Genre Analysis: Undergraduate Engineering Laboratory Report (UELRR)

Chae Kwan Jung (Korea Institute for Curriculum and Evaluation)


Recent developments in the field of genre analysis have led to a renewed interest in not only academic writing across disciplines but also academic writing as professional practice. The undergraduate engineering laboratory report (UELRR) represents an example of such a genre. However, despite the fact that the laboratory report is to play a key role in the academic work of many engineering, so far little attention has been paid to the UELRR genre. This study discusses textual situation and linguistically recurring features of the UELRR using 99 authentic UELRR exemplars within British Higher Education (HE). Overall results indicate that many UELRRs have similar conventional features. For example the textual situations were very similar since the UELRRs are formal standardized assessments produced during Bachelor of Engineering (BEng) degree courses. Their structure, more specifically linguistic moves and steps in the reports, seem to have a certain pattern. However some recurring non-linguistic features such as scientific symbols and units of measurement were often very specific depending on their particular degree titles. It is apparent from these results that undergraduate engineering students deal with similar topics and write similar reports in their earlier years but they become discipline specific progressively as they upgrade their studies.

**Keywords**

genre analysis, corpus linguistics, academic writing / 장르 분석, 코퍼스 언어학, 학술 글쓰기
I. Introduction

‘Genre’ can be a very slippery term, constantly reappearing with different definitions in the past three decades (see especially Bazerman, 1994, 1997; Bhatia, 1993; Dudley-Evans, 1987; Freedman & Medway, 1994; Halliday, 1973, 1985; Hyland, 2004a; Johns, 2008; Martin, 1991; Miller, 1984; Paltridge, 2002; Russell, 1997; Swales, 1981, 1990 among others). In the conventional sense, there has been a dichotomized tension between genre as an abstraction and genre as a specific thing. Feuer (1992) argues, “a genre is ultimately an abstract conception rather than something that exists empirically in the world” (p. 144). In other words genre is similar social action and represents “typified rhetorical action” (Miller, 1984, p. 151). Bazerman (1988) takes Miller’s claim and proposes “a genre is a social construct that regularizes communication, interaction and relations” (p. 62). If there are two texts which are produced in similar social actions under similar situations, ultimately then they can be considered as the same genre in this sense. For example a group of researchers (Carter, Ferzli, & Wiebe, 2004, 2007; Wiebe, Brawner, Carter, & Ferzli, 2005; Wiebe et al., 2001) have identified three different types of ‘laboratories’, namely Standard Lab (normally students test a hypothesis), Descriptive Lab (students do not test a hypothesis but follow a pre-arranged procedure), and Student-Designed Lab (students design their own laboratory) in the field of Science and Engineering during the development of an online lab report writing resource at NC State University funded by National Science Foundation (DUE-9950405 and DUE-0231086). Although there can be different aspects in each different type of ‘laboratories’ within different specific academic disciplines, they conceptually see all the outcome texts of the ‘laboratories’ and a ‘laboratory report’ genre.

On the other hand, Swales (1981, 1990) argues genres are very specific things that are being recognized by discourse
communities which own those particular genres. In this view, genre is primarily associated with particular text characteristics in terms of recurrent linguistic features and most importantly are defined by shared communicative purposes (Bhatia, 2004; Melander, Swales, & Fredrickson, 1997). There exists a very significant body of scholarship based on the identification of specific genres and the investigation of their characteristics. For example, Flowerdew and Dudley-Evans (2002) treat editorial letters to international journal contributors as one of these ‘genres’. Other examples suggested and researched by this genre tradition are ‘newspaper law reports’ (Badger, 2003) and ‘retention-promotion-tenure reports’ (Hyon, 2008) that all tend to be very specific in terms of their discourse communities, communicative purposes, and recurrent linguistic features. The analysis that follows seeks to develop a description of a specific genre using a ‘Swalesian’ approach (Askehave & Nielsen, 2005; Nathan, 2013) but raises questions about prototypicality which suggest that general characterizations of the sort proposed by the group of researchers at NC State University may in fact represent a more realistic reflection of textual realities.

The purpose of the study is to develop a description of the Undergraduate Engineering Laboratory Report (UEL) in a British higher education context by using a genre analysis and computational text investigation. The study attempts to define UEL as a genre and distinguish it from other text types in a large collection of academic written texts. This entails not only a description of the rich textual and contextual features of the UELs, but also the development of a practical methodology for their location, description, analysis and exploration.

II. Background: Genre and Genre Approach

Various genre scholars and practitioners use different theoretical concepts of genre in different academic and
professional contexts. This lack of agreement leads to various
genre definitions (see Ventola, 1989 for overviews and see
e especially Johns et al., 2006 for views of different researchers in
the field). While a variety of definitions of the term genre has
been suggested by various genre scholars, there seems to be
consensus that it is useful to classify genre scholarship into three
broad perspectives: North American New Rhetoric (NR), English
for Specific Purposes (ESP) and Australian Systemic Functional
takes her suggestion and summarizes the different genre
scholarships as follow:

(1) genre in the NR is... “systems of complex literature activity
constructed through typified actions”
(2) genre in the ESP is... “genre comprises a class of communicative
events linked by members of a discourse community”
(3) genre in the SFL is... “genre is a staged, goal-oriented social
process which involves the interaction of participants using
language in a conventional, step-wise structure” (p. 17)

Hyon (1996) has identified common goals among different genre
schools (helping students succeed and empowering students). She
also found different emphases in each genre school at the same
time. According to her extensive three-year study, the pedagogic
approaches which emerge from the three different genre
orientations have been theorized to be more or less effective in
different social and educational contexts. For example, she argues
that the NR approach is effective with university students and
novice professionals while the SFL is centered mainly on primary
and secondary school students and adult migrants in English
education and workplace trainings. She also reports that the ESP
approach is more effective with students in an English for
Academic Purposes (EAP) and English for Professional
Communication (EPC) classroom environment than others.
Laboratory reports tend to have little extended text compared to text oriented essays in non-engineering subjects such as History and Philosophy. Other features such as tables, figures and photographs from the laboratory reports are equally important when investigating this engineering disciplinary genre. This study argues above that assessed texts are shaped more than anything by their communicative purposes, as in the ESP tradition. In other words, this study does not seek systemic functional grammar or register issues which the SFL school tends to highlight (Paltridge, 2001; Scheleppenegrell, 2002) in the UELR genre. Instead this study will focus on the NR and ESP genre orientations (Flowerdew, 2012; Paltridge, 2013; Tardy, 2012), which the author now discuss.

1. The New Rhetoric (NR)

As the name indicates, many researchers in the NR school have a background in rhetoric and composition theories. They tend to emphasize more that “concepts, arguments, and conclusions stem from rhetorical, social, and ideological stances rather than from detailed analyses of language and text organization” (Johns, 2003, p. 209). In this tradition, genres are recognized as conventionalized social actions (Devitt, Reiff, & Bawarshi, 2004; Freedman & Medway, 1994; Miller, 1984, 1994 among others). NR Scholars prioritize situational context, for example situations, communities, writers and readers, in their explanations of texts (Coe, 2002). Therefore Miller (1984) argues, “a rhetorically sound definition of genre must be centered not on the substance or the form of discourse but on the action it is used to accomplish” (p. 151). Bazerman (1997) also notes, “genres are not just forms. Genres are forms of life, ways of being. They are frames for social action… Genres are the familiar places we go to create intelligible communicative action with each other and the guideposts we use to explore the familiar” (p. 19). Coe (2002)
takes their views and develops their concept of genre as “a socially standard strategy, embodied in a typical form of discourse, that has evolved for responding to recurring types of rhetorical situation” (p. 197).

The main point of the NR school is not to help students become experts who are specialized in a particular text form, but to assist them as to how to respond to various writing tasks in their academic lives for their future professional lives. Therefore academic assignments in educational settings are considered as apprentice genres and students gradually develop their own writing strategies especially from the first year of study at universities, responding to different situated settings they face through a process of repetition and refinement before graduating and becoming real professionals (Carter et al., 2007). For example, Pechenick (2006) offers biology students at university level an opportunity of how to think and express their ideas through a series of their writing practices. Nevertheless her focus is to help the students how to organize their ideas and write like as professional biologists: she does not necessarily train them to become experts who are specialized in a particular type of text. Therefore publications in the NR tradition include the study of experimental articles in an academic setting (Bazerman, 1988) and the process of writing, re-writing, or transformation of biology research articles (Myers, 1990).

The NR school makes use of both ethnographic and linguistic methods to understand and learn more about situational context of genres (Martin-Martin, 2005). For example, Wiebe et al. (2005) observed a series of laboratory session at undergraduate level in various academic disciplines such as Geology and Materials Engineering first. Then they interviewed the students who had participated the ‘laboratories’ in order to portray what was going on and to learn more about the undergraduate laboratory report genre which was the result of the ‘laboratories’. Similarly Artemeva and Fox (2010) used a series of observations how
students reacted to different genres and interviewed their students while they were investigating students’ prior genre knowledge in their engineering genre-competence assessments. Pollach (2008) has analyzed samples of online product reviews in web based consumer communities. Due to the anonymity of participants, she was not able to conduct interviews with the consumers who had written the reviews. As a result, her NR orientation genre analysis was largely based on text analysis in conjunction with a series of observations of the activities in the online community. The analysis here focuses on the views of instructors who are responsible for assessing the relevant texts, but it also sets this in a broader institutional context that is relevant to their production.

2. English for Specific Purposes (ESP)

The ESP genre tradition is largely based on Swalesian approach named after John Swales’s two pioneering studies on genre analysis in 1981 and 1990 (see also ESP Journal special issue in honor of John Swales, 2008). In the ESP genre orientation, the term ‘genre’ has been considered as “a class of communicative events, the members of which share some set of communicative purposes. These purposes are recognized by the expert members of the parent discourse community, and thereby constitute the rationale of the genre. This rationale shapes the schematic structure of the discourse and influences and constrains choices of content and style” (Swales, 1990, p. 58). Another important ESP genre scholar, Tony Dudley-Evans (1987), defines genre as “a typified socially recognized form that is used in typified society circumstances. It has characteristic features of style and form that are recognized, either overtly or covertly, by those who use the genre” (p. 1). These two pioneering ESP genre scholars place a premium on communicative purpose which ultimately influences strategic moves and steps and linguistic
choices within a textual form.

In the ESP school, researchers focus on typical features in forms of text belonging to a category accepted by the discourse community for example ‘written feedbacks to postgraduate students in a part-time education program’ (Mirador, 2000), ‘conference abstracts’ (Swales & Feak, 2009), or particular sections in research articles e.g. ‘abstracts from medical journals’ (Salager-Meyer, 1991), ‘the structures of Results, Discussions, and Conclusions in research articles in applied linguistics’ (Ruiying & Allison, 2003). Therefore for many ESP researchers it is important to identify recurrent linguistic patterns amongst others. For example, Hyland (2003) collected 96 Masters’ and 117 doctoral level dissertations in different academic disciplines from different universities in Hong Kong, identifying the generic structure of those dissertations as well as the detailed steps and moves of the acknowledgment section, while Bruce (2009) has investigated the results sections in sociology and organic chemistry articles.

In the ESP genre orientation, the overall aim of a genre analysis is to identify linguistic and rhetorical moves and steps (Swales, 1981, 1990). According to Dudley-Evans and Johns (1998), a step is “a lower text unit than the move that provides a detailed perspective on the options open to the writer in setting out the moves” whereas a move is “a unit that relates both to the writer’s purpose and to the content that s/he wishes to communicate” (p. 89). For example, Swales (1990) suggests a three move ‘Creating a Research Space’ (CARS) model for successful research article introductions after analyzing 48 journal articles from various academic disciplines such as Physics, Medicine and Social Sciences. Although not all 48 journal articles had all three moves and followed exact sequential orders in conjunction with steps, he has identified three moves which frequently appeared from the introduction sections and suggested the CARS model, which has subsequently influenced many genre
scholars and practitioners, making an important contribution to ESP teaching.

Its pedagogic approach is to show authentic examples of linguistic patterns such as structures and frequent vocabulary items in a particular target genre to especially L2 students so that they could use that language effectively (Cho & Lim, 2011; Henry & Roseberry, 2001; Soh, 1999). Introductions in research articles (Samraj, 2002) and generic structure of dissertation acknowledgements (Hyland, 2004b) are some examples which fall under this pedagogic approach. ESP has also significantly influenced ESP course design for graduate students’ writing using ESP genre-based pedagogy across the world (Paltridge & Starfield, 2007; Swales & Feak, 2000, 2004, 2009).

3. My Position with Regard to Genre and Genre Analysis in This Study

Although the concept of genre is complex, it is important to clarify my position with regard to genre and genre analysis in the present study. To me, genre is a frequently appearing fixed form as a result of repeated actions which may be dynamic with a set of specific communicative purposes within a particular discourse community. In this study, the scene of the genre is British HE, the setting is an engineering school within the British HE, and the genre is the UELR: the outcome of students’ repeated compulsory academic activities for assessment purposes in a ‘laboratory’ during their degree programs. With regard to genre analysis, the present study combines the NR and ESP genre traditions. From the NR tradition, it follows Devitt, Reiff, and Bawarshi’s (2004) genre analysis combined with some limited ethnographic techniques, for example visiting and exploring one of the Engineering Schools where UELRs were born, and brief email communications with undergraduate engineering laboratory course instructors. From an ESP perspective, it uses Swales’s
move analysis of 99 UELR examples in conjunction with quantitative computational text analysis to analyze the UELR genre. It is important to embrace these two quite contrastive but complementary perspectives to understand the UELR more in general, rather than see them as two distinct views. This is mainly because different perspectives are not necessarily in conflict with each other, but may be used in complementary ways (Stubbe et al., 2003).

Consequently my position with regard to genre analysis in this study is that it is important to look for not only textual situation, which the NR tradition emphasizes, but also linguistically recurring features that the ESP tradition focuses on. In addition it can be appropriate to combine these two genre traditions in order to understand the similarities and differences between all the ‘slightly’ different UELRs in different specific Engineering disciplines and at different levels of study. There are simply too many variables in different textual situation (Belcher, 2004; Johns, 2002) to be accommodated by analysis in a single tradition. Dudley-Evans (2002) found comparable problems in his study on ‘the essay assignment’ in a British university and learned the ESP tradition could not describe all essays in a range of different disciplines. In a similar vein, although the NR approach has been used in the area of academic writing particularly providing rich contextual information (Adam & Artemeva, 2002; Coe, 2002), if it lacks textual analysis, it may not be enough to explain what genre a text belongs in among the diversity of assignment genres in a British HE context.

III. Methodology and Results

The contextual data in this study were mainly collected in 2007–09, the same period as the textual data was obtained. The key contextual data are based on official reports and documents from the UK government and agencies (Quality Assurance
Agency, QAA), ABC University official prospectuses from 2000 to 2009, the School of Engineering web pages, departmental handbooks and supplementary materials (a booklet detailing the different courses available) produced for students by the School and individual lecturers. In particular, ABC University official prospectuses were obtained through ABC University Communication Office in October 2008. The author photocopied all pages regarding Science and Engineering, and most undergraduate courses and digitized all of them using Fujitsu Scansnap S300. The prospectuses were critical for this study since they showed not only the structure of the School but also other faculties’ structure and course details. This study used a 2007/08 academic year version of the prospectus in the present study because the author initially started collecting the examples of the UELR in the same academic year. The author had email communications with undergraduate laboratory course instructors in the School regarding their views on important aspects of engineering laboratory reports in November 2007. In addition, some of their laboratory reports were collected from them. The author also visited the School on 16 January 2007 for about an hour.

Although the author have found many corpora, for example British National Corpus (BNC), Bank of English (COBUILD), Corpus of Contemporary American English (COCA), most of them were rather too general for the purposes of the present study. They did not fit with the category that the author was focusing on (engineering laboratory report examples at undergraduate level in a British HE context). There were some specialist academic written English corpora such as Hyland (2004a)’s research articles corpus, Lancaster Corpus of Academic Written English (LANCAWE), Michigan Corpus of Upper-level Student Papers (MiCUSP) and Reading Academic Text Corpus (RAT). The most important issue was whether the specialist corpora had a reasonable number of the examples of the UELR.
Although the MICUSP had some examples, but it did not have very many and they were not easily recognizable. In order to investigate the existing corpora systematically, the author created a flowcharting system in conjunction with scientific algorithm which followed a set of rules to identify an appropriate corpus for the present study (Jung, 2011; Jung & Warton, 2012). While exploring many potential source corpora, the author found one promising source corpus which offered me the authentic UELR examples that the author was looking for, namely British Academic Written English (BAWE) corpus.

The ESRC-funded BAWE (RES-000-23-0800) holds 2,761 examples of authentic students academic writing (approximately 6.5 million words) from various disciplines at different levels of study in British HEs from 2004 to 2007 (Nesi & Gardner, 2012). The corpus is in the public domain via the Oxford Text Archive (OTA) with accompanying documents such as data spreadsheet which contains not only comprehensive textual information but also detailed contextual information and, most importantly, ‘13 genre families’ suggested by the corpus developers using Systemic Functional Linguistics tools (Gardner, 2012). Although the proposed categorization represents a considerable advance in terms of our understanding of academic genres, the corpus developers may nevertheless have overlooked some important genres in academic writings in British HEs. The UELR is an example of such a genre, even though it is a core text that all engineering students must master during their studies at British universities. Undergraduate Engineering Laboratory Report Corpus (UELRC) is a collection of authentic UELR examples representing 21st century written academic English in the field of Engineering within British HE. Although UELRC was originally extracted from BAWE, the author has eliminated some errors which occurred during the project; hence it has been partly recategorized. It consists of 99 UELR examples from 11 specific engineering disciplines which include both single- and multi-
disciplinary degree programs, written by 29 undergraduate engineering students (19 male and 10 female) at various undergraduate levels of study in three different British universities.

Table 1

<table>
<thead>
<tr>
<th>Course</th>
<th>No. of Assignments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Civil Engineering</td>
<td>2</td>
</tr>
<tr>
<td>Computer Systems Engineering</td>
<td>4</td>
</tr>
<tr>
<td>Electrical Engineering</td>
<td>1</td>
</tr>
<tr>
<td>Electronic and Communication Engineer</td>
<td>2</td>
</tr>
<tr>
<td>Electronics Engineering</td>
<td>4</td>
</tr>
<tr>
<td>General engineering</td>
<td>22</td>
</tr>
<tr>
<td>Engineering Business Management</td>
<td>3</td>
</tr>
<tr>
<td>Engineering Design and Appropriate Technology</td>
<td>2</td>
</tr>
<tr>
<td>Manufacturing Engineering and Management</td>
<td>2</td>
</tr>
<tr>
<td>Mechanical Engineering</td>
<td>55</td>
</tr>
<tr>
<td>Systems Engineering</td>
<td>2</td>
</tr>
</tbody>
</table>

IV. Research Findings

1. The Context

This section describes the disciplinary and institutional context in which the relevant texts are primarily produced. It contextualizes the UELR from a number of perspectives, ranging from the importance of laboratory reports in Engineering education to engineering laboratory instructors’ views, and focusing on four key aspects: setting, purpose, participants and community expectation within a British HE context (e.g. the School of Engineering, ABC University).
1) Setting

ABC University is a well-established British institution that is highly rated in higher education league tables in terms of both its research and teaching. The Engineering faculty, which is housed in its own building, attracts over 2,500 students a year on a range of programs from undergraduate to doctoral level. The School has maintained its specific aims and objectives as regards the undergraduate curriculum in two broad areas: academic and professional. From the academic side, they aim “to develop students’ knowledge and understanding of professional engineering based around five themes: Science; Analysis; Design; Manufacture/Construction; Business” (The School Handbook, 2007, p. 18). From the professional side, they aim “to develop a range of key skills relevant to professional engineering and to other occupations” (ibid, p. 18).

According to ABC University Guidance on Approval and Publication of Course Specifications in 2008, all specific engineering degree programs showed a strong emphasis on practical work based learning. For their laboratory session, the first year students must take a particular topic from among six that are available (‘Dimensional Analysis’, ‘Save Energy!’, ‘Measurements in AC Circuits’, ‘Leveling’, ‘Mechanics=Inertia’, and ‘Strain Gauges Laboratory’) in ‘Technological Science 1’ course which is compulsory. Normally students are informed by the School which specific ‘laboratory’ they have to carry out. However, the subjects of the laboratory sessions become more specific along with specialized courses as students follow their specific pathway, although there are still some common laboratory sessions in the second and third years of study.

Engineering laboratory courses at ABC University involved a range of practical work. Normally the courses operated in two different places: one was in a seminar room where students learned scientific and engineering concepts, whereas the other
was in an actual laboratory where they carried out practical work. The seminar room was often used as a place for discussing the concepts or the work they had carried out or for drafting some results of the work. There was a place called the Electronic Laboratory where Electrical and Electronic Engineering related practical work, for example electronic measurement, electronic design, and so on, was carried out. Interestingly the Electronic Laboratory was located just next to the seminar room; hence students could move to the laboratory swiftly after their lectures or seminars. There was a place called the Engineering Hall where many different types of Civil and Mechanical Engineering related practical work was carried out.

According to the 'Engineering Handbook for All First Year Students 2007/08', the hall was used mainly by Civil, Mechanical and Metrology engineering students. There were also facilities for specific uses e.g. a micro-engineering room, a microscopy laboratory and some places for specific engineering workshops. Students used high performance computers and cutting edge specialist computer applications such as MATLAB (a numerical interactive software package), SIMULINK (a tool for modeling, simulating and analyzing multi-domain dynamic systems) and SOLIDWORKS (3D CAD design software) in a place called the Computer Aided Design (CAD) Suite. During more detailed investigation, it was identified that the computers in place CAD Suite had a wide range of software and were open to all undergraduate engineering students from different engineering sub-disciplines. The students came to the place and used their specialist applications for their own particular purposes for example analyzing digital images or designing a product.

The School also had several multi-purpose facilities, often storing specialist apparatus in cabinets for safety purposes according to 'Health and Safety’ section in their hand-out. For actual laboratory report writing, there were two types of place: university and non-university environments. In the university, a
student might use facilities such as computer aided design suite and the university library where many university students work with their own laptops or university owned computers. Alternatively, the student could work at home. In this case, the students often needed to return to the university to use specialist computer applications for further experiments if necessary. In other words, the whole UELR writing process can be affected by the settings since the writing process and ‘laboratories’ often occur concomitantly.

2) Purposes

Despite the fact that many UELRs in UELRC were slightly different in terms of the length, style, and tasks the students had done, they had one key point in common. All the UELRs were formal compulsory coursework which inevitably had to be graded within the British undergraduate engineering curricula strictly. Therefore, although each laboratory report had a particular aim and objectives, there were two ultimate purposes for students and course instructors respectively. For students, it was ‘to be assessed’ by showing their understanding before, during and after their laboratory work as future engineers. For undergraduate engineering laboratory course instructors, the ultimate purpose of the UELR was ‘to assess’ on the basis of the students’ performance professionally. This might sound obvious to many non-Engineering background audience, but undergraduate engineering students normally had only one opportunity to practice a particular type of UELR. Considering many engineering graduates are often responsible for the electrical, mechanical and health and safety aspects of products and buildings, the students had to be properly ‘engineered’ by their course instructors before graduating.
3) Participants

The School accepted prospective students with a variety of academic qualifications (General Certificate of Education A-Levels, Business and Technology Education Council, European Baccalaureate, International Baccalaureate, Foundation Programs, Scottish Qualifications) for admission, its normal admission requirements being A levels of BBB/BBC for BEng (three years course) and A levels of AAB/ABBB for MEng (four years course). However the students had to have studied science subjects, for example Mathematics and Physics, before applying for a place at the School. Based on this information, it is reasonable to claim that even the first year students in the School were not total strangers to science or engineering discourse. Having investigated the entire web pages, hand-outs, and prospectuses of the School, the author noted that the course instructors who ran 'laboratories', had a PhD in a very specific engineering subject area. For example, Instructor A had a PhD in Civil Engineering, whereas instructor B held a PhD in Electronical and Electronic Systems Engineering. Instructor A ran a series of laboratory sessions in his specialized engineering areas (more specifically Geotechnical Laboratory within Civil Engineering) while Instructor B ran Digital Systems Design laboratory. In addition, it was found that there was one main instructor (course leader) who worked with several other instructors. Their roles involved the activities during laboratory sessions and lectures and seminars during the whole course.

4) Community Expectations

Today’s British universities are expected to offer an increasing number of tailor-made courses that would meet today’s business needs. Speeches from the UK government have placed emphasis on 'employability' issues, represented as graduates equipped with
the high level of practical skills that they need in a future workplace (Mandelson, 2009). In the field of Engineering, for example, Civil Engineering related employers have certain expectations from a graduate with a Civil Engineering degree (BEng) from a good British university. The employers expect the Civil Engineering graduates to have not only subject knowledge but also a sound understanding of the business context within Civil Engineering work. Consequently these expectations from future employers have exerted a strong influence on many engineering curriculums. It is not surprising to see that the course aims of the Civil Engineering degree program are designed with a view to practical transferability for students’ future jobs.

For the purpose of the present study, the author contacted three laboratory course instructors through the Undergraduate Academic Office in the School, and two of them kindly responded to email enquiries seeking their views on laboratory reports and marking. These enquiries are not treated in this study as a separate data set, but rather as an additional resource to the contextual analysis of the UELR and a source of insight into the disciplinary context. One of the instructors taught ES21R Digital Design course to students in 2004/05 and the author had some examples of the UELR from that particular course in UELRC. The other instructor had been teaching various Civil Engineering related laboratory courses (e.g., Geotechnical Engineering) to students in the School. Again the author had some UELR examples from his laboratory courses in the UELRC too. The questions the author asked them related to 1) what they considered the most important thing when they assessed a student’s laboratory report; and 2) the quality of English during the assessment process. Instructor A and B made the following responses to our questions:

I suspect you might get different answers to this depending which of my staff you ask - a statement revealing in itself! All of the above
are important, but the key must be the presentation of the information in the most appropriate manner. We expect a certain type of structure. We require writing that is unambiguous and conforms to the norms for our disciplines, e.g. third person passive... In marking a report we are not just marking the article, but the work that is being reported on (Instructor A).

The requirement is clearly defined on the briefing page of the first lab: In writing reports, even if it is a brief report, it should have the following sections: 1. Title, 2. Contents, 3. Introduction, 4. Detailed description of your laboratory work. This should include a brief description of hardware/software sections of your laboratory work, 5. Conclusion... It is also clearly defined in each of the assignments hand-out (Instructor B).

Interestingly, both instructors agreed that the structure of the report was the most critical element in evaluating their undergraduate engineering students’ laboratory reports. The first instructor also mentioned engineering writing style in the Engineering community, highlighting clarity of writing:

It is also clearly defined in each of the assignments hand-out. As stated above we are seeking clarity of writing. Issues such as poor spelling would be commented upon, but would not be the ‘make or break’ factor in assessment (Instructor A).

However, he also valued the quality of laboratory work (if a student has followed the instructions she or he was given appropriately) rather than just evaluating a grammatically correct written piece of text. The second instructor also stressed the structure of the laboratory report. However, the author did not find any ‘clearly defined’ instructions regarding the quality of English in the assignment hand-outs which he had provided.
2. Linguistic Features of UELR: Move Analysis

The following sections present findings from the data focusing on conventional linguistic features of the UELRs. This section will show identified moves and steps using Swales's (1990) genre analysis. The UELRs were analyzed for their move structure to determine how undergraduate engineering students produced their reports. Since the author was investigating common features of the UELRs, the author was especially interested in an overall UELR move structure rather than a particular section such as Introduction or Discussion or Result within UELRs. Therefore it was logical to pay attention on headings and sub-headings which expressed particular functions. This involved creating an Excel spreadsheet and recording all the headings and sub-headings of the 99 UELRs to the spreadsheet one by one manually. The author then summed up the headings and sub-headings. Although not all the structures of the laboratory reports were identical, many UELRs within UELRC were written in a fairly structured way i.e. Summary - Introduction - Theory - Apparatus and Method - Observations and Results - Analysis of Results - Discussion - Conclusion with a series of sub-headings. Also the structure that the author have identified showed much more complex than Instructor B’s structure. Figure 1 shows schematic structure of UELRs and Table 2 offers move frequency in UELRC.
Most (72 out of 99) UELRs in UELRC had a cover page which includes course code, date of laboratory performance and so on. The page was provided by the Undergraduate Office in the School; hence it was excluded from ‘Move’ item in the present study.

<table>
<thead>
<tr>
<th>Move</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analysis of results</td>
<td>92</td>
</tr>
<tr>
<td>Introduction</td>
<td>79</td>
</tr>
<tr>
<td>Conclusion</td>
<td>77</td>
</tr>
<tr>
<td>Discussion</td>
<td>64</td>
</tr>
<tr>
<td>Summary</td>
<td>56</td>
</tr>
<tr>
<td>Theory</td>
<td>54</td>
</tr>
<tr>
<td>Observations and results</td>
<td>33</td>
</tr>
<tr>
<td>Apparatus and methods</td>
<td>27</td>
</tr>
</tbody>
</table>

Although it may be difficult to generalize all the moves and
steps in UELRC, Table 3 presents the identified moves and steps within UELRC using the inductive approach which is similar to that of Flowerdew and Wan (2010).

<table>
<thead>
<tr>
<th>Move 1: Summarize the UELRC</th>
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1) Move 1 (Summarize the UELR)

A summary appears at the start of the laboratory report in UELRs in the UELRC. Three steps have been identified in this move: stating the purpose of work, presenting the method used, and summarizing conclusions. An average length of a summary in the collection was around 100 words.

Step 1: Stating the purpose of work (although this step did not have a particular heading or label, normally it came immediately after the ‘Summary’ heading).

Example 1 in Summary
An experiment was carried out to gain more knowledge of...

(Computer Systems Engineering, 1st year)

Step 2: Presenting the method used (many students offered a brief summary of the method they had used for their work in this step)

Example 2 in Summary
There are several ways of sensing force, as for this experiment, strain gauges are used to do...

(Electronic and Communication Engineering, 2nd year)

Step 3: Summarizing conclusions (usually this step came in the final part of the Summary to offer the readers what had been concluded in one or two sentences).

Example 3 in Summary
The system had a low pass filter added in order to reduce the noise that would have reduced the accuracy of all the readings...

(General Engineering, 2nd year)
2) Move 2 (Introduce the ‘Laboratory’)

It has been frequently identified that the students offer a statement of major objectives, a short theoretical background of the work, the principal conclusion (and the degree to which objective have been achieved occasionally) using the method they have used in Move 2. An average length of the Move 2 within the collection was about 300 words.

Step 1: Stating main objectives (this step usually included a statement of the specific objectives and the context of the work. The frequent use of bullet points has been identified)

Example 4 in Introduction
The purpose of this experiment was to develop understanding of...
Constructing a circuit that contained resistance and inductance in series carried this out...

(COMPter Systems Engineering, 1st year)

Step 2: Providing a brief theoretical background of the work (many students described how they were going to use the theory before introducing the full background of the theory in one or two sentences)

Example 5 in Introduction
FE Analysis and theoretical calculations will be compared to these experimental results and comparisons made between the three methods

(Mechanical Engineering, 3rd year)

Step 3: Introducing the experimental method (this step provided experimental techniques in conjunction with an overall method during the ‘laboratory’)

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Example 6 in Introduction
Multiple readings were taken when doing the experiment to make the obtained values more accurate... having two members in the group helped out with taking readings and setting up the apparatus and doing many other different tasks simultaneously...

(Manufacturing Engineering and Management, 1st year)

Step 4: Providing a statement of the principal conclusion (this step offered what the student’s main conclusion was based on the ‘laboratory’ she or he had carried out)

Example 7 in Introduction
The conclusion of this laboratory serves to reinforce the need to run inductor motors at their rated power levels to obtain maximum efficiency and reduce...

(General Engineering, 1st year)

3) Move 3 (Explain the Theory of the ‘Laboratory’)

This move showed for the readers of the report how the analysis of results would be carried out by the students. Therefore it was found that many students began this move with a key theoretical concept first, then explained how they were going to apply the theory they had learned during lectures for their planned work. An average length of the Move 3 in the collection was about 300 words.

Step 1: Introducing main theory (although the ways of introducing the main theory varied, it appeared that many students started this step with a directly quoted definition with one or two figures)

Example 8 in Theory
Fatigue is defined as “the progressive, localized, and permanent
structural damage that occurs when a material is subjected to...

(Mechanical Engineering, 3rd year)

Step 2: Setting out how an analysis of the results would be carried out (this step set out which parameters the students were going to investigate along with their definitions of the parameters)

Example 9 in Theory
In this experiment the variables are as follow:
- m is the mass of the weights
- s is the height that the weights fall through...

(General Engineering, 1st year)

4) Move 4 (Illustrate the Apparatus and Method)

Many students described the details of the equipment they have used for their ‘laboratories’ and experimental parameters on which the data could depend such as temperature and strain rate. This move also included each procedural step of work practice using figures before collecting actual data in Move 5. An average length of the Move 4 in the collection was around 300 words.

Step 1: Describing apparatus with diagrams, sketches or photographs (this step often started with figures, then gave a detailed description of the experimental equipment they had employed)

Example 10 in Apparatus and Method
Figure 2.0
A cantilever rig (Figure 2.0): it consists of a cantilever beam with two strain gauges are bonded to the top and bottom surfaces of the beam. There is a nylon screw attached...

(Electronic and Communication Engineering, 2nd year)
Step 2: Providing the details of the data set (this step explained what the students were going to measure during their experiment)

Example 11 in Apparatus and Method
The display was set up to the first measuring page, showing voltage, current, power and power factor...

(General Engineering, 1st year)

5) Move 5 (Describe the Observations and Results)

Many students showed both qualitative and quantitative observations in this move. The qualitative observations included not only expected phenomena from an experiment, but also unexpected behaviors that might affect the experiment. As regards the quantitative observations, they almost always used tables for displaying their collected data from the experiment. An average length of the Move 5 in the collection was around 200 words.

Step 1: Describing qualitative observations and results (this step often came with a range of figures to offer the readers of the report more explicit visual messages)

Example 12 in Observations and Results
A phase diagram is shown in figure 13 below... Here, when the air supply was 0.1MPa the transfer of output was slow and when the air supply was 0.2MPa the transfer of output was faster...

(Electronics Engineering, 3rd year)

Step 2: Providing quantitative measurements and results (the students frequently used tables to display their computed numerical results in the move)
Example 13 in Observations and Results
The table below shows the records of the loading force F1 with system output voltage Vo...

(Electronic and Communication Engineering, 2nd year)

Step 3: Stating any errors which might be associated with measurements (it was found that many students explained some estimated errors during their measurements in this move)

Example 14 in Observations and Results
Although the watch gives reading in 2 decimal places the reading is rounded up to the closest decimal place because the stopwatch is controlled by human, and the human reaction times vary from people to people. Therefore the error and uncertainty in each of...

(General Engineering, 1st year)

6) Move 6 (Present the Analysis of the Results)

In this move, the students reported the final results of observations mostly in a table format along with various other formats such as line or bar charts, graphs and so on. Many students displayed the method of calculation in algebraic form in addition to the main body of text. An average length of the Move 6 in the collection was around 200 words.

Step 1: Presenting the final and important intermediate result (the students often provided their results with a range of visual figures as mentioned previously)

Example 15 in Analysis of Results
All the exercises performed give almost the same result as required...

(Electronics Engineering, 3rd year)

Step 2: Providing the method of calculation (this step offered
the process of their data calculation in detail)

**Example 16 in Analysis of Results**
The peak voltage obtained from the oscilloscope was 27.2V. However, this was not in r.m.s.

(General Engineering, 1st year)

**Move 7 (Discuss the Results)**

In this move, many students began with the extent to which the results of the observations were consistent with the theory they had learned. Then they provided suggestions for possible improvements which may reduce any potential errors during the measurement. An average length of the Move 7 in the collection was about 500 words.

Step 1: Describing the degree of correlation between theory and observation (the students described how their work actually ended up and compared the results to the theory)

**Example 17 in Discussion**
The observation is consistent with theoretical prediction. Comparing the moment of inertia of the three disc calculated from experimental results with those that is derive using the theoretical formula, it is found that...

(General Engineering, 1st year)

Step 2: Providing any suggestions for improvement to reduce potential errors (the students explained how they could have minimized some expected errors during the 'laboratory' in this step)
Example 18 in Discussion
“Eliminating the need to read the peak current manually by counting off an oscilloscope, and instead recording a readout from a much more precise machine would produce far more accurate results...”
(General Engineering, 1st year)

Step 3: Stating the degree of confidence in conclusions (the students often limited their findings since they had already mentioned some errors during their work)

Example 19 in Discussion
The harmonics of the circuit had a period of 50Hz, but were difficult to read after the 5th harmonic...
(General Engineering, 1st year)

8) Move 8 (Conclude the Report)

The students briefly reaffirmed their conclusion which had already been discussed in Move 7. Since the key point of carrying out ‘laboratories’ during their degree courses was to learn scientific theories through practical work, it seemed to be not so critical whether they had negative results or not. Even if they had some negative results from their experiments due to their own mistakes or unexpected incidents the final grade appeared not to be affected as long as the students reported what had happened accurately. In this move, many students used numbered bullet points in order to highlight or summarize their points. The students also introduced some practical use of their findings before closing the report. An average length of the Move 8 in the collection was about 100 words.

Step 1: Restating the conclusion (this step summarized the discussed points in the Discussion and the conclusions based on the work)
Example 20 in Conclusion

The three-phase induction motor upon which the laboratory was conducted showed that for loads requiring power levels much lower than the rated values, the efficiency of the motor is very low indeed...

(General Engineering, 1st year)

Step 2: The practical usefulness of the results (this step offered the overall practicality of their findings and how and where the results could be used)

Example 21 in Conclusion

Pneumatic exercises carried out can be used in real life in many areas. For example, exercise 2 can be used to operate an automatic doors which...

(Electronics Engineering, 3rd year)

V. Discussion and Conclusions

Some NR genre practitioners may question how it is possible to identify a commonality of recurring actions associated with laboratories and laboratory reports at undergraduate level. This could be very confusing as the group of researchers at NC State University found. They observed many laboratory sessions at undergraduate level in various academic disciplines such as Geology and Materials Engineering in NC State University in North America. However, the group leader, Michael Carter informed the author through personal emails that his research team had experienced difficulties in establishing commonality since the laboratory sessions that they had observed in different classes were run in a slightly different way, primarily depending on course instructors. They found that the 'laboratories' themselves were different and therefore the laboratory reports were somewhat different. Eventually they were able to identify three sub-genres of undergraduate laboratory report, namely
standard laboratory report, descriptive laboratory report and student-designed laboratory report as the author have mentioned earlier. All these reports were the result of the recurring actions, namely standard 'laboratories', descriptive 'laboratories', and student designed 'laboratories' respectively. This research supports Carter et al.'s (2007) approach to categorizing the laboratory report as a genre, and dividing it into the three sub-genres in principle. Then, perhaps ESP genre practitioners may take issues with Swales’s (1990) prototypicality (or commonality in conventional terms) issues in the light of structure. Even though the author limited the target academic discipline to a specific degree title, the issue that different laboratories asked for slightly different laboratory reports still remained as mentioned previously.

However, all the UELRs had headings and sub-headings. Furthermore all of them were written in a fairly structured way. Admittedly it is still far from clear what a prototypