficult, I pay closer attention to what I'm reading.	1	2	3	4	5
GLOB	17. I use tables, figures, and pictures in text to increase my	1	2	3	4	5
PROB	18. I stop from time to time and think about what I'm reading.	1	2	3	4	5
GLOB	19. I use context clues to help me better understand what I'm	1	2	3	4	5
SUP	20. I paraphrase (restate ideas in my own words) to better understand what I read.	1	2	3	4	5
PROB	21. I try to picture or visualize information to help remember	1	2	3	4	5
GLOB	22. I use typographical aids like bold face and italics to identify key information.	1	2	3	4	5
GLOB	23. I critically analyze and evaluate the information presented	1	2	3	4	5
SUP	24. I go back and forth in the text to find relationships among	1	2	3	4	5
GLOB	25. I check my understanding when I come across conflicting information.	1	2	3	4	5
GLOB	26. I try to guess what the material is about when I read.	1	2	3	4	5
PROB	27. When text becomes difficult, I re-read to increase my	1	2	3	4	5
SUP	28. I ask myself questions I like to have answered in the text.	1	2	3	4	5
GLOB	29. I check to see if my guesses about the text are right or	1	2	3	4	5
PROB	30. I try to guess the meaning of unknown words or phrases.	1	2	3	4	5

Appendix C

The Persian Version of MARSI adapted by Sajad Davoudi

توضیحات: پرسشنامه زیر در رابطه با کارهایی است که افراد در هنگام خواندن متون درسی یا دانشگاهی انجام می دهند.

در مقابل هر جمله پنج گزینه وجود دارد. معنای عدد هر گزینه به ترتیب عبارت است از:

(1) = من هرگز یا تقریبا هیچ گاه این کار را انجام نمی دهم.

(2) = من فقط گاهی این کار را انجام می دهم.

(3) = من بعضی اوقات این کار را انجام می دهم.(تقریبا نیمی از اوقات)

(4) = من اغلب این کار را انجام می دهم.

(5) = من همیشه یا تقریبا همیشه این کار را انجام می دهم.

1	2	3	4	5	شرح گویه	ردیف
					من هنگام خواندن هر متنی، هدفی را دنبال می کنم.	1
					من با یادداشت برداری هنگام خواندن به فهم متن کمک می کنم.	2
					من با رجوع به دانسته های قبلی ام به درک متن کمک می کنم.	3
					من برای آگاه شدن از کلیت مطلب قبل از خواندن دقیق متن، آن را به صورت اجمالی برانداز می کنم.	4
					هنگامی که خواندن متنی مشکل است آن را بلند می خوانم تا بفهمم.	5
					من از آنچه می خوانم خلاصه برداری میکنم تا بعدا به اطلاعات مهم آن فکر کنم.	6
					من به اینکه آیا مضمون متن با هدف من از خواندن آن مطابقت دارد فکر می کنم.	7
					من برای اطمینان از فهم متنی که می خوانم آنرا آهسته ولی با دقت می خوانم.	8
					من برای سنجش فهم خود از متن در مورد آن با دیگران گفتگو می کنم.	9
					من قبل از خواندن متن آن را از جهت ویژگی هایی مثل طول و ساختار برانداز می کنم.	10
					هنگامی که تمرکزم را از دست می دهم دوباره سعی می کنم حواسم را جمع کنم.	11
					من دور یا زیر مطالب مهم متن خط می کشم تا بعدا بهتر آنها را به یاد بیاورم.	12
					من سرعت خواندنم را مطابق با متنی که می خوانم تنظیم می کنم.	13
					من تصمیم می گیرم کدام قسمت ها را به دقت بخوانم و از کدام قسمت ها بی توجه بگذرم.	14
					من از کتاب های مرجع مانند دیکشنری ها برای فهمیدن متنی که می خوانم کمک می گیرم.	15
					هنگامی که متنی دشوار می شود برای فهم بهتر، آن را با توجه بیشتری می خوانم.	16
					برای فهم بهتر مطلب از جدول ها،آمار و تصاویر موجود در متن استفاده می کنم.	17
					هنگام خواندن متون گهگاه مکث می کنم و در مورد آنچه خوانده ام فکر می کنم.	18
					من از سرنخ های موجود در متن برای درک بهتر آن کمک می گیرم.	19
					برای فهم بهتر متن آن را به زبان ساده برای خودم تکرار می کنم.	20

					برای به خاطر سپردن مطالب سعی می کنم آنها را در ذهنم تجسم کنم.	21
					هنگامی که قسمتی از متن پررنگ یا مایل نوشته شده است متوجه می شوم که آن قسمت حاوی اطلاعات مهمی می باشد.	22
					من اطلاعات موجود در متن را به صورت نقادانه تحلیل و بررسی می کنم.	23
					من هنگام خواندن متن به جلو و عقب می روم تا ارتباط بین مطالب آن را بفهمم.	24
					هنگامی که احساس می کنم اطلاعات متناقضی در متن وجود دارد فهم خود را وارسی می کنم.	25
					هنگام خواندن سعی می کنم حدس بزنم متن در مورد چیست.	26
					وقتی فهم متنی دشوار است سعی میکنم آن را دوباره بخوانم.	27
					هنگام خواندن، از خودم سوالاتی می پرسم که احساس می کنم در متن به آنها پاسخ داده شده است.	28
					من درست یا غلطی حدس هایم را درباره متن وارسی می کنم.	29
					من سعی می کنم معنای لغات و عبارات نا آشنا را حدس بزنم.	30

A Needs Analysis of Underprivileged Technical Students at Indian School of Mines, Dhanbad, India

Priya Kumari and Md. Mojibur Rahman

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Biodata

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Abstract

The purpose of the present study is to identify and analyze the language needs of students studying a Bachelar of Technology degree programme (B.Tech.) at the Indian School of Mines and to make recommendations for enhancing the present English syllabus and making it more learner-centered. To find out the needs of these B.Tech. students, a needs analysis was conducted. Two questionnaires, one for students and one for EST teachers, were prepared and administered. The data was then tabulated and analyzed. Then the researcher had a discussion with some students to re-assess the data collected through questionnaires. The results show that even after having learned English at primary, secondary and higher secondary levels, the students are unable to use the English language, as they were taught English as a subject in their schools.

1. Introduction

With the globalization of trade and economy and the continuing increase of international communication in various fields, the demand for English for Specific Purposes (ESP) is expanding. The growth of the ESP movement is a result of the fast development of the world economy and has been greatly influenced by ELT methodology and the development of applied linguistics. In India, with the help of the British Council, many institutions developed ESP courses for students in the 1980s and 1990s, but very few institutions could maintain and run the courses, except for some management institutions, communication training centres and a few technical institutions. One of such technical institutions is the Indian School of Mines (ISM).

The ISM, Dhanbad has been following the ESP approach to teach English language skills in undergraduate and postgraduate classes for the past twenty-five years, and use books such as:

- Singh, R.K. 2004. *Communication in English: Grammar and Composition.* Bareilly:

Prakash Book Depot

- Singh, R.K. 2010. *Using English for Science and Technology.* Bareilly: Prakash Book Depot.

- Williams, R., Ray, R, and Swales, J. 1988. *Communication in English for Technical Students.* Hyderabad: Orient Longman Pvt. Ltd.

The syllabi of two ESP courses adopted by ISM are given below:

Syllabus for Preparatory course
Semester I

ENGLISH I
Course Code: HSC81146

General English Skills
1. Grammar Revision
2. Passive Construction
3. Paragraph Writing
4. Essay Writing
5. Sentence Joining
6. Reading Comprehension and Vocabulary

Semester II
ENGLISH II
Course Code: HSC82104
1. Impersonal Passive
2. Rhetorical functions: instruction, report, description, definition
3. Paragraph Writing
4. Letter Writing
5. Word Formation/Phrase Construction
6. Sentence Joining
7. Reading Texts

One semester consists of almost 46 study hours.

The researcher conducted the needs analysis during her Masters of Philosophy study in English Language Teaching at ISM and the present paper is a part of her dissertation.

To evaluate how effective the teaching and learning process at ISM is and what the real needs of the students in a technical institution are, preparatory students at ISM were selected to participate in this research. These preparatory students have been admitted through the Indian Institute of Technology - Joint Entrance Examination [IIT-JEE], and all of them belong to the SC/ST category (schedule cast /tribe: economically deprived community in India). Since 1983, the preparatory programme has been offered in all IITs, including ISM, Dhanbad, to students who fail by a small margin in the entrance examinations (Thorat, 2009: 17). The Indian Ministry of Human Resource Development has taken this initiative so these SC/ST students can match up with other general students academically. This programme consists of intensive instructions in physics, chemistry, mathematics, and English. Remedial classes are provided to improve the academic skills, linguistic proficiency and levels of comprehension of some SC/ST students. Those who pass preparatory courses by scoring at least 40% marks in each subject are admitted into the regular B.Tech. programme. In the preparatory classes, these students are prepared to face the challenges of the B.Tech. courses so they can stand academically at par with the regular B.Tech. students. In the language classes, these students are encouraged to develop their writing skills and grammar skills so they can perform well in their written examination. The ESP approach is practiced at ISM to develop students' language skills.

The present study seeks to identify the academic and sociolinguistic needs of the learners in the preparatory programme and to make a few recommendations that may help to enhance the present English syllabus for preparatory students at ISM, and to make the present syllabus more learner-centered, meeting the requirements, necessities and wants (Hutchinson and Waters, 1987)

of the learners. The study is also concerned with the practical, sociopolitical, logistic and administrative needs of the teachers. As the main concern of the study is to demonstrate how the learners can learn the English language most effectively, it would be vital to explore what the learners actually know. The objectives of the study are to identify learners' subordinate skills and knowledge required by the learners in order to carry out real world communication tasks; to find out what these learners should be taught at this level when they are getting prepared to face the challenges of B.Tech. courses; to see what can be done to improve students' poor motivation; and to examine how the course of study should be prepared to serve students' academic needs in language usage and to cater to their sociolinguistic needs.

2. Literature review

In the context of Indian institutions, ESP stands for the need for functional commands of English for academic purposes (sandwiched between library language and skill development) (Singh: 2005). Indian students specifically need English as a medium of communicating information in science, technology, and business, acquiring knowledge about new developments in these fields, and making social interactions within the country and in foreign countries. In ESP, the main principles are based on the idea of learners' needs. Needs assessment involves the gathering of information about the personal, academic or professional, cultural and language background of the learners in order to give shape and direction to an ESP course. For example, Munby's (1978) Communicative Needs Processor (CNP) represents a sociolinguistic model that defines the content of "purpose-specific language programme", aiming to give a valid specification of the communicative competence of a student. The model operates in two stages: by building up a profile of students' needs, and by converting the needs into syllabus content.

Although the ESP course is centered on the needs of its learners, the actual needs of the learners are determined by a number of external considerations. In addition, students may have their own needs confused with wants and desires in learning English. Therefore, the roles of the curriculum planner, the material developer and the teacher become very crucial.

2.1 Importance of needs analysis

Needs analysis is a crucial starting point for designing a learner-centered course. According to Singh (2005:110-111), needs assessment starts with identifying the learners' personal, sociocultural and educational traits, involving an assessment of the students' expectations and interest, and their real language needs. To achieve this goal, Singh (2005) suggests that it is necessary to:

a)   Study each and every possible situation in which the students might need English.

b)   Specify the students' communicative purposes by observing and assessing the activities they would be performing, and the roles the students play, in using English.

c)   Determine the level of English language proficiency the students are expected to attain.

2.2 Components of needs analysis

Needs analysis involves many aspects and components, including educational and cultural background, language analysis, language level, theories of learning, subjects to be studied, methods of teaching, study skills proficiency, learning style, data availability, experience, material production, constraints of money, time available, teaching equipment, facilities granted, physical setting, course designer, sponsors (such as the technical institution in the present study), teachers, and the students. The data related to learners' educational and cultural background may

help in analyzing their language competence and exposure to the English language. In a needs analysis exercise, it is vital to explore the study skill and learning style of the learners in order to achieve effective learning and teaching. Other components, like learning materials, money, facilities granted, teaching equipments and the physical setting in which the course is taking place, also contribute to the success of an ESP course. Apart from these, the course designer, sponsors, teachers, and the students are the four major pillars of an ESP course.

Richards (1984) suggests that needs analysis serves the following three main purposes:

(i)   It provides a means for inculcating wider input into the content, design and implementation of a language programme.

(ii)   It can be used in developing objective, goals and content of a language Programme.

(iii)   It provides data for reviewing and evaluating an existing programme.

The present study is concerned with examining the above three purposes.

3.   Methodology

The study collected information regarding students' necessities, wants and requirements by designing a questionnaire to investigate the different language needs of the preparatory students. The questionnaire was based on the model of Munby's Communicative Needs Processor and the questionnaire used in the ISM Project, 1984-86 (please refer to Appendix-I and II for questionnaires).

3.1 Participants

One hundred and forty-four preparatory students, three EST teachers and three Junior Research Fellows, or JRFs (actively involved in teaching language to the preparatory students.), were involved in the study. The three EST teachers, all holding a PhD degree, were teaching ESP at ISM, one for the last three decades and two for the last six years. The JRFs were pursuing their PhD study and were actively involved in teaching.

3.2 Research tools

A questionnaire for students was used to identify the general English language needs of the learners, their present needs of the English language, and the situations in which they would be using the language for academic and social interactions. The questionnaire for teachers was used to identify the real and practical needs of the learners as well as the teacher's self-perceived limitations as ESP teachers.

3.2.1 The questionnaire for students

The questionnaire for students was divided into three main parts (See Appendix I for the questionnaire):

Learners' profile: This section of the students' questionnaire was aimed to extract data related to students' cultural, sociolinguistic and educational backgrounds.

Learners' requirement of language skills: The objective of this section was to assess the learners' present language competence, and the language skills that are required in different situations.

Syllabus adequacy: This section aimed to investigate the adequacy of the present language syllabus, and the areas and the fields which the learners find more important and relevant to support their study of some courses.

3.2.2 The questionnaire for teachers

The questionnaire for teachers was divided into seven main sections (See Appendix II for the questionnaire):

Sociopolitical: This section investigated the teachers' use of the English language; their attitude towards the language, student-teacher relationships, and the syllabus; and their motivation and commitment regarding the course and their work.

Logistical: In this section the teachers were asked about the availability of the resources, their accessibility and their own ability as language teachers.

Administrative: This section extracted data that were related to the administrative part in the education system, such as number of students in a class, course duration, and implementation of new ideas in the course.

Psycho-pedagogic: This section was designed to extract data related to students' linguistic needs, their language competence and perception, and the teachers' ability to understand their students.

Methodological: This section aimed to identify teachers' perception of ESP, their ESP methodology, and their attitude as ESP practitioners.

Course design: This section aimed to extract data about the content of the syllabus, the course design and the teacher's commitment as an ESP course developer.

Teacher expertise: This section investigated the teacher's competence, credibility and efficiency as ESP practitioners.

4. Findings and discussion

Students' linguistic and academic competence

Among 144 students, 80 of them mentioned Hindi as their mother tongue, 49 as Telugu, 3 as Bengali, 3 as Marathi, 2 as Santhali, 2 as Punjabi, 2 as Oriya, 1 as Assamesse, 1 as Mizo, 1 as Adi, 1 as Lambadi, and 1 as Urdu. The class is linguistically heterogeneous and almost 94% of the total students feel that it is more comfortable to converse in their mother tongue. More than 88% of all students think that English is very important to shape their career. This data reflects that the majority of students are aware of their language needs. Among the students, almost 65% use Hindi sometimes to interact with their teachers, about 16% often use Hindi and nearly 19% never use Hindi while interacting with the teachers.

The majority of students sometimes interact with their teachers in Hindi irrespective of their mother tongue. When interacting with their classmates, 84% of the students use Hindi, and 15% sometimes use Hindi. This is because of the social setting – the institution is at Dhanbad in Jharkhand where Hindi is the dominant language of use in the society, and everybody can speak and understand Hindi. It might be due to this reason that the speakers of Telugu, Marathi, Bengali, Punjabi, Oriya, Mizo, Assamese, Adi, Lambadi and Urdu adopted Hindi as the language of communication. When it comes to the use of the mother tongue, more than 27% of the students use their mother tongue often to interact with their teachers, over 50% use it sometimes and almost 30% never use their mother tongue while interacting with their teachers. Students of the preparatory programme use Hindi when they are not able to express their ideas in English.

The results show that over 58% of the students have problems in speaking fluent English, more than 25% are able to converse fluently and around 12% cannot interact fluently. More than

25% of total students are satisfied with their proficiency in English, but 36% of students admit that they will not be able to cope with the demands of B.Tech. courses and over 37% are not sure about their status. Less than 1% of students gave no response in this regard.

It must be taken into account that the medium of instruction at ISM, Dhanbad is English; all course books are in English, and students do their lab work in English. They are expected to understand the lectures, laboratory work, examination papers, and of course their course books. However, the students' response reflects that the majority of them are unable to express themselves in English. This may be due to lack of any functional English course at the school level.

The questionnaire was also designed to assess the writing skills of preparatory students. When the students were asked whether they find any difficulty in writing their laboratory reports or examination answer scripts, it was observed that over 70% of them encounter no such problem. But more than 19% sometimes face difficulty and nearly 10% have difficulty in writing mainly due to lack of vocabulary, less grammar competence, and inability to frame sentences. Some of them feel that they are able to understand and form concepts but unable to express their views in English.

If the overall view of the preparatory students is considered, around 61% of students rank speaking as the most important language skill; 19% rank listening as the most important skill; 10% rank writing as the most important skill; and 10% rank reading as the most important skill. The course of study not only concentrates on developing their speaking skills or sociolinguistic competence, but also helps them to do better in their course subjects in response to the question, 'Does the present English syllabi help you to do better in your main course of study?' Almost 73% of the total students responded positively, whereas 9% responded negatively and 18% were

not sure whether the English course of study helps them or not. This data reflects that almost 27% students think that the present course of English is not of much help to do better in their subject course.

Preparatory students are well acquainted with the subject and the topics in the classroom as they have already read these topics before entering IIT-JEE. They have learned pure science subjects such as chemistry, physics and mathematics in preparatory classes. So after completion of two semesters of intensive study, the students are able to understand their course books. Almost 70% of total students suggest that writing skills must be given extra emphasis, 17% disagree, 12% are not sure and 1% does not respond. In English language teaching all the four skills of listening, speaking, writing, and reading are considered equally important. In EST it is important that they should possess good writing skills, as it is helpful in writing their answer scripts and lab reports. The majority of the students in the preparatory class support the idea that the teachers should, while teaching, emphasize developing students' writing skills.

The questionnaire finds that 94% of the students need English for studies, 85% for laboratory report writing, 92% for exams, 87% for group discussion, 90% for interviews, 84% for talking to important people, 81% for reading journal articles, 65% for reading for pleasure, 82% for reading newspapers, 85% for studying abroad, 71% for interacting socially, and 86% for communicating on the internet.

Another question was designed to find out the students' view towards the language skills in five different physical settings i.e. class, self study, laboratory, outside the institution, and inside the campus. In the class, 134 students suggest it is listening; 36 suggest writing; 23 speaking, and 15 reading. In self study, 115 students said reading is important; 51 said writing, and only 4 said it is speaking. For lab work, 74 students think it is writing; 69 listening, 36

reading, and 27 speaking. Outside the institution, 127 students suggest that writing is the most important, 39 suggest reading, 14 listening, and 14 writing. Inside the campus, 123 students respond that it is speaking that is mostly needed, 48 listening, 27 writing, and 21 reading.

Another question students were asked was 'Among speaking, reading, writing, listening, pronunciation, public speaking, sentence framing, vocabulary development, discussion and conversation, grammar, and punctuation, which one of them should be given more attention in the language classes?'. Nearly 90% of total students choose speaking skills, 83% public speaking, 85% vocabulary development, 82% discussion and conversation, 64% grammar, and 60% sentence framing. Punctuation and reading, with 38% each, are skills which only few students mentioned to be areas that need more attention (Table 1).

Table 1: Areas that should be given more attention in the class

Mother Tongue	Speaking	Reading	Writing	Listening	Pronunciation	Public Speaking	Sentence Framing	Vocabulary Development	Discussion/ Conversation	Grammar	Punctuation
Total (144)	90%	38%	72%	51%	71%	83%	60%	85%	82%	63%	38%

Tables 2-8 below summarise the teachers' responses to questions in the categories of sociopolitical (Table 2), logistical (Table 3), administrative (Table 4), psycho-pedagogic (Table 5 a and b), methodological (Table 6), course design (Table 7), and teacher expertise (Table 8). In each table, the questions and number of response are given.

Table 2: Sociopolitical Section

Questions	Is English the medium of all instruction within the Institution?		Do you use other language/ languages, other than English, while teaching the students?		Do you think English should be the medium of instruction in all areas?		Do your students use English to communicate their ideas to each other/ teaching staff?			Do your students translate ideas in textbooks/ lectures into their own language when communicating with each other /teaching staff?			Are your students positively motivated towards using English for their studies?	
Total No. of Teachers	Yes	No	Yes	No	Yes	No	Always	Sometime	Never	Always	Sometime	Never	Yes	No
6	**6**	**--**	**5**	**1**	**5**	**1**	**--**	**6**	**--**	**1**	**5**	**--**	**4**	**2**

Four out of six teachers envisage that speaking skills should be given more attention and 79% of students feel that in language classes speaking skills need to be given more attention.

The preparatory students feel the need of English, especially spoken English, in all sorts of activities and therefore they want speaking skills to be given more attention. The majority of the teachers think in the same manner. So it becomes vital that the proposed course of study should include lessons on speaking skill development.

The team of teachers is positively motivated and interested to try new methods, so new techniques and methodology may be introduced in language classes.

Half of EST teachers find that the present syllabus, as it is being followed, is adequate for the preparatory course students, while at the same time the other half of teachers are not satisfied with the present course of study. Almost more than 30% of students are not satisfied with the present course of study and in the learning-centered approach to language teaching – 30% of students cannot be ignored. It seems that the syllabus needs to be modified to meet the needs of the learners.

Five out of six teachers are not satisfied with the teaching equipment they are provided. If the teachers are provided adequate language teaching equipment and aids, the language class can be made more interesting and this can motivate students to attend language classes, not out of pressure but out of interest. It was found that in the open discussion with the preparatory students that they find language classes very boring and monotonous and that is the reason they do not feel motivated enough to attend language classes. Using visual aids, tape recorders, and organizing certain language-based activities can challenge the assumptions of the students.

Table 3: Logistical Section

Questions	Do you always communicate your ideas to students in the English language?		Do you think the syllabus as it is followed now is adequate for the Preparatory course students?			Are you independent enough to introduce changes in the syllabus or classroom teaching?		Do you think that your credibility as an English teacher would be lost/ damaged if you were seen to be participating in a science lecture for example?		Are you motivated to try new methods and techniques in English language teaching?		How committed are you to pursue ESP-related teaching?		
Total No. of Ts	Yes	No	Yes	No	Somewhat	Yes	No	Yes	No	Yes	No	Fully	Partially	Somewhat
6	**3**	**3**	**3**	**1**	**2**	**1**	**5**	**--**	**6**	**6**	**--**	**5**	**1**	**--**

Five out of six EST teachers said that they do not get enough support, time and financial support to develop new ideas. This is an important factor which the administration has to pay an extra attention.

The majority of preparatory students think that there should be three or more English language classes per week and the teachers think that the frequency of language classes should be four to five per week. At ISM, the EST classes run concurrently with the subject syllabus and four hours per week is reserved for language classes. Five out of six teachers think that there should not be any changes in this regard.

The basic language requirement of the learners at the preparatory level is that the language courses of study should be such that it should help the students perform well in their subject courses. Special language courses for the students of science and technology should fulfill their academic needs but at the same time, their sociolinguistic needs cannot be ignored. The preparatory class at ISM is a multilingual classroom, and in such a classroom, it is necessary that a common language can be spoken and understood by everyone. In such a situation English can play an important role.

Half of EST teachers said that their students do not understand basic concepts of science and technology in their own language but at the same time, it was observed that the majority of students can take down notes during subject classes and more than 95% of students understand their course books. This certainly means that they understand the concepts of science and technology, though they may have problems in translating them into English.

All the EST teachers agree that remedial grammar teaching is necessary for preparatory students. The majority of students think that their present proficiency in English is not enough to cope with the demands of B.Tech. courses. At this stage, when these students are getting prepared to face the challenges of B.Tech. courses it is important their basics of language must be very clear and remedial grammar can help these learners to overcome the grammatical mistakes they often commit while speaking and writing. It can also be helpful in framing correct sentences.

Table 4: Administrative

Questions	Will there be any increase in teaching staff to help with syllabus design materials writing etc?		Do you have adequate teaching equipment, e.g. tape-recorders, visual aids, language laboratory, textbooks?		Is it expected that you will solve the language teaching problems/ lack of language teaching that exist at present?		Do you have sufficient resources to develop new ideas? (time, money, government/ institute backing)		Do you have access to up-to-date information on the largest developments in the field of language teaching?	
Total No. of Teachers	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
6	**3**	**3**	**1**	**5**	**5**	**1**	**1**	**5**	**4**	**2**

The majority of teachers regard writing as the most required language skill. On this very issue, both the teachers and the students opine differently. Actually at preparatory level, student performance is measured on the basis of their writing skills only. But more than 80% of students feel the need of developing their speaking skills as they require speaking English inside and outside the classroom, in social situations, and for many other purposes. Keeping in view the real needs and wants of the learners, the syllabus should emphasize developing their speaking and writing skills and grammar competence.

Table 5(a): Psycho-pedagogic

Questions	Will your students see a special language course as fulfilling their needs?		Do your students understand the basic concept of science and technology in their own language before the start of their higher education course?		Do you think that your students would be expected to do in English what they would not be able to do in their native language? e.g. read a subject text rapidly and take appropriate notes	
Total Number of Teachers	Yes	No	Yes	No	Yes	No
6	**5**	**1**	**3**	**3**	**4**	**2**

All the EST teachers think that inclusion of social/general English in ESP course design can motivate the students toward attending language classes. It is also possible that the students may not be motivated. They have opted for engineering courses and must have great interest in the area. Authentic or course-specific text may help them to retain their interest.

Table 5(b): Psycho-pedagogic

Questions	Do you agree that for the purposes of motivation, it may be a good thing to include some general/social English into the ESP course?		Would you agree that practice in one language skill, such as speaking can result in a corresponding improvement in reading comprehension?		Would your students expect to use authentic subject texts as materials for language practices?	
Total Number of Teachers	Yes	No	Yes	No	Yes	No
6	**6**	**--**	**6**	**--**	**6**	**1**

The EST teachers at ISM assert that the preparatory students need to improve their writing skills; instead, they need a course that should be based on remedial grammar (as remedial grammar can help them overcome their grammatical incompetence) and should be subject-specific in nature. The EST teachers comment that they are bound to use Hindi in the class to make the students understand certain concepts and to assure communication. They express the view that the students hesitate to speak English in the class either due to less knowledge or lack of understanding of what is being taught in the class. When interpreting these findings, it must be taken into consideration that these preparatory students are granted their respective branches of engineering on the basis of their performance in their class tests, mid-semester exams, and their end-semester examination. They are not judged on the basis of their speaking skills, but their writing skills. So it is important that the language classes should focus on developing their writing skills.

Table 6: Methodological

Questions	Do you think the teaching of ESP requires a special methodology?		Are you motivated enough to learn some of the scientific and technical knowledge that your student are learning?		Would you consider team-teaching with a subject lecturer a valid methodological approach to ESP?		Would you welcome an opportunity to discuss your approaches to ESP with the subject lecturer?	
Total Number of Teachers	Yes	No	Yes	No	Yes	No	Yes	No
6	**6**	**--**	**5**	**1**	**3**	**3**	**5**	**1**

Table 7: Course Design

Questions	Does your student need an English language course?		Will you have to write your own course materials?			Would you welcome the opportunity to discuss your course materials with a subject specialist?		Will you have to devise a system of testing your students' progress in a language course?	
Total Number of Teachers	Yes	No	Yes	No	Some-times	Yes	No	Yes	No
6	**6**	**--**	**1**	**--**	**5**	**6**	**--**	**6**	**--**

Table 8: Teacher Expertise

Questions	Do you have a scientific/ technological background?		Can you teach reading and writing skills?		Have you ever done any team-teaching?		Have you written specialist English course syllabuses before?		Do you understand how scientists/ technologists write, speak, develop their ideas?	
Total No. of Teachers	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
6	**4**	**2**	**6**	**--**	**3**	**3**	**2**	**4**	**6**	**--**

These preparatory students encounter difficulties when they are required to interact with their classmates of different language backgrounds, and in such a situation, they freely use sign-language and Hindi to a great extent. They are unable to interact with their teachers in English, and even face problems to communicate with their seniors, as the preparatory students find

themselves unequipped with the desired language techniques. For social interactions, they should improve their language skills.

5. Conclusion

To conclude, the preparatory students at ISM need a language course that encompasses teaching of all the four language skills, emphasizing speaking and writing. The teachers seem quite aware of the students' real and practical needs, but at the same time the wants and necessities of the learners cannot be ignored as wants and necessities of the learners can be helpful in retaining their interest in the language. Therefore, it can be suggested that the syllabus may be designed in such a way that it meets the academic as well as sociolinguistic needs of the preparatory students, emphasizing speaking and writing skills as well.

5.1 Recommendations

Given the wants, necessities, and lack of language skills of the preparatory students, the following items are suggested for the course:

Remedial Grammar

1. Fundamentals of English Grammar:

i. Parts of Speech - Implications

ii. Modifiers and Articles

iii. Prepositions and Thought-Connectors

2. Descriptive Paragraph Writing

3. Precis

4.   Dialogue Writing

Vocabulary Development

For the overall vocabulary development of the students, different exercises and activities may be carried out in the classroom. One such beneficial activity may be to display several objects or their pictures with their spellings and synonyms once or twice, and then the students may be asked to write the names of the objects from memory. The teachers can then describe the objects and their usage to the students, and ask them to construct sentences from the words.

Discussion/ Conversation:

For the improvement of conversational skills, one specialized class may be organized every week or two. In such classes, the teacher should assign a general topic or choose any subject-oriented topic for discussion. The students should be encouraged to express their ideas and opinions, and hence create a proper atmosphere for the conduct of a discussion and to boost the students confidence in speaking. Any errors committed by the students during the activity should be collectively discussed at the end of the activity.

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Appendix I

Needs Analysis Questionnaire for Preparatory Students, ISM, Dhanbad

I.LEARNERS' PROFILE

1. Student's name   :
2. Age   :
3. Sex   :
4. Native place   :
5. Mother tongue   :
6. Other languages known:
7. Studying English as a subject for the last _____years.
8. % of marks in English in X^{th} _____
9. % of marks in English in XIIth _____
10. Name the examining body:

CBSE (   )   ICSE (   )   State Board   (   )   any other   (   )

11. Medium of instruction at school level--

English   (   )   Hindi   (   )   Bangla   (   )   Others   (   )

II.LEARNAERS' REQUIREMENT OF LANGUAGE SKILLS

12. Are you more comfortable talking in your mother tongue?

Yes   (   )   No   (   )

13. How important is English to shape up your career?

Very important   (   )   Important   (   )   Not important   (   )   Don't know   (   )

14. How often do you use your mother tongue while interacting with teachers?

 Often   (   )   Some Time   (   )   Never   (   )

15. How often do you use Hindi while interacting with teachers?

Often   (   )   Sometime   (   )   Never   (   )

16. How often do you use Hindi or mother tongue while interacting with your friends?

Often   (   )   Sometime   (   )   Never   (   )

17. Are you able to interact fluently in English with your teachers and classmates?

Yes   (   )   No   (   )   Some difficulty   (   )

18. Do you think your fluency and accuracy in English is quite enough to cope with the demands of B.Tech courses?

Yes   (   )   No   (   )   Not sure   (   )

19. Is it easy to take down notes during subject classes?

Yes   (   )   No   (   ) Not too easy   (   )   Not too difficult   (   )

20. Do you find any difficulty related to language in answering your examination paper or writing your lab reports?

Yes   (   )   No   (   )Sometime   (   )

Specify the difficulty_____

21. Are you able to understand your course book?

Yes   (   )   No   (   )

22. When do you need to use English?

--for studies   ☐

--for laboratory   ☐

--for examination   ☐

--for group discussion   ☐

--for interviews   ☐

--to talk to important people ☐

--to read journals   ☐

--to read for pleasure ☐

--to read newspapers ☐

--to interact socially ☐

--to study abroad   ☐

--to communicate on internet

23. Which is the most important language skill? (Rank them by putting 1, 2, 3, & 4)

--reading   ☐

--writing   ☐

--speaking ☐

--listening ☐

24. Which is the most important language skill? (L-listening, S-speaking, W-writing, R-reading)

--in class	L	S	W	R
--in self study	L	S	W	R
--in laboratory	L	S	W	R
--outside the institution	L	S	W	R
--In the campus	L	S	W	R

SYLLABUS ADEQUECY

25. Which of the following areas must be given more attention in your language course of study?

--speaking   (   )

--reading   (   )

--writing   (   )

--listening   (   )

--pronunciation   (   )

--public speaking   (   )

--sentence framing   (   )

--vocabulary development   (   )

--discussion/conversation   (   )

--grammar   (   )
--punctuation   (   )

26. Does the present English syllabus help you to do better in your course subject?

Yes ☐   No ☐   Not sure ☐

27. Are you satisfied with the present course of study?

Yes ☐   No ☐   Not sure ☐

28. What changes do you want in your present English course?

_____

_____

29. Do you think in English classes the stress must be given to develop your speaking skills?

Yes ☐   No ☐   Not sure ☐

30. Do you think in English classes the stress must be given to develop your writing skills?

Yes ☐   No ☐   Not sure ☐

31. What should be the frequency of language classes?

Thrice a week ☐   twice a week ☐   once a week ☐

Not sure ☐

Any other suggestions/comments_____

Signature

Appendix II

Needs Analysis Questionnaire for EST Teachers, ISM,   Dhanbad

Section I : socio-political

1. Is English the medium of all instruction within the Institution?

Yes   ☐   No   ☐

If no in which areas it is used?

2. Do you use other language/languages, other than English, while teaching the students?

Yes ☐   No ☐

3. Do you think English should be the medium of instruction in all areas?

Yes ☐   No ☐

_____

4. Do your students use English to communicate their ideas to each other/teaching staff?

Always ☐   Sometime ☐   Never ☐

5. Do your students translate ideas in textbooks/lectures into their own   language when communicating with each other/teaching staff?

Always ☐   sometime ☐   Never ☐

6. Are your students positively motivated towards using English for their studies?

Yes ☐   No ☐

Why? _____

7. Do you always communicate your ideas to students in the English language?

Yes ☐   No ☐

Why? _____

8. Do you think the syllabus as it is followed now is adequate for the Preparatory course students?

Yes ☐   No ☐   Somewhat ☐

9. What kind of change or changes do you envisage necessary in English teaching for the Preparatory students?

_____

10. What is the present status of the Department of English within your institution?

       i)   Autonomous (own established course of study)

       ii)   Service functions and research department. (linguistic study, material development, course design, curriculum development, remedial language unit)

11. Are you independent enough to introduce changes in the syllabus or classroom teaching?

Yes ☐   No ☐

12. Do you think that your credibility as an English teacher would be   lost/ damaged if you were seen to be participating in a science lecture for example?

Yes ☐   No ☐

13. Are you motivated to try new methods and techniques in English Language teaching?

Yes [ ]   No [ ]

14. How Committed are you to pursue ESP related teaching?

Fully [ ]   Partially [ ]   Somewhat [ ]

Section Two

Logistical

15. Will there be any increase in teaching staff to help with syllabus design materials writing etc?

Yes [ ]   No [ ]

16. Do you have adequate teaching equipment, e.g. tape-recorders, visual aids, language laboratory, textbooks?

Yes [ ]   No [ ]

17. Is it expected that you will solve the language teaching problems/lack of language teaching that exist at present?

Yes [ ]   No [ ]

18. Do you have sufficient resources to develop new ideas? (time, money, government/institute backing)

Yes [ ]   No [ ]

19. Do you have access to up-to-date information on the largest developments in the field of language teaching?

Yes [ ]   No [ ]

Drawbacks_____

Section Three

Administrative

20. How many staff would you have available to teach a language programme?

_____

21. Do you think it's enough?

Yes [ ]   No [ ]

22. About how many students would there be in one class?

_____

23. Do you envisage teaching specialist English to students from one subject discipline or from a mixture of subject disciplines?

One [ ]   Mixed [ ]

24. About how many hours per week would you consider a reasonable amount for specialist English?

_____

25. Do you envisage your language syllabus running concurrently with a subject syllabus?

Yes ☐   No ☐

26. If the answer to 25 is 'NO' does this mean that you intend to run a presessional language course?

Yes ☐   Don't know ☐

27. Over what period of time would your language course run?

_____

28. Will you have to implement new ideas for a language course immediately/for the next academic term/year?

(Tick any one)

Section Four
PSYCHO-PEDAGOGIC

We cannot assume that motivation and learning behavior of our students is constant, complete and neutral in determining needs.

"Good teaching is no guarantee of good learning; for it is what the learner does that makes him learn" (Mackay 1976).

29. Will your students see a special language course as fulfilling their needs?

Yes ☐   No ☐

30. Do your students understand the basic concept of science and technology in their own language before the start of their higher education course?

Yes ☐   No ☐

31. Do you think that your students would be expected to do in English what they would not be able to do in their native language? eg. read a subject text rapidly and take appropriate notes.

Yes ☐   No ☐

32. Do you envisage a conflict between the felt needs of your students (eg. The need for general language improvement/social English), and the needs felt by the institution (eg. English for Specific Purposes , English for Academic Purposes)

Yes ☐   No ☐

33. Do you think Grammar teaching/Remedial grammar teaching is necessary for the Preparatory course students?

Yes ☐   No ☐

34. What is the order of emphasis in teaching the four skills: Rank these:

Reading ☐   Writing ☐   Speaking ☐   Listening ☐

35. Do you agree that for the purposes of motivation, it may be a good thing to include some general/social English into the ESP course?

Yes ☐   No ☐

36. Would you agree that practice in one language skill, such as speaking can result in a corresponding improvement in reading comprehension?

Yes ☐   No ☐

37. Would your students expect to use authentic subject texts as materials for language practices?

Yes ☐   No ☐

Drawbacks_____

Methodological

38. Can you see how any of the factors in Section Four could affect you methodology?

Yes ☐   No ☐

    If YES, state briefly which factor and why?

_____

39. Do you think the teaching of ESP requires a special methodology?

Yes ☐   No ☐   Don't know ☐

5. Are you motivated enough to learn some of the scientific and technical knowledge that your student are learning?

Yes ☐   No ☐

40. Would you consider team-teaching with a subject lecturer a valid methodological approach to ESP?

Yes ☐   No ☐

41. Would you welcome an opportunity to discuss your approaches to ESP with the subject lecturer?

Yes ☐   No ☐

Drawbacks_____

<u>**Section Six**</u>

Course Design

42. Does your student need an English language course?

Yes ☐   No ☐

43. If the answer is YES in 43, what type of course?

    a. REMEDIAL ENGLISH to bring students to a required level of proficiency in general English. ☐

    b. LANGUAGE ENRICHMENT to introduce sub-technical lexical items; use English by drawing analogies from science and technology etc. ☐

    c. SPECIFIC ENGLISH to teach students how to read scientific text, discuss findings, interpret none linguistic data etc. ☐

    d. ACADEMIC ENGLISH to teach study skills using non-specific language texts. (tick the course that approximates to your wish.) ☐

44. Do you see your course as being a combination of any of the 4 mentioned above? If so, can you say why?

45. Within you course, do you envisage an emphasis on any particular language skill?

Reading ☐ Writing ☐ Speaking ☐ Listening ☐

Try to give these skills an order of importance if your answer is YES.

46. Will you have to write your own course materials?

Yes ☐ No ☐ Sometime ☐

47. Would you welcome the opportunity to discuss your course materials with a subject specialist?

Yes ☐ No ☐

48. Will you have to devise a system of testing your students' progress in a language course?

Yes ☐ No ☐

Section Seven

Teacher Expertise

49. Do you have a scientific/technological background?

Yes ☐ No ☐

50. Can you teach reading and writing skills?

Yes ☐ No ☐

51. Have you ever done any team-teaching?

Yes ☐ No ☐

52. Have you written specialist English course syllabuses before?

Yes ☐ No ☐

53. Do you understand how scientists/technologists write, speak, develop their ideas?

Yes ☐ No ☐

54. Do you have a theory of how learners learn language?

If YES state briefly what your theory is.

_____

_____

_____

Teacher's name: _____

Signature: _____

Writing Professional Discourse:

The Challenges Faced by Malaysian Engineers

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Biodata

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Abstract

In Malaysia, English is taught and used as a second language. Nevertheless, English has become a requirement for employment and career advancement. Mastering English requires mastering the spoken and written aspects of the language, and written linguistic competence requires grammatical and pragmatic competence to produce a cognitively understandable text. In the petroleum industry, written professional discourse plays an important role as a core element of the communication process. Yet written workplace literacy in the petroleum industry in Malaysia has yet to be explored and thus requires investigation, particularly since it is anticipated that there will be an increase in the demand for engineers in Malaysia in the near future. Thus, in the interests of making suggestions for curriculum design, research exploring the actual written communication of Malaysian petroleum workers is necessary to understand what professionals need in real work situations, and through such needs analysis teaching methods can be evaluated and revised. This paper presents the findings of an inquiry into the challenges faced by Malaysian engineers in the petroleum industry while preparing job-related written communication. Data were obtained through on-site observations at work sites during field visits and semi-structured interviews conducted with 8 engineers from 4 key companies in the local petroleum industry. Findings were triangulated between field notes, interviews, and textual analysis of official company documents called 'work procedures'. Results showed that engineers engage in daily written communication and competence in writing is a crucial requirement for the petroleum industry. The findings presented here may be useful to ESP course designers for petro-chemical engineering at higher learning institutions in Malaysia.

Keywords: professional discourse, workplace written literacy, petroleum industry, written communicative events, engineers.

1. Introduction

In Malaysia, English is taught and used as a second language and is a fundamental requirement for career advancement. As mastering English requires mastering the spoken and written aspects of the language, English for Specific Purposes (ESP) courses have been integrated into various curricula in the country.

In order to explore the effectiveness of ESP teaching practices in Malaysia, especially the teaching of ESP writing, it is necessary to first examine how written English is used in the prospective workplaces of students, such as in the petroleum industry. Yet written workplace literacy in the petroleum industry in Malaysia has yet to be explored and requires investigation. Thus, before curricular suggestions can be made, research exploring the actual written communication of Malaysian petroleum workers is necessary to understand what language learners will need in real work situations after completing their studies. Once a picture of the English petroleum workers' needs has been formed, this can inform pedagogy and syllabus planning.

This is a timely topic because the demand for engineers in various industries in Malaysia is expected to increase in the near future. The National Economic Action Council (MTEN) forecasted that by the end of 2010, Malaysia would need 210,000 engineers (Abang Abdullah Abang Ali, 2004). However, in 2005, it was reported that engineering graduates made up approximately 15% of the total unemployed graduates in Malaysia (Suresh, 2006). Thus there seems to be a mismatch between the demand for engineers and the current unemployment rate. This mismatch and the importance of written communication skills have been highlighted by studies conducted in various industries, including business (Leong, 2001), manufacturing (Ainol

Haryati Ibrahim, 1993; Hadina Habil, 2003), the chemical industry (Hafizoah Kassim and Fatimah Ali, 2010) and government service (Manvender, 2004).

According to Awang, et al (2006), one reason for the high rate of unemployment among engineering graduates is the disconnect between the curriculum requirements of higher learning institutions and industry needs, with the requirements of the industries not reflected in higher learning education. In the university, graduates are taught to write research papers and specific subject-related assignments, but these activities do not reflect the demands of on-the-job writing tasks. Thus a needs analysis is necessary to better understand the English use of professional engineers in Malaysia, which can then inform curricular change. This study is concerned with the local petroleum industry and is intended to inform ESP teaching at higher learning institutions in Malaysia.

In a keynote address during a Malaysian Employers' Federation (MEF) conference, Fong Chan Onn (Fong, 2004) stated the problem of skills mismatch is due to lack of coordination between the industry's projections of their human resource requirements and planning on the part of education providers in the country. This issue is also highlighted in a survey conducted by the MEF in 2010 as re-posted in a collection of daily archives:

Feedback from local and international employers shows that verbal and written communication skills in English remain the most sought-after attribute in prospective employees. According to a recent Malaysian Employers Federation (MEF) survey, English communication skills are the most important traits employers look for when recruiting graduates. The MEF Salary Survey for Executives 2010 revealed that 68% of the companies surveyed named communication skills as the top quality required in job applicants, followed by working

experience (67%), interpersonal skills (56.2%) and passion and commitment (55.7%). (The Universe of My Mind: April, 10th, 2011)

Shamsuddin Bardan, executive director of MEF, is quoted as saying "…globalization had changed the nature of jobs, making communication skills, specifically in English, a valuable asset to today's worker." Referring to the engineering context, he added, "…this was an essential criterion even for professions traditionally seen as 'backroom' staffs such as engineers, technical personnel and scientists" and that engineers are now, "a different breed from the past" (Hariati Azizan & Lee Yen Mun, 2011).

Similarly, Melissa Norman, the managing director of Kelly Services (M) Sdn Bhd, a top headhunting company in Malaysia, stated they encounter problems where local graduates are weak in spoken and written English and have limited vocabulary. She further explained that six out of ten graduates who attended their interviews could not communicate effectively in English (Hariati Azizan & Lee Yen Mun, 2011).

Thus the industry experience is that the English taught during school does not reflect the English required in industry. While industry executives note the importance of all four communication skills in Malaysia: speaking, writing, listening and reading, the focus of this study is to investigate written communication in the Malaysian petroleum engineering workplace, an important part of professional discourse.

English language communication needs have been explored globally. For example, in Thailand, Kaewpet (2009) investigated the communication needs of a group of Thai civil engineering students. In her study, Kaewpet interviewed 25 specialist informants comprising employers, civil engineers, lecturers and former civil engineering students to determine the extent of the communication needs of the students. The findings showed there is an increased

demand for learning professional English in engineering in Thailand and a need to increase the number of English courses taught on engineering programmes. However, Kaewpet's study emphasized the importance of all four communication skills and did not analyze the importance of each skill separately, the focus of the present study with respect to writing. The similarity of Kaewpet's study to this study is in terms of focus of investigation, the communication needs of engineers. Similar to Kaewpet's study, this study also used interviews to extract useful information related to the importance of English, focusing on written communication specifically rather than the general communication needs of engineers.

In Malaysia, a case study focused on written texts produced by trainee engineers assigned to shadow engineers in a Japanese multinational corporation involved in assembly of car audio (Anie Attan, 2009). Anie Attan identified nine types of written texts; Job Instruction Manual, Technician Report, End-of-shift Report, Memorandum, Trouble Countermeasure Report, Cause and Countermeasure Report, Rework Report, Production Instruction Manual and Technical Report.

Similarly, via field observation the present study highlights and tabulates the different types of written communicative events produced by engineers. An in-depth investigation of a specific written document is also undertaken to highlight the challenges faced by engineers while writing. Therefore written *Work Procedures*, which are generally prepared by engineers, were examined, similar to Manvender and Shamsudin (2009), who highlighted the challenges faced by Malaysian graduates in various business and management settings. Among their findings was the suggestion that the graduates faced difficulty in applying English language grammar rules to their daily workplace writing.

As it seems, the language taught does not correspond to the actual language needs of learners once they enter the workplace, this research explores the language needs of petroleum professionals through the following research questions:

(i) What are the written communicative events of engineers in the petroleum industry in Malaysia?

(ii) How important are the written communicative events to engineers in the petroleum industry in Malaysia?

(iii) What are the challenges faced by engineers when producing the written communicative events in the petroleum industry in Malaysia?

2. Literature review

Historically, written discourse is a relatively recent invention when compared to spoken discourse (Grabe and Kaplan, 1996). Unlike the spoken language which is coterminous with the history of humanity, written language has a documented history of little more than 6,000 years. Furthermore, while the spoken language is believed to have some biological origins, the same cannot be said of the written language, as written abilities are learned and not naturally acquired. In addition, writing is a technology, a set of skills which must be practiced and learned through experience (Grabe & Kaplan, 1996), which explains why students, especially from English as a foreign language settings such as in Malaysia, encounter problems when writing in real-life complex situations.

This study was conducted from an ESP perspective and is aimed at investigating written communicative events produced by engineers in the petroleum industry in Malaysia. For practical reasons, ESP has developed its own methodology relying on samples of authentic

language as it is used. The main concerns of ESP have been with needs analysis, text analysis and preparing learners to communicate effectively within their work contexts (Hutchinson and Waters, 1987; Strevens, 1988; Dudley-Evans and St. John, 1998). Relying mainly on Hutchinson and Waters' (1987), Strevens' (1988) and Robinson's (1991) definition of ESP, it would be safe to conclude that ESP is basically an approach for teaching English as defined through the following characteristics:

-        ESP is based on the learning needs of students;

-        ESP serves as a tool to teach specific subject-contents (for example: civil engineering, accountancy and law);

-        ESP has the characteristics of General English embedded in it to serve the acquisition of language systems, communicative skills and discourse knowledge;

-        ESP courses are time-framed;

-        ESP courses are designed for learners with similar learning objectives.

Many countries where English does not serve as a first language recognize the ultimate importance of the language as a core asset in international trade, political affairs and technological advancements. For example, most developments in science and technology are documented in English (Khairi Izwan Abdullah, 2002). However, it is insufficient to rely on an approach that focuses on the learners' needs for specific subject-based instruction in the academic setting alone. More has to be done by ESP practitioners. The gap has been highlighted (Leong, 2001; Manvender and Shamsudin, 2009; Shamsudin, 2008; Zubaidah Awang, et al., 2006) indicating a mismatch between what is being taught in university and what is required from learners in the workplace. At present, ESP teaching of written skills is based on

accomplishing tasks given according to academic requirements and learners applying what they are taught in the classroom, which may not reflect the requirements of industry. ESP experts and researchers have, in the past, acknowledged the importance of relying on authentic materials such as the actual written communicative events as produced in industry in order to develop accommodative models of language teaching in ESP teaching practice.

Bhatia (1994) suggests that it is not enough for ESP professionals to look at language trying to bridge the gap between language teaching and ESP professions; they need to make significant inroads in the world of professional life, especially in the form of relevant ESP research output. Johns (1993) emphasizes the need for local-based research particularly into the area of ESP teaching, and in response further research needs to be pursued. One solution to the lack of empirical evidence to inform ESP pedagogy may be target situation analysis (hereafter TSA) which identifies the needs of learners in specific targeted contexts. An important part of TSA is identifying and using specialist informants to provide information on the target community. According to Khairi Izwan Abdullah (2002), specialist informants are now used widely in TSA to explain how texts are used and produced by members of the discourse community so that ESP teachers can better prepare their learners to understand or produce authentic texts. As underpinning principles for this study, ESP and TSA were used to conduct an investigation into language use by engineers in a specific discourse setting.

3. Background of the discourse community

The development of Malaysia's industries is planned and implemented under the Industrial Master Plans (IMP). So far, the nation has developed its industry under two of the master plans, IMP1 and IMP2, each covering a period of 10 continuous years. The third Industrial Master Plan

(IMP3) is a 15-year plan and was implemented on 18 August 2006. This Master Plan maintains the petroleum industry as a major contributing component to the economy, in addition to the manufacturing industry and the service sector. As a major contributor to the Malaysian economy, the petroleum industry has under its hat a worldwide human capital of approximately 39,236 individuals, which forms its strong foundation of supporting services such as fabrication, refineries, construction, manufacturing and engineering (von der Mehden and Troner, 2007).

Asserting Malaysia's move towards a knowledge-based economy, Zubaidah Awang, et al. (2006) point out that Malaysia needs to develop human capital that is highly knowledgeable, highly skilled and has a positive mindset. It is believed such human capital would steer the nation toward a prospective developmental stage along with advancements in international investment. The Malaysian government envisions a fully developed nation by the end of 2020. The investment in the petroleum industry in Malaysia stood at Ringgit Malaysia (RM) 57.2 billion in 2008.

The petroleum industry is involved in the production of petroleum products, petrochemicals, and natural gas. The rapid expansion of the industry is mainly credited to the accessibility of oil and gas as feedstock, a strong foundation of supporting services, well-developed infrastructure, and the country's strategic location within ASEAN and its closeness to key markets in the Asia Pacific. Most petroleum companies work in association with Malaysia's national petroleum company, PETRONAS which stands for Petroliam Nasional Berhad (Reference for Business, 2012).

For the present study, four companies which are key players under the wings of PETRONAS were selected. These companies engage in integrated engineering and fabrication work for oil and gas production facilities and drilling rigs in Malaysia. The profiles of these

companies are shown in Table 1. The common corporate languages used in these companies are English and Bahasa Malaysia. The focus of the research was on the use of English and specifically on the written components of English in the workplace.

It was necessary to focus the study on one specific area as the overall operational activities of the selected companies are expansive. Upon gaining entry into the companies, the researcher selected a specific department, the Quality, Health, Safety and Environment (QHSE) Department. QHSE compliance in the petroleum industry falls under the principal Petroleum (Safety Measures) Act of 1984, the Occupational, Safety and Health Act (OSHA) of 1967 and the Environmental Quality Act of 1974, requiring *Work Procedures* to be prepared with an acceptable degree of quality and professionalism. The *Work Procedures* of the QHSE departments are prepared by specifically assigned engineers, who are given the task of creating and updating the procedures. The procedures are first drafted and discussed with senior and general managers before a final copy is prepared and numbered accordingly. Original copies of the procedures are kept in the QHSE departments while copies are circulated among employees at work sites.

Table 1: Profiles of the selected discourse community

Company	Location	No. of engineers	Core business	Track record (approx.)
Company A	Kuala Lumpur	8,100	Oil and gas production, fabrication, construction of pipelines, design and engineering, project management	37 years
Company B	Pasir Gudang, Johor	2,240	Fabrication and construction, offshore and onshore construction support services	25 years
Company C	Kemaman, Terengganu	540	Fabrication and construction, engineering, project management, procurement, maintenance	15 years
Company D	Lumut, Perak	1,400	Fabrication and construction, engineering, maintenance, hook-up commissioning, support services	11 years

4. Data collection and analysis

4.1 Participants

In order to gain reliable and informative feedback, purposive sampling (Neuman, 2000) was used to select eight engineers to be interviewed to investigate the preparation and execution of work in the QHSE department. As mentioned earlier, the *Work Procedures* are prepared and maintained by engineers from the QHSE departments of the companies. The selected participants have completed degree courses in various disciplines as offered in local higher learning institutions. Their degrees were not confined to petro-chemical engineering; two held degrees in business management, two were electrical engineering graduates and the other four participants had petro-chemical engineering backgrounds. At the time of the interviews the participants held engineering positions in the four main companies in the petroleum industry in Malaysia and had

between two to five years of working experience as engineers. Their employment in their companies at the time of the interviews was based on their prior experience in similar settings. The participants were four male and four female engineers, aged between 25 to 37 years old. The participants are expected to use English for writing and speaking, have been exposed to the language throughout their employment and are responsible for preparing *Work Procedures* in their respective QHSE departments.

4.2 Methodology

This study sought to investigate and highlight the challenges faced by engineers in the four selected petroleum companies. To get a clearer picture of the job functions of the engineers, it was important to observe the on-site work conducted by the engineers, especially work related to the preparation of the *Work Procedures* and implementation of the instructions in the *Work Procedures*. For each company written consent was solicited and strict confidentiality was assured. It was necessary to inform the gatekeepers that the study conducted was specifically for academic purposes and to convince them that the researcher was not a threat to the industry and ongoing work activities.

Observations were conducted for two weeks at each company through on-site field visits. The time allocated for each observation varied from 45 to 90 minutes. The observations were conducted concurrently with the semi-structured interviews. Notes of the observations were taken down. During the visits, twice the engineers were involved in briefing the content of the *Work Procedures* to the workers at job sites. This activity is known as the *tool-box meeting* and is conducted weekly. The researcher was present to observe this weekly activity at all the four

companies. The researcher had to rely on the engineers to arrange for a meeting when they were assigned to conduct these meetings.

In order to avoid any faulty inferences occurring from the time-constrained observations or due to personal postulation on the issue, it was necessary to directly consult and interview the engineers. The aim was to elicit reliable responses to the research questions, especially regarding the importance of the written component of English in their workplace. The time and the place of the semi-structured interviews were set by the respondents. The interviews were conducted in English. Recording was avoided as this might have disturbed those working in the area. Furthermore, the area where the weekly tool-box meetings are conducted is located in a yard where there is a lot of noise such as vehicles being driven in and out of the compounds. The observations and interviews were enhanced with a macro level text analysis. The researcher gathered 120 written *Work Procedures* (see Appendix A for an example); 30 from each of the QHSE department in the companies. In the QHSE department, the *Work Procedures* were compiled into folders and some were stored as softcopies in company computers. As requested the engineers provided printed copies of the *Work Procedures* for analysis.

4.3 Data analysis

Data analysis was conducted using both qualitative and quantitative techniques. The notes from the observations were analyzed according to the occurrences of general written communicative events and interaction between the engineers and the workers. Each location of the observation was identified via a code given according to observation at the individual companies; OA, OB, OC and OD (O stands for 'Observation' followed by the company code).

The responses from the interviews were transcribed manually and analyzed according to the occurrences of similar themes in the transcriptions. To avoid confusion of data and to ensure confidentiality, each respondent was given a specific code, for example; QHSE001A (department, respondent number followed by the company code). The individual codes given to the participants are shown in Table 2 below.

Table 2: Profiles of the participants for the interviews

COMPANY	CODING	AGE*	EXPERIENCE*	FIRST DEGREE**
A	QHSE001A	26	2	Business Management
	QHSE002A	30	3	Petro-chemical Engineering
B	QHSE003B	31	3	Petro-chemical Engineering
	QHSE004B	29	3	Business Management
C	QHSE005C	25	2	Electrical Engineering
	QHSE006C	30	4	Petro-chemical Engineering
D	QHSE007D	37	5	Petro-chemical Engineering
	QHSE008D	28	2	Electrical Engineering

*Age and experience are given in years.
**First degree refers to the degree of study taken by the participants in a tertiary course

The *Work Procedures* were coded using the format: DOCQHSE001A, (DOC for Work Procedures, QHSE refers to the specific department selected, the number of the document followed by the company's code). The macro level textual analysis was aimed at examining the documents for communicative purpose, content and layout of components.

5. Results and discussion

5.1 Findings from the observations

The observations provided some indication of the major written output produced by engineers as daily work requirements. The findings of the observations are categorized in Table 3. Written communication was tabulated according to internal and external execution of the documents.

Internal written communicative events are meant to be used as a communication tool between the internal higher management and lower sections of the companies while external written communicative events are used to communicate internal information to the shareholders and for external business purposes.

Table 3: Types of written communicative events produced by engineers

Type of written communication	The written output
Internal	inter-office memorandums, e-mails, work procedures/job instructions, employee manuals, standard operating procedures, meeting minutes, standing instructions, management reviews, data analyses, survey reports, training modules, counseling reports, corrective action plans, risk analysis reports, environments assessment reports (EA), document control procedures, etc.
External	e-mails, news/press release, newsletters, tender documents, procurement reports, project reports, risk assessment reports, business plans, market surveys, etc

Among the listed internal and external written communicative events, items such as e-mails, memos and inter-office memorandums are not confined to specific formal formats. These documents are written in simple formats with almost 80% of the words technical words. On the other hand, documents such as work procedures, instruction manuals, reports and business analyses are confined to specific formal formats, integrating technical words with directive English language use. These documents are highly informative towards specific job-related issues. All of the engineers stated that they are directly involved with preparation of the written work procedures used in their companies. Therefore, relying on the feedback received from the interviews with the engineers, for the purpose of text analysis it was decided to collect examples of the *Work Procedures* for analysis. During the observations, it was noticed that the *Work Procedures* are one of the most important documents in the QHSE departments, where they

function as guiding instruments for safe work practices. Every task in a yard has a specific *Work Procedure* which is to be read and followed strictly, thus they play an important role as guiding tools for the workers and are intended to allow work to be executed safely.

During the tool-box meetings, it was observed that the engineers emphasized the importance of executing work within the domain of the *Work Procedures* and advised workers not to ignore any part related to workplace safety as stated in the procedures. It was necessary for the engineers to communicate the content of the written documents so that the workers adhere to the written rules and regulations related to daily work in the companies' yards.

5.2 Findings from the semi-structured interviews

The responses from the semi-structured interviews were analyzed according to thematic analysis. Three main themes were identified. Each theme was further divided into sub-themes according to the construct of the interview questions. It was noticed that a single question asked tended to result in responses to a few themes and sub-themes. The responses from the semi-structured interview questions were then tabulated into the different themes shown in Table 4. The analysis provided evidence related to the written communicative events and the importance of the *Work Procedures*.

Table 4: Tabulation of the themes from the semi-structured interview questions

No.	Interview Questions	Theme
1	1. Do you use English at your workplace? How often? 2. As an engineer what job requires you to use the English language?	**Workplace English language requirement**
2	1. In your workplace do you use the English language to write? 2. In your workplace what are the documents that you write in English?	**Workplace written English language competence**
3	1. Do you face difficulties when writing in English? 2. What are the difficulties faced when you write using the English language?	**Difficulties faced while writing the written communicative events**

Data from the semi-structured interviews revealed that the engineers are required to master written English to accomplish their daily writing tasks. The following are some of the responses to individual themes:

5.2.1 Theme: Workplace English language requirement

Respondent QHSE008D:

"…yes, sometime I use English sometime I use Malay (pause) depend la with who I talk (pause) if boss then I use English if friend I use Malay (pause) every day we meet people who speak English so we also have to speak in English like (pause) with our boss the GM (General Manager) and the SM (Senior Manager) when they speak English we reply in English but sometime we use Bahasa to explain something like (pause) the welder pakai topi salah (the welder wears a wrong helmet) and the sign tak betul (the sign used is incorrect) it all depend on the situation actually…"

Respondent QHSE005C:

"…yes we use English every day when we work (pause) normally with our managers and clients (pause) you can see them here always (pause) English is important but sometimes we also speak in Malay no harm (pause) normally with bosses we use English but with friend or colleague we use Malay (pause) English is important we have to write a lot in English because (pause) half of our job is to write (pause) write emails every day write memos write reports and all …"

According to the responses related to the workplace English language requirement, all eight participants agreed English plays an important role in their daily job requirements, both spoken and written. The respondents further stated that they need to speak in English with higher level management and their clients who are mainly from abroad. These clients are generally expatriates working for the petroleum industry in Malaysia.

5.2.2 Theme: Workplace English language written competence

Respondent QHSE001A:

"…we have to use English language to write these reports (pause) there are also other things that we write, like procedures and instructions (pause) if speaking, we can use Bahasa Melayu (Malay language), but when writing we cannot write in Bahasa Melayu (Malay language) (pause) because our clients are all (pause) they are from (pause) mostly from oversea so (pause) as a QHSE engineer I always write in English…"

Respondent QHSE003B:

"…normally we use English in everything here (pause) we write in English and sometimes we have to speak in English (pause) you know the bosses are using English always (pause) yes

(pause) we write many type of documents in English like (pause) e-mails, memos and (pause)we write e-mails everyday (pause) like these report (pause) we write a lot of reports everyday (pause) we also have to prepare other documents like that procedure (pause) we prepare them for the general workers (pause) they just follow what we write..."

Respondent QHSE006C:

"…we have to be good in English otherwise the bosses will not understand our writings (pause) even though most of the written documents are edited many times (pause) we will try to write in good English (pause) but for your information what we write may be you cannot understand but our workers understand (normally) they don't have to read (pause) we explain to them it's our job to make sure they understand (pause) we write simple so when people read they don't get confuse (pause) that's why we must know how to write properly for example our reports (pause) they are very important for our clients (pause) other things like our procedures we write all in English not in Malay because they want it in English (pause) but we sometime use Malay to explain them to our workers (pause) they are not that good in English cannot understand many things so we have to translate…"

Respondent QHSE007D:

"…you see (pause) I have been working here more than 5 years (pause) yeah many of our clients are from overseas so you see (pause) they cannot understand Malay (pause) so we write in English it's very important (pause) the company want everything in English (pause) we must know English and how to write good English you are dealing with important people here (pause) I mean most of our customers are English speaking people so it's important…"

The responses obtained for workplace written English language competence showed the engineers have to be competent and have good writing skills while preparing written communication. However, further probing into difficulties faced while writing showed the engineers faced difficulties in areas such as problems with the structural knowledge of sentences and the correct use of grammar. The respondents highlighted that they face problems with the structural elements of the written texts and following the grammatical rules of English. Almost all of the respondents also stated that they prefer to avoid using long sentences when writing. According to the respondents, in order to achieve the main objective of their writing, they prefer to write short and straightforward sentences as they have to use and explain many technical words. Their main objective is to relay important information related to safe execution of work in the yards which every worker has to understand and comply with.

5.2.3 Theme: Difficulties faced while writing

Respondent QHSE001A:

"…sometimes we find it very difficult to write using bombastic words you know words that people who are really good will use (pause) we end up writing very simple English then (pause) but we don't really need to use bombastic words (pause) what is important is that we write clearly (pause) the problem normally is when it comes to writing long sentence with correct grammar and all (pause) at home you don't write much using English so when at work you have to write in English you will be scratching your head…"

Respondent QHSE004B:

"…yes sometimes we find it difficult to write proper sentence in English (pause) normally the problem will be with grammar (pause) the correct words to use and you know how to adjust your writing so that it will look nice (pause) spelling we can correct by using the function in the computer but we must know how to write properly (pause) we use a lot of technical words and the explanation is important…"

Respondent QHSE006C:

"…I have difficulty in writing correct English language sentence (pause) so normally I write in very simple English (pause) I use short sentence (pause) I don't like long sentence because (pause) then maybe I might write wrongly so (pause) I just explain with simple sentence…".

According to the responses received, the authors faced difficulties in writing longer and complex sentences. Most authors opt to use simple and direct sentences. The feedback elicited also shows that the respondents were having problems with vocabulary and grammar. Most sentences are written using technical words avoiding wider English language vocabulary use. However, all the respondents agreed that writing using correct and proper English is important as it reflects their ability to use the language, especially in a multinational company.

5.3 Findings from the text analysis

The *Work Procedures* written guidelines for various working practices at the companies and are a crucial measurement of QHSE compliance. The *Work Procedures* are prepared by safety engineers and are reviewed by the QHSE Senior Managers before being approved by the General Managers of the QHSE departments. The procedures are written to be referred to by the

employees of the companies as a guide for safe execution of their daily tasks, according to specific QHSE requirements. The *Work Procedures* outline the objectives, the scope, the responsibilities and the step-by-step instructions to be completed by employees. The procedures also define the related references and definitions according to the responsible QHSE accreditation bodies such as the National Institute of Occupational Safety and Health (NIOSH) and the Department of Occupational Safety and Health (DOSH).

The primary use of the written *Work Procedures* is to highlight safety measures related to critical work in the companies and to ensure those critical jobs are conducted in a safe and healthy manner and are performed by competent employees. In a particular department, there could be as many as ten different working stations on the yards, each assigned with different tasks, requiring specific steps for task execution. These tasks are all bound together with identical safety measures which are implemented through the *Work Procedures*. For instance, the *In House Scaffolding Training* is a procedure prepared for the safe execution of in-house scaffolding. The *Electrical Safety Procedures* outlines the necessary safety measures required during various activities involving work with electrical appliances. The *Safety Coordination Meeting on Board Vessel* outlines the QHSE precautions for vessels undergoing repairs.

The *Work Procedures* were analyzed for core components and content. They are prepared in a formal and uniform outline. Beginning with the objective or the purpose, the texts then outline the scope covered and the specific QHSE rules and regulations related to the procedures. A list of definitions is presented next, followed by the process flow or work instructions and responsibilities. Each of the sections outlined has between one to two sentences describing the individual section of the procedures. Appendix B presents samples of sentences used for the Objective, the Scope, References, Definitions, Responsibility and the Instructions sections of the

procedures. These samples of texts are part of the longer *Work Procedure* for the *Lifting and Hoisting Operations*. The written *Work Procedures* strictly follow similar outlines, employing a detailed and focused set of instructions for executing a task.

The writers aim to achieve the purpose of these procedures through direct instructions to the reader without allowing for any ambiguity in intended meaning, using an almost parallel style of writing. It is important for the reader to fully understand the text and be able to apply the given instructions accordingly. Failure to understand the instructions could lead to serious problems, including incorrect execution of the jobs described, which could lead to injury or damage to costly equipment. The writers of the *Work Procedures* are bound by their companies' communication systems that require direct and clear flow of communication among employees. The English used in the documents is simple and directive. The text seems to be communicating directly with the reader. Generally, the instructions are presented in point form, avoiding lengthy illustrations. The content is meant to be precise and direct, providing step-by-step guidelines of job procedures. The reader is assumed to have an understanding of the technical words used in the text as most of the sentences are integrated with technical words, for example;

DOCQHSE001A:

The monitoring parameter shall include but not limited to the following:-

i. Emission to the air (parameter, frequency and location)

ii. Discharge to the water (parameter- Standard B, frequency and location)

iii. Noise level (boundary noise;- specification: 65 db day time, 55 db night time)

iv. Indoor noise (noise mapping, frequency and location)

v. Scheduled wastes (inventory, reference to the Scheduled Wastes Management

Procedure)

vi. Reusable waste (inventory, reference to The Waste Management Procedure)

vii. Environment Objective, Target & Programme

DOCQHSE0069C:

3.2.3.1. Mechanical and Piping

* To hook-up and operate test equipment as per XXX approved test package procedure.

* Together with electrical and instrument commissioning team run main and auxiliary equipment in accordance with XXX approved test package procedure, record operating parameters required.

* Together with vendor and XXX representative perform crank test, start sequence test and shutdown test of Turbo-Compressor.

Further examination of the texts revealed the allocation of supporting documents in the form of appendices. However, these appendices were not provided for this analysis.

6. Discussion

The objective of the observations was to identify types of documents written by engineers. At present in Malaysia there are few investigations which highlight the precise written output produced by engineers in the petroleum industry. The findings provided data related to actual practice, in terms of written communication occurring at present in the petroleum industry in Malaysia. This empirical investigation may provide useful insights for the development of suitable ESP courses for petro-chemical engineering programs in higher learning institutions and also contribute to graduates' success at seeking employment in the petroleum industry.

6.1 Malaysian petroleum engineers' written communicative events

Many types of written communicative events occur daily in the petroleum industry where the engineers are required to produce various types of written documents which include project reports, e-mails, memos, job instruction manuals, operating procedures, training modules, surveys, management reviews and meeting minutes which are also used to link different managerial levels of the organizations. During the field trips it was observed that the engineers often engaged in written activities such as writing short notes to be expanded later in the office. Basically there are about sixteen internal and nine external written communicative events produced by the engineers in the petroleum industry in Malaysia as showed in Table 3. However, according to the respondents interviewed, not all of these written documents are produced daily as some of them are meant to be written and delivered to the higher management on a weekly or monthly basis.

The written documents identified in this study are quite similar to the ones identified by Anie Attan (2009). Unlike Hadina Habil's (2003) study of the written interaction form using electronic messages (emails), Anie Attan's study concentrated on analyzing the text in the Job Instruction Manual which plays a crucial role in guiding machine operators in the manufacturing industry. The text analysis was based on the type, content and form of the written communicative event. She showed how the writer actually achieves the purpose and negotiates the meaning of the written text. As over eighty percent of the line operators were Malays, "…all imperatives and content words were expressed in the Malay language to ensure that the actor fully understands the task that he has to fulfill" (Anie Attan, 2009). Similarly, the findings of the text analysis in Anie Attan's study (2009) suggested that the text confines the execution of job instructions to the

characteristics of the actors (operators), the expectations of the stakeholders (the firm) and the purpose and rules of negotiation.

In the present study, similar documents such as the instruction manuals, reports, memorandums and also the work procedures were produced. However, in Anie Attan's (2009) study, the written documents related to job execution and job functions were called *Job Instruction Manuals* while in this study the documents are *Work Procedures*. Although the documents are identified with different names, the overall function of the written documents is the same; guiding instruments for the lower ranking workforce of the companies. The text analysis in the present study demonstrated a high level of worker-superior dependency. The text reflects the amount of responsibility placed on the writer of the *Work Procedures*. The writer is authorized to direct and instruct the workers to safely perform a series of tasks. The writer has to be competent with the use of the technical language of the workers and be sensitive to the demands of the community and the organization, the participations, the stakeholders and the related rules of negotiations. It is also noticed that the written communication in these organizations seems to contribute greatly to the effectiveness of the QHSE Work Procedures. The safe execution of the work in the procedures is basically endorsed by the written texts prepared by the engineers and is carried out based on the merits of the written texts.

6.2 The challenges faced

As the aim of this study was to investigate and highlight the challenges faced by engineers in the petroleum industry in Malaysia. The findings highlight answers to the research questions, repeated below:

(i)   What are the written communicative events of engineers in the petroleum industry in Malaysia?

(ii)   How important are the written communicative events to engineers in the petroleum industry in Malaysia?

(iii)   What are the challenges faced by engineers when producing the written communicative events in the petroleum industry in Malaysia?

The semi-structured interviews provided information related to the importance of the written communicative events in the petroleum industry and the challenges faced while writing the communicative events. From the analysis, it can be concluded that the challenges faced by the engineers while writing include:

(i)   difficulties in constructing grammatically correct sentences

(ii)   using different styles of writing

(iii)   delivering the intended content in a written form

(iv)   writing long sentences in English

(v)   explaining technical words in English

In was noticed that to avoid the above difficulties, the engineers often opted for simple and direct sentences, using mostly simple English and technical words in their writing in order to avoid lengthy sentences. This was also supported by the text analysis where it was noted that most of the sentences were short, precise and constructed using mostly technical words.

Similarly, a study by Kaewpet (2009) also identified the use of simple English with technical and non-technical terms used in reports written by civil engineers.

The challenges faced by the engineers present implications for petro-chemical engineering course outlines. As an ESP guided course outline, petro-chemical engineering courses are designed to cater to the needs of future engineers in related fields where the knowledge acquired is applied directly to real world job requirements. The importance of written communication as highlighted in the present study reflects the teaching practice of petro-chemical engineering courses in higher learning institutions in Malaysia. However, it is insufficient to highlight students' need for written English in higher learning institutions; there is a need for those courses to reflect the English used in the prospective workplace. The challenges highlighted also indicate a need to look into the structural patterns being used by engineers so as to understand the ultimate foundation of the writing practice they use.

7. Conclusion and pedagogical implications

Currently in Malaysia, studies describing written communicative events are scarce and require further exploration, particularly in specific job-related fields such as engineering, accountancy, teaching and legislation. In order to explore the effectiveness of ESP teaching practices presently employed in Malaysia, especially the teaching of ESP writing, it is necessary to conduct studies involving authentic written texts produced in actual workplaces. Workplace use of written English is important since organizations are dealing with clients from abroad, so employees may be involved in writing English daily to communicate with clients from around the world. As suggested by the literature, there is evidence of incompatibility in terms of the relevance of ESP linguistic knowledge when applied to real work world demands.

Every genuine ESP course should be prepared based on the actual needs of learners. ESP course designers and language practitioners have attempted to determine learners' language needs as closely as possible to actual language use, using various methods of needs assessment. While assessment of learners' needs is complicated and often process-based (Johns and Price-Machada, 2001), the present study indicated written discourse is an important communication tool in the daily activity of the engineers involved in this research. The engineers were required to prepare different types of written communicative events and faced difficulty applying their knowledge of written English, especially in their underlying grammatical and structural knowledge of the language. Such insights could serve to inform future Malaysian ESP courses for engineers. However, how the written communicative events are linked to the competence of the engineers requires further analysis.

This study also showed the responsibility placed on the writers of the *Work Procedures*. The written texts function as the communicative voice of the engineers and are direct commands from the engineers to the general workers which must be followed exactly, indicating that in the petroleum industry, written communicative events play an important role in company communication processes, as the overall performance of QHSE departments depends on the engineers' writing.

Pedagogically, the findings in this study offer a fresh platform for the design of ESP courses, especially in the area of petro-chemical engineering. The job-related written output supports the existing comprehensible output hypothesis suggested by Swain (1985), requiring learners to be exposed to opportunities for pushed output which is very much situationally appropriate. The types and subtypes of the communicative events that emerged from the analysis may well be useful in creating authentic teaching materials for petro-chemical courses in

Malaysia. The existing gap between the present curriculum for engineering students and engineers' real-life language requirements needs to be closed. Teaching needs to be aligned to the industry's need for English language use. However, the present study is only limited to the petro-chemical setting in Malaysia and should not be generalized to other industrial settings and contexts.

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Appendix A

ENVIRONMENT PERFORMANCE MONITORING AND MEASUREMENT

TABLE OF CONTENT

7   APPENDICES   8

1 OBJECTIVE
The purpose of this procedure is to ensure that all the environmental management system and operation processes are correctly measured and monitored.

2 SCOPE
This procedure defines the actions, responsibility and interfaces involved in measuring and monitoring of key environmental management system and operation process performance.

3 REFERENCES
3.1 XXX HSE Management System Manual Doc. No.: HSE/000
3.2 MS ISO 14001: 2004 Clause 4.5.1

4 DEFINITIONS
4.1 DOE
The Department of Environment, Malaysia
4.2 HSE
Health, Safety and Environment.
4.3 Legal
The applicable HSE legislations and regulations related with XXX operations.
5 PROCESS FLOW RESPONSIBILITY ACTIVITY INTERFACE

6 PROCEDURE
6.1 Identification
* Identify key environmental performance indicator
6.2 Registration inside the Master list
* Register the key environmental performance indicator into Environmental Monitoring and Measurement Master List which consists of the following information
i. Number
ii. Type of monitoring and measurement
iii. Location
iv. Standard Value / guideline
v. Measurement
vi. Frequency (Where applicable, the frequency of monitoring is stated in the letter of approval from the government or authority)
vii. Internal / External body
viii. Remarks
6.3 Develop Environmental Monitoring and Measurement Schedule which consists of the following information;
  i. Number
ii. Type of monitoring and measurement
  iii. Month & year
  iv. Remarks
6.4 Appoint sub – contractor for monitoring activity

6.4.1 Engage licenced or approved sub-contractor to monitor the environment performance

6.4.2 The monitoring parameter shall include but not limited to the following:-

i. Emission to the air (parameter, frequency and location)

ii. Discharge to the water (parameter- Standard B, frequency and location)

iii. Noise level (boundary noise;- specification: 65 db day time, 55 db night time)

iv. Indoor noise (noise mapping, frequency and location)

v. Scheduled wastes (inventory, reference to the Scheduled Wastes Management Procedure)

vi. Reusable waste (inventory, reference to The Waste Management Procedure)

vii. Environment Objective, Target & Programme

6.5 Monitoring of the Environmental performance by the relevant division;

6.5.1 If the monitoring carried out by BU/SU, report shall be submitted to Executive, Environment for evaluation.

6.5.2 If the result of the monitoring does not comply with specification, BU/SU shall prepare the corrective action to ensure compliance of the requirements.

6.6 Monitoring and Evaluation of report

6.6.1 Executive, Environment shall monitor and evaluate the report then submit to GM, QHSE.

6.6.2 Executive, Environment and relevant division shall prepare the corrective action and improvement action, where necessary to ensure the compliance of environmental.

6.6.3 GM, QHSE shall evaluate the report given by sub-contractor and make necessary arrangement to do the corrective action or preventive action and improvement which area not complied with environmental regulations and legislation.

6.6.4 GM, QHSE and GM from relevant division shall present the data for Management Review.

7 APPENDICES

7.1 Monitoring and Measurement Master List

7.2 Monitoring and Measurement Schedule

* The above document has been edited in order to remove related information that may expose the organization's identity and secured information.

Appendix B

The Components in the Work Procedure of Lifting and Hoisting Operations

LIFTING AND HOISTING OPERATIONS

1. OBJECTIVE

The purpose of this procedure is to provide guideline for the safe lifting and hoisting operations and the use of Lifting Equipment.

2. SCOPE

2.1 This procedure is intended to cover all aspects of lifting and hoisting operation and the use of lifting equipment by AAA employees, sub-contractors, client and third parties associated with the company activities.

2.2 The operations apply to pedestal cranes, mobile cranes, crawler crane, overhead and gantry crane, level luffing cranes, jib crane, derrick, hoist, winches, hooks, slings, lifting point, mobile aerial platform, skid and pallet.

3. REFERENCES

3.1 Occupational Safety and Health Act 1994

3.2 Factories and Machineries (Notification Certificate of Fitness and Inspection) Regulations

3.3 Lifting and Hoisting HSE

3.4 International Association of Oil and Gas Procedures – Lifting and Hoisting Safety recommended practice

4. DEFINITIONS

4.1 Heavy Lift

Heavy lifts and lifting activities in excess of 50T

4.2 Lift Category

A categorization of lifting operations (routine and non-routine) reflecting the risk of lifting operation and the required level of control.

5. RESPONSIBILITY

5.1 The Senior Manager, HSE shall be responsible for implementation and maintenance of this work instruction

6. INSTRUCTIONS

6.1 Movement of Crawler Crane

6.2 Communications

* The above document has been edited in order to remove related information that may expose the organization's identity and secured information.

Moving Along General – Specific Purpose English Continuum in Assembling a Test: On the Dimensionality of an Admission Language Test for Accounting

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Abstract

Previous studies (e.g., Abedi, 1997) have confirmed the contribution of dimensionality assessment in ascertaining the internal structure of the test and making decisions concerning reporting the part-scores. The present study aims, first, to explore, the dimensionality structure of

an admission test in an ESP context in Iran when it is made up of both general and specific purpose components; and second, to calibrate the items with that model of item-ability parameters estimation which best constrains the items as to the dependency between items and dimensionality. This study has implications for assembling a joint general-specific purpose test in one module and scoring it meaningfully under a special Rasch multidimensional model and its constraints.

Keywords: English for specific purposes test; English for General-Specific Purposes; Rasch analysis; test dimensionality

1. Introduction

In so many areas and sub-areas of teaching / learning foreign languages, there has always been a debate over the generality or specificity of whatever is/are the theory/ies, purpose/s, approach/es or construct/s corresponding to those areas. In the area of teaching and learning of the academic texts, for example, two approaches can be distinguished (Sahragard, Rahimi, & Shams, 2009), one emphasizing common core (Clapham, 2001) and the other emphasizing subject specific materials (Hyland, 2002). In the area of language testing, a similar distinction between *common core* and *specific language* leads to the modularity of tests and hence great variations in the testing options available to the test takers. The distinction between IELTS academic and general module (EGP) tests, including IELTS general or the TOEFL whose objectives are not specific (Sahragard, Rahimi, & Shams, 2009), is the case in point.

However, is there any way for the test developers to transcend the boundaries between English general and specific purposes (ESP) tests where the modules were said to have overlapping components and lay along a same continuum (Dudley Evans & St John, 1998)? The

present study aims at investigating the dimensionality of a high-stake English language test with the assumption of measuring language achievement of the candidates in both general and specific purposes English in one module (details about the structure and scoring system of the test are presented in the next section). To this end, two consecutive phases ordered the progress of the present research, namely a dimensionality decision phase and a model recovery phase. The questions that guide the process of this research are as follows:

1a) Is there any constraint evident in test content classification regarding the

dimensionality-based partitioning of the EGP-ESP test items?

2a) Given multi-dimensional test data, does the multi-dimensional compensatory one-

parameter model fit the item response patterns of the concerned ESP test any

much better than the unidimensional model?

Answering the above questions provides some theoretical and empirical evidence as to the multidimensional nature of the joint EGP-ESP test in psychological and psychometric aspects and sets the ground for the second phase of the research which was designed to be a simulation study. Since data simulation is a statistical sampling procedure which, like an empirical investigation, must be conducted through making and testing hypothesis, the following research question must be answered and its follow-up hypothesis (H) must be tested empirically:

1b) What is the effect of considering constrained higher dimensional models of

IRT as opposed to the unconstrained multidimensional models on the estimate

of person and item parameters in the EGP-ESP test?

H1) Models which consider secondary abilities tapped along with the primary

abilities in bundling of the items without any constraints as the dependency of

the items generate item and person parameters which best match the real item

and person parameters.

H2) Models which consider local item dependency in sub-dimensions as well as

the correlation between sub-dimensions of the test as a constraint generate

item and person parameters which best match the real item and person

parameters.

2. Background of the study

In many testing situations, there is no exact correspondence between the dimensions of the test

and the structure of its item clusters. In most of the cases, as described by Gierl, Leighton, and

Tan (2006), when the data are unidimensional, clusters of items will be found that are not

homogeneous (measuring a single trait). On the other hand, there is a controversy over

measuring different latent abilities in two or more independent tests or the development of a

single test with a composite structure (with each item set measuring more than one latent ability)

for tapping those abilities (Torre & Patz, 2002; Johnson & Carlson, 1994). A number of empirical

investigations have been conducted which showed that the estimation method for the correlated

abilities yields more efficient results when it is based on the simple structure than composite

structure items (ibid).

In the education system in Iran, the entrance exam for the admission of prospective

students into post graduate programs is a battery of about 8 different subtests (one English

subtest and 4 to 7 knowledge subtests of different content courses) where the raw scores of individual subtests are averaged to form an overall test battery mean score and participants are ranked based on a composite percentile. As to the language subtest, after experiencing several years of upgrading, our test developers in Iran have finally reached a fixed framework for the language subtest. For almost all of the fields, this subtest consists of two parts: general English and specialized English. The first part starts with 10 vocabulary test items and continues with a cloze test of grammar with a text of non specialized content. The specialized part is composed of 2 field- specific reading test-lets, each with about 5 multiple choice (dichotomously scored) items. Regarding the fact that these two parts have been examined in two independent tests for the counterpart exam for entering the PhD program, it would be of no surprise, if one catches the very challenge by asking the following questions: does such a domain involve a single multidimensional construct or multiple constructs that are correlated? The present study aims at detecting whether items assembled in one subset in such complex tests contribute only to a simple structure or to a complex one and whether through some modifications in item assembly sub-layer of test architecture, the upgraded item-sets could represent the true dimensionality of the test, and hence meaningful part-scores for each set.

3. Methodology

The present study first explores the dimensionality structure of an admission test in an ESP context in Iran. The test comprises both EGP and ESP components. It then calibrates the items with that model of item-ability parameters estimation which best constrains the items as to the dependency between items and dimensionality. To these ends, the design of this study follows a two-phase procedure, as described below.

3.1 Participants

Test content analysts

Three groups of EFL teachers were selected to analyze the content of the operational version of the test in one of its recently administered versions. They were sampled from among a number of teachers at Isfahan University and Isfahan University of Technology based on their availability at the time of conducting this project. One group were PhD candidates of TEFL (n=4) with about two to three years of EFL classroom experience who had already passed some special courses both in language assessment and ESP. A second group consisted of 2 assistant professors in TEFL who had been teaching language assessment on average for 5 years and a third group was made up of EGP (n=4) and ESP (n=2) teachers. Table 1 shows the teacher participants background and experience by group.

Table1: Teacher participants training and teaching background

Groups	Experience Details		
	EFL teaching	*Assessment –related Teaching or training*	*ESP –related Teaching or training*
G1. PhD candidate in TEFL (n=4)	2 to 3 years	Three semesters training in language testing	Two semesters training in ESP
G2. Assistant Professors (n=2)	About 8 years	On average for 5 years teaching experience in language assessment	Two semesters training in ESP
G3. EGP / ESP teachers (n=6)	About 8 years	Three semesters training in language assessment	On average for 6 years ESP/EGP teaching experience

3.2 Dataset

3.2.1 Exploratory sample

For the first phase of the study, the dataset contains the real data obtained from the administration of 2010 operational items of accounting MA entrance exam language subtest for a group of accounting students (N=100; 67% female and 33% male). About 59% of the respondents were passing the last year of their BA programme of study in Payam e Noor University and the rest of them were from Isfahan University of Technology and Mahan Institute. This field of study was selected due to its popularity among the MA candidates in the Humanities.

3.2.2 Calibration sample

For the second phase, since real data analysis cannot provide an actual generating value of the parameters (due to the removal of misfitting items from estimation), the study continued with a constrained simulation design. To do this, item responses from 1000 simulees to the 30 items were generated by a ConQuest simulate command file whereby item parameters were generated with the Uniform distribution of (-2 : 2) and person parameters were simulated on a multivariate normal distribution of a given mean and variance matrix.

3.3 Instruments

In addition to the 2010 version of the operational MA entrance exam (Appendix A), statistical software was used in this study, as described below.

Acer ConQuest

There are many computer programs for modeling item and ability parameters under different testing conditions. In multidimensional tests, however, there are some situations where dimensions measured in the test have a non-zero correlation and items in one dimension provide

information about the other dimensions (collateral information). On the other hand, not all the models account for the local item dependence between items in one sub-dimension.

ConQuest (Wu, Adams & Wilson, 1998) is one of the unique software which has as many different settings as there are psychometric constraints on the items in the test. The multidimensional random coefficients multinomial logit model (MRCMLM) which ConQuest can be fitted for enables the software to be set for the Rasch Sub-dimension model. Monte Carlo Sampler also adds to the program's utilities by augmenting the data obtained from any number of correlated sub-dimensions. Last but not least is the possibility of setting the program for within item multidimensionality, the capability which makes the software unique.

In this study, ConQuest was used for its two utilities: first, generating the initial value of the parameters and the required design matrix which, then, were imported into software for the simulation purpose, and second, calibrating the items to the proposed Rasch models and estimating and evaluating their fit indices.

4. Procedure and analyses

4.1 Exploratory phase

In the very first step one should explore whether the covariance structure of the dataset is appropriate for unidimensional solution or rather, some violation of unidimensionality assumptions occurred which made the test data fit more closely to the multidimensional models. Of course, dimensionality and test structure assessment are both senseless without theoretical grounds concerning the construct. The first phase of the present study, therefore, was designed to proceed along both substantive and statistical levels of analysis. To this end, content analysis was

selected for the substantive level and the model fit evaluation procedure with a changing dimensional solution was considered for the empirical/statistical level of analysis.

Content analysis of the test items, at the beginning, was conducted as an attempt to make the plausible hypothesis regarding the actual dimensionality of the concerned test. It was considered substantive to the extent that at the end of this stage, identified dimensions could be actually interpretable and a testable hypothesis could be made regarding the composition of the items or item bundles and the nature of dimensions in each of them. The procedure is as follows:

Participants were given worksheets on which they analyzed the items in different sets. The only tools used by the participants in their item analysis were Nation's (2001, 2003) Vocabulary-Profiler for determining the frequencies of words in vocabulary item sets, Purpura's (2004) coding scheme for grammar subsection, Weir et al.'s (2000) parameters of English for Academic purposes (EAP) reading, and Brown's (1988) item types for specialized and general reading test-lets. The results of the analysis are presented in Tables 2 to 5 for different sub-components of the joint EGP/ESP test in 2010.

Table 2: Frequency analysis of the words selected as the options in the subtest of General vocabulary Knowledge administered in 2010 for accounting field of Study

Year / *field* / *frequency*	**2010**
	Accounting
1st-1000 words	7.5 %
2nd -1000 words	5%
Academic Vocab	30%
*Off-list Vocab	57.5%

*Off-list vocabulary refers to the technical or subject specific words.

It is clear from Table 2 that in 2010, this was the technical vocabulary knowledge of different ranges (Read, 2000) which was mostly tapped by the items.

Table 3: Average percentage of teacher participants' allocation of the items in cloze Sub- section to the components of grammatical knowledge based on Purpura's (2004) model

Year *------* *field* *components*	2010
	Accounting
Lexical form (LFORM)	% 60
Lexical meaning (LMEAN)	----------
Morphosyntactic form (MSFORM)	% 40
Cohesive form (CFORM)	% 40
Cohesive meaning (CMEAN)	% 40

As shown in Table 2, one interesting issue was that the percentages reported in the cells add up to more than 100%. This was explained by the participants as an indication of the items in the cloze subsection which measure more than one component at the same time.

For analyzing the specialized reading test-lets, at first, participants rated the passages (abbreviated as P1 and P2) on the scheme of textual parameters developed by Khalifa and Weir (2009). The results of this analysis were reported in Table 4 below.

Table 4: Qualitative and Quantitative features of the texts selected as the stimulus in specialized reading test-lets

Field / Textual Features		AC	
		P1	**P2**
Grammatical	*Length (No. of words)*	261	274
	Vocabulary (lexical density)	0.63	0.59
	Readability (Flesch Reading Ease)	5.0	25.5
Discourse	*Genre*	Exposition News Art	Exposition Textbook
	Rhetorical task		
Content	*Subject area*	Ac	Ac
	Subject specificity — *% AWL words*	15.15	13.28
	% off-list words	15.53	7.75

After this initial analysis, participants in different groups were asked to analyze the test-let items separately in terms of the skills and strategies they tapped. For this part, Weir et al.'s (2000) parameters of EAP reading were used as a framework. However, as the results of a pilot study showed that the participants may have had difficulty in reaching a consensus regarding Weir et al.'s categories, a modified version was used in the main study in which Weir's Explicitly Stated Main Idea (EXMI) was replaced by Kim's (2009) Reading for Literal Meaning; Weir's

Syntax component was replaced by Rhetorical Function (Brown, 1988); and Weir's Inferring Lexical Meaning category was distinguished into sub-technical and technical vocabulary. Table 5 presents the modified version. Each cell of this table shows the number of items which tapped a special skill or strategy in two stimulus passages (abbreviated as P1 and P2).

Table 5: Pattern of assembling of the item types in different test-lets as marked by the participants

Field / Item Type		Accounting	
		P1	P2
Scanning			
Skimming for the main idea		/	/
Understanding Factual information/literal meaning		////	///
Vocabulary	Sub-technical	//	/
	technical	/	
Inference	propositional	/	/
	pragmatic		
Rhetorical Functions			
Total		9	6

In the next stage, for the actual dimensional structure to be more meaningfully represented, two checklists were developed and given to the participants. The items were coded in different categories based on the ability dimensions they tapped. Tables 6 and 7 show the categorization of each item which is based on the coding of that item in that category counting to more than 80% of the participants (remaining 20% coding in other categories were ignored).

Table 6: Participants' coding of the items in different categories based on the ability they tapped.

| Items | English for Accounting | | | |
| | Linguistic Factors | Content Factors | | |
		Field related	Other fields	Common-core
1			√	
2		√		
3			√	
4			√	
5		√		
6		√		
7			√	
8			√	
9		√		
10			√	
11	√			
12	√			
13	√			
14	√			
15	√			
16		√		
17		√		
18		√		
19		√		
20		√		
21		√		
22	√			
23				√
24				√
25		√		
26	√			
27		√		
28		√		
29	√			
30				√

Table 7: Participants' cross joining of the items across categories

Test Subsections		English for Accounting					
		*(GE)		EGAP		ESAP	
		structure	vocabulary	vocabulary	reading	vocabulary	reading
GE	Structure				16,17,18,19,20		22,29
	Vocabulary						
EGAP	Vocabulary				1,5,6		19,23,24,26,30
	Reading						
ESAP	Vocabulary				2,3,4,7,8,9, 10		
	Reading					16,17,18,20,21, 25, 27,28	

* Note: GE stands for General English
EGAP stands for English for General Academic Purposes
ESAP stands for English for Specific Academic Purposes

Table 7 shows that item responses in this version of the test can be characterized in a multidimensional manner (Ackerman, 1992; Roussos & Stout, 1996a; Shealy & Stout, 1993). However, in order to find out whether a substantively multidimensional test is also statistically multidimensional, the real data obtained from the administration of MA exams in the accounting field of study were submitted to ConQuest for dimensionality detection. To minimize the effect

of guessing and missing data on the precision of the estimation, during the administration session, participants were asked not to leave any of the items unanswered. They were also informed of being penalized for their wrong answers. Appendix B shows the results of the ConQuest analysis for testing the unidimensionality and two aspects of dimensionality of the real data sets. The criteria used for assessing the model-data-fit are Type I error rate, Infit and Outfit mean square (called also weighted and unweighted fit indices) and *t*-statistic. Type I error of the fit statistics indicates the number of items (persons) falling outside the selected critical values to screen misfitting items (persons). The critical values to calculate Type I error rate were 1±0.2 for a mean square fit and ±2 for a t statistic fit (see ACER ConQuest Manual); in other words, if the MNSQ fit statistic lies outside the confidence interval for its expected value (which under the null hypothesis is 1.0), then the null hypothesis that the data conforms to the model can be rejected. If the MNSQ fit statistic lies outside the interval, then the corresponding *t*-statistics will have an absolute value that exceeds 2.0. For careful analysis, the chi-square and deviance statistics for different models are presented in Table 8 and compared by year and by fields of study.

Having in mind the critical values of MNSQ and *t*-statistics, as shown in Appendix B, the Rasch simple logistic model did not fit the data. To be more exact, half of the items in accounting 2010 showed Outfit MNSQ t >2 and about one third of them showed Infit MNSQ t > 2. The results also suggested that the Rasch two-dimensional model in which dimensions of the test matched the actual partitioning of the test into EGP and ESP components did not again fit the data. As to degree of deviance and chi-square, Table 8 summarizes the results of analysis reported in Appendix B, as follows:

Table 8: Rasch unidimensional and 2-dimensional fit indices for accounting ESP test, 2010 version

	1 Dimensional	2 Dimensional
2010		
Chi square	624.32 (df=24)	481.37(df=25)
Deviance	2296.20	2280.95

As shown in Table 8, although the amount of deviance reported for 1 dimensional and 2 dimensional solutions are not significantly different from each other, the reading of about twice higher for chi-square indices in 1 dimensional cells shows that the fit of 1 dimensional models is worse than the fit of 2 dimensional model. It follows that the hypothesis that unidimensional model fits these data as well as the two-dimensional model could be rejected.

4.2 Calibration phase

Model and Parameters Recovery for higher-dimensional solutions

As it became clear in the exploratory phase, the test which has been currently administered for the admission of the candidates into Master Degree course of study was neither unidimensional nor 2 dimensional in its underlying traits. So any calibration procedure must be designed in a higher dimensional structure, in this case, 3 dimensional solutions.

To test the two hypotheses (H1 and H2), two types of dimensional configurations were designed as the framework for Monte Carlo simulation phase of the study: one, in which items were bundled differently according to the participants' cross joining of the abilities tested in different sections without taking into account the existed test-let effects or local item dependency between items, and, second, a configuration with the local item dependency and inter correlated sub-dimensions as a constraint. Table 9 is a summary of the proposed configurations. Note that Abbreviations of D and C in this table stand for Dimension and Configuration respectively.

Table 9: Summary of the multidimensional IRT test structure for accounting field of study, 2010 version.

| Test Subsections | English for Accounting | | | |
	3D C1 C2 C3			*3DC4* Subdimension model
General English (GE)				
•*Structure*	1	1	1	1,2
•*Vocabulary*	1	1	1	1,2
English for General Academic Purposes (EGAP)				
•*Vocabulary*	2	3	2	1,2
•*Reading*	2	2	1	1,2
English for Specific Academic Purposes (ESAP)				
•*Vocabulary*	3	3	3	1,3
•*Reading*	3	3	3	1,3
				1,2,3

In 3DC1, the first dimension is measured by the second test-let plus common core items, second bundle comprises items measuring linguistic factors, and the last dimension is measured in remaining items. In 3DC2, ESAP components measure EGAP vocabulary, so item bundles are 1) items which measure linguistic factors, 2) common core items +vocabulary subsection items, and 3) remaining items. Configuration 3 in 3D assemble items in the bundles in a way that EGAP reading component measures also the structure and vocabulary of GE; in 3DC3, therefore, common core items plus items number 22, 26, and 30 comprise the first bundle, cloze items are bundled as a distinct dimension; and items measuring content factors comprise the third bundle.

Unlike 3D configurations where neither the local item dependency nor the correlation between dimensions was considered, 3DC4 configuration, following what Brandt (2007a, 2008) proposed in his Rasch sub-dimension model, accounts for both of the above mentioned constraints by, firstly, making all the items in different components load on one common general factor, i.e. English for accounting, and secondly, allowing a space for each "sub-dimension specific factor", i.e. GE, EGAP, or ESAP, to be estimated in correlation with other sub-dimension factors in the test (ibid).

4.3 Evaluating Cluster Solutions

To evaluate the various MIRT structures, the parameter estimates and data-model fit of the different MIRT solutions were compared to each other. however, because of the existence of over and underfitting items in real data set and automatic removal of these parameters from ConQuest analysis, observed items and ability distribution of real data set could not be relied on any more for designing the simulation study, and in the calibration phase, and therefore, the study should continue with the prior distribution parametrization which was constrained by the researcher. Designing a constrained simulation as opposed to the close simulation has another advantage of minimizing the contaminating effect of the "expected" noise in the real data (Curtis, 2004). A sample of the ConQuest syntax for generating 3-dimensional item response datasets of 1000 simulees answering 30 multiple choice questions are presented below. Note that for each configuration, a new data set was generated so that the number of items in each item-to-dimension bundling matched the number of items in the original test already suggested by the content analysts for that configuration.

simulate !nitems=15:9:6, npersons=1000, maxscore=1,

itemdist=uniform(-2:2), abilitydist=mvnormal(0.5:1:1:1:0:1:0:-0.7:0.8),

method=montecarlo, nodes=2000;

According to Brandt (2007, 2008) ConQuest offers five different ways of defining or constraining a specific model within the MRCMLM:

1. Through the definition of the design matrix, which describes the linear relationship among the items;

2. Through the definition of a scoring matrix, which assigns the items to specific ability dimensions and assigns scores to their response categories;

3. Through the anchoring of the item-difficulty parameters, which can be used not only for linking to other tests but also for identification purposes;

4. Through specification of mean abilities for the population distribution (within ConQuest denoted as regression parameters); and

5. Through anchoring of the variance–covariance matrix.

For the purpose of the present study, with the exception of 3DC4 (sub-dimension model) where some additional model constraints were applied, the scoring matrix was used for defining different item-to-dimension solutions. Appendix C shows the results obtained from ConQuest analysis for each solution. For this stage, the deviance statistics of alternative models were compared to provide a formal statistical test of the relative fit of models. Table 10 shows the deviance statistics of different configurations and the differences between them, as follows:

Table 10: Comparison of the deviance statistics in different model configurations

	Deviance	**Difference**
3DC2	35600.27	
3DC1	35528.04	72.23
3DC3	34818.36	709.68
3DC4 (sub-dimension model)	33557.92	1260.44

Table 10 shows that the degree of improvement of the deviance between different configurations increases moving from 3DC2 to 3DC4, with the most significant one reported between 3DC3 and sub-dimension model 3DC4. It can, therefore, be concluded that among 3D solutions, 3DC4 introduces the best item-to-dimension configuration for optimizing the joint EGP-ESP test both substantively and statistically.

5. Results

Research question 1a showed the evidence of multiplicity of objectives in this version of ESP operational test. With a closer look, however, a kind of incongruence was observed between items and the objectives which they were meant to test, but this incongruence was revealed to be a construct-relevant multidimensionality with some of the constructs acting as primary traits and some others as ancillary to those primary traits. Inter-items dependency constraint also characterized about half of the items in the test where items were assembled in the test-let based clusters.

Given multidimensional data, question 2a sought to explore the statistical dimensionality of the tests. The fit of two models, i.e. unidimensional and 2- dimensional, was investigated at the item level by considering the patterns of misfit in items and at the overall level on deviance using chi-square test. *T*-statistics and MNSQ indices indicated that neither the unidimensional nor 2-dimensional model could fit the test data at the item level. At the overall level, a chi-square test was applied to compare the deviance yielded by the two analyses (Table 8). Although the difference in the deviance statistics was not so significant but the 2-dimensional model with a lower deviance and higher degrees of freedom ($p<0.01$) showed better fit to the data than the unidimensional model.

Addressing two research hypotheses in the second phase which were made on the basis of the results of exploratory phase of the study, four 3-dimensional configurations (see Table 9) were suggested as the map for cross-joining the items relevant to the dimensions they tapped. In Appendix C, the results of ConQuest Multidimensional Rasch analysis were reported for each configuration; a comparison was also made between the deviance statistics of each model in recovering true item ability parameters which was summarized and reported in Table 10. In that section, the criterion which was used for evaluating the precision of model was the observed deviance statistics which, in this case, significantly had improved for 3DC4 comparing with other 3D solutions. For the exact differentiation of the proposed configurations and the evaluation of the significance of their effects on the ability estimation of individuals in each dimension, however, a Multivariate Analyses of Variance (MANOVA) was conducted to address the two research hypotheses H1 and H2, as follows:

5.1 Multivariate ANOVA to Test the Effect of Different Calibration Models on the Ability Estimation

To test the research hypothesis on the effects of the constrained model of IRT on the correlation between sub-dimensions and local item dependency within each dimension, as opposed to unconstrained multidimensional models, a Multivariate ANOVA was conducted with four configurations of 3DC1 (abbreviated as *Config*1) to 3DC4 (abbreviated as *Config4*) as grouping variables and different dimensions of ability estimation (D1-D3) as dependent variables. Box's M test shows that with F (18, 5.64)=1041.49 and *p*=0.000, the covariance matrix of the dependent variables have been nearly similar, and so the MANOVA can continue with the table of multivariate test.

Table 11: Box's Test of Equality of Covariance Matrices[a]

Box's M	18772.297
F	1041.491
df1	18
df2	5.643E7
Sig.	.000

Tests the null hypothesis that the observed covariance matrices of the dependent variables are equal across groups.
a. Design: Intercept + grouping

To find out whether the effects of different configurations on the ability estimates have been significant or not, the results of F test (F (9, 9720) = 29.27, *p*< 0.0005, effect size = 0.02) are reported in Table 12:

Table 12: Multivariate Tests[d]

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[b]
Intercept	Pillai's Trace	.022	29.545[a]	3.000	3994.000	.000	.022	88.634	1.000
	Wilks' Lambda	.978	29.545[a]	3.000	3994.000	.000	.022	88.634	1.000
	Hotelling's Trace	.022	29.545[a]	3.000	3994.000	.000	.022	88.634	1.000
	Roy's Largest Root	.022	29.545[a]	3.000	3994.000	.000	.022	88.634	1.000
grouping	Pillai's Trace	.063	28.578	9.000	11988.000	.000	.021	257.204	1.000
	Wilks' Lambda	.937	29.274	9.000	9720.497	.000	.021	213.192	1.000
	Hotelling's Trace	.067	29.834	9.000	11978.000	.000	.022	268.504	1.000
	Roy's Largest Root	.067	89.557[c]	3.000	3996.000	.000	.063	268.672	1.000

a. Exact statistic

b. Computed using alpha = .05

c. The statistic is an upper bound on F that yields a lower bound on the significance level.

d. Design: Intercept + grouping

Wilks' Lambada statistics presented in Table 12 show that the effects of different independent variables (Config1-Config4) on the dependent variables (D1-D3) are significant, with each independent variable accounting for 0.02 of the total variance. To identify similarities and differences between the reported effects of different configurations, the multiple comparisons give the mean differences of the dependent variables as well as the significance of this difference for each dependent variable (see Table 13). Asterisks are printed next to differences which are significant at the 0.05 level or better.

Table 13: Pair-wise Comparisons

Dependent Variable	(I) grouping	(J) grouping	Mean Difference (I-J)	Std. Error	Sig.[a]	95% Confidence Interval for Difference[a]	
						Lower Bound	Upper Bound
D3	Config1	Config2	.002	.021	.925	-.040	.044
		Config3	-.002	.021	.942	-.043	.040
		Config4	-.049*	.021	.022	-.091	-.007
	Config2	Config1	-.002	.021	.925	-.044	.040
		Config3	-.004	.021	.868	-.045	.038
		Config4	-.051*	.021	.017	-.093	-.009
	Config3	Config1	.002	.021	.942	-.040	.043
		Config2	.004	.021	.868	-.038	.045
		Config4	-.047*	.021	.026	-.089	-.006
	Config4	Config1	.049*	.021	.022	.007	.091
		Config2	.051*	.021	.017	.009	.093
		Config3	.047*	.021	.026	.006	.089
D1	Config1	Config2	9.191E-5	.033	.998	-.064	.064
		Config3	-.005	.033	.885	-.069	.060
		Config4	-.225*	.033	.000	-.289	-.160
	Config2	Config1	-9.191E-5	.033	.998	-.064	.064
		Config3	-.005	.033	.882	-.069	.060
		Config4	-.225*	.033	.000	-.289	-.160
	Config3	Config1	.005	.033	.885	-.060	.069
		Config2	.005	.033	.882	-.060	.069
		Config4	-.220*	.033	.000	-.284	-.156
	Config4	Config1	.225*	.033	.000	.160	.289
		Config2	.225*	.033	.000	.160	.289
		Config3	.220*	.033	.000	.156	.284
D2	Config1	Config2	.000	.028	.991	-.055	.055
		Config3	-.003	.028	.904	-.058	.052
		Config4	.103*	.028	.000	.048	.158
	Config2	Config1	.000	.028	.991	-.055	.055
		Config3	-.003	.028	.912	-.058	.052
		Config4	.103*	.028	.000	.048	.158
	Config3	Config1	.003	.028	.904	-.052	.058

	Config2	.003	.028	.912	-.052	.058
	Config4	.107*	.028	.000	.052	.162
Config4	Config1	-.103*	.028	.000	-.158	-.048
	Config2	-.103*	.028	.000	-.158	-.048
	Config3	-.107*	.028	.000	-.162	-.052

Based on estimated marginal means

a. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

*. The mean difference is significant at the .05 level.

Quite consistent with the reported results in the previous section, in all of the categories of dependent variables, the effect of configuration 4 has been more significant than other three configurations. Scheffe Post hoc test shows the same results.

Table 14: Multiple Comparisons

Dependent Variable		(I) grouping	(J) grouping	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
							Lower Bound	Upper Bound
D1	Tukey HSD	C1	C2	.0001	.03284	1.000	-.0843	.0845
			C3	-.0048	.03284	.999	-.0892	.0796
			c4	-.2247*	.03284	.000	-.3091	-.1403
		C2	C1	.0000	.03284	1.000	-.0845	.0843
			C3	-.0049	.03284	.999	-.0893	.0796
			c4	-.2248*	.03284	.000	-.3092	-.1404
		C3	C1	.0048	.03284	.999	-.0796	.0892
			C2	.0049	.03284	.999	-.0796	.0893
			c4	-.2200*	.03284	.000	-.3044	-.1356
		c4	C1	.2247*	.03284	.000	.1403	.3091
			C2	.2248*	.03284	.000	.1404	.3092
			C3	.2200*	.03284	.000	.1356	.3044
	Scheffe	C1	C2	.0001	.03284	1.000	-.0918	.0919
			C3	-.0048	.03284	.999	-.0966	.0871
			c4	-.2247*	.03284	.000	-.3166	-.1329
		C2	C1	.0000	.03284	1.000	-.0919	.0918

			C3	-.0049	.03284	.999	-.0967	.0870
			c4	-.2248*	.03284	.000	-.3167	-.1330
		C3	C1	.0048	.03284	.999	-.0871	.0966
			C2	.0049	.03284	.999	-.0870	.0967
			c4	-.2200*	.03284	.000	-.3118	-.1281
		c4	C1	.2247*	.03284	.000	.1329	.3166
			C2	.2248*	.03284	.000	.1330	.3167
			C3	.2200*	.03284	.000	.1281	.3118
D2	Tukey HSD	C1	C2	-.0003	.02805	1.000	-.0724	.0718
			C3	-.0034	.02805	.999	-.0755	.0687
			c4	.1032*	.02805	.001	.0311	.1753
		C2	C1	.0003	.02805	1.000	-.0718	.0724
			C3	-.0031	.02805	1.000	-.0752	.0690
			c4	.1035*	.02805	.001	.0314	.1756
		C3	C1	.0034	.02805	.999	-.0687	.0755
			C2	.0031	.02805	1.000	-.0690	.0752
			c4	.1066*	.02805	.001	.0345	.1786
		c4	C1	-.1032*	.02805	.001	-.1753	-.0311
			C2	-.1035*	.02805	.001	-.1756	-.0314
			C3	-.1066*	.02805	.001	-.1786	-.0345
	Scheffe	C1	C2	-.0003	.02805	1.000	-.0788	.0781
			C3	-.0034	.02805	1.000	-.0818	.0751
			c4	.1032*	.02805	.004	.0247	.1816
		C2	C1	.0003	.02805	1.000	-.0781	.0788
			C3	-.0031	.02805	1.000	-.0815	.0754
			c4	.1035*	.02805	.004	.0250	.1819
		C3	C1	.0034	.02805	1.000	-.0751	.0818
			C2	.0031	.02805	1.000	-.0754	.0815
			c4	.1066*	.02805	.002	.0281	.1850
		c4	C1	-.1032*	.02805	.004	-.1816	-.0247
			C2	-.1035*	.02805	.004	-.1819	-.0250
			C3	-.1066*	.02805	.002	-.1850	-.0281
D3	Tukey HSD	C1	C2	.0020	.02133	1.000	-.0528	.0568
			C3	-.0015	.02133	1.000	-.0564	.0533
			c4	-.0489	.02133	.100	-.1037	.0059

			-.0020	.02133	1.000	-.0568	.0528
	C2	C1	-.0020	.02133	1.000	-.0568	.0528
		C3	-.0035	.02133	.998	-.0584	.0513
		c4	-.0509	.02133	.080	-.1057	.0039
	C3	C1	.0015	.02133	1.000	-.0533	.0564
		C2	.0035	.02133	.998	-.0513	.0584
		c4	-.0474	.02133	.118	-.1022	.0075
	c4	C1	.0489	.02133	.100	-.0059	.1037
		C2	.0509	.02133	.080	-.0039	.1057
		C3	.0474	.02133	.118	-.0075	.1022
Scheffe	C1	C2	.0020	.02133	1.000	-.0577	.0617
		C3	-.0015	.02133	1.000	-.0612	.0581
		c4	-.0489	.02133	.154	-.1086	.0108
	C2	C1	-.0020	.02133	1.000	-.0617	.0577
		C3	-.0035	.02133	.999	-.0632	.0561
		c4	-.0509	.02133	.128	-.1106	.0088
	C3	C1	.0015	.02133	1.000	-.0581	.0612
		C2	.0035	.02133	.999	-.0561	.0632
		c4	-.0474	.02133	.177	-.1070	.0123
	c4	C1	.0489	.02133	.154	-.0108	.1086
		C2	.0509	.02133	.128	-.0088	.1106
		C3	.0474	.02133	.177	-.0123	.1070

Based on observed means.
 The error term is Mean Square(Error) = .228.
*. The mean difference is significant at the .05 level.

These results in turn support the H1 that predicted a better effect of 3DC4 (sub-dimension model) on the ability estimation of the individuals than other three configurations. The results further reject the H2 that predicted a better estimation of ability parameters in unconstrained models of IRT, in this case 3DC1 to 3DC3.

6.   Discussion and conclusions

As described in figures in Tables 6 and 7, almost in all of the sub-components of the concerned test, expert judges pointed to the non-simple structure (more than one latent trait) behind item clusters; this result provided some evidence on the substantive multidimensionality of EGAP-ESAP test data and set the ground for making a multidimensionality hypothesis which was later tested empirically in a second stage of ConQuest Rasch analysis. On the other hand, a simple two dimensional structure corresponding to the original partitioning of the test into EGAP and ESAP components was rejected in a later Rasch analysis. This stemmed from the overlapping nature of the underlying factors in each of these components and the fact that much of the variance in one component (ESAP) could be accounted for by the other component (EGAP) (Brown, 1988). The non-zero correlation between different dimensions further complicated the issue and bolstered the idea of cross-joining of the abilities into different sub-dimensions, hence proposing some higher dimensional model of item responses for the test, something that had already been suggested implicitly by the content analysts in their item –to- dimension mapping.

Question 1b was answered after various conditions of 3-dimensionality were simulated with different item-to-dimension mapping patterns. The results of both informal and formal tests of the hypothesis showed that among 4 different 3D configurations, the last model in which items were assembled based on the constraints of Rasch sub-dimension model was the best model for recovering item and persons parameters of the joint EGAP-ESAP test.

Recovering the 3-dimensional sub-dimension model as the optimal model of item responses brings to the fore the constraints (of both quantitative and qualitative nature) and cautions which should be accounted for in assembling a joint EGAP-ESAP test. The constraints are:

i) Non-zero correlation between dimension specific factors

ii) Zero covariance between sub-dimension factors and general factor

iii) Setting the mean of the ability estimation in general dimension to zero (Brandt, 2007a)

In upgrading the test assembly sub-layers of the test concerned, the first constraint should be met by the selection of dimension-specific traits from ELT continuum (Dudley-Evans and St John, 1998) which runs from General English to very specific ESP components. The second constraint should be met by considering the English for accounting (specific purpose background knowledge) as the general factor and language knowledge factors (general English and common core language elements as the first dimension specific factor and knowledge of the rhetorical functions as the second dimension specific factor). This selection can be justified by the results of a regression analysis conducted by Salmani-Nodoushan (2003) on the ESP reading tests which showed that there is a lack of multi-collinearity between specific purpose content knowledge and proficiency. It is therefore concluded that the content knowledge is a good option, among other things, to act as the main dimension in the present situation.

In addition to the above mentioned constraints, one of the primary assumptions of the Rasch sub-dimension model is that the test would comprise up to four test-lets. In upgrading the present ESP test, therefore, the pre-test items can have a item assembly sub-layer, namely a) a cloze test of general and common core language components, b) a reading test-let which tap pragmatic inference ability and knowledge of rhetorical functions, and c) a reading test-let with composite items of both general and specific components. Stimulus texts should also be selected in such a way that they have no overlapping content, although they must all be coming from the texts students may encounter in accounting courses with different degrees of difficulty.

7. Implications

According to Zhang (2006), when the multidimensionality of a test becomes certain, it is possible for the test designers to control the dimensional structure of the test by prescribing the content specifications of items. This issue of "control" over the dimensionality structure of the test along with the use of test content analysis in this study as a dimensionality detection method can open the minds of the test crafters to the applicability of this method for directing the multidimensionality of the test and controlling the degree of this multidimensionality.

The recovery of person abilities on multiple dimensions for a test which has already been used and interpreted based on the wrong assumption of unidimensionality also implies that for a present context in ESP admission tests in Iran, a properly designed assessment with a justified bi-factor structure can accurately measure multiple traits on multiple dimensions and report the person theta values on multiple scales far more efficiently and far more precisely than can a unidimensional measurement model.

Acknowledgement

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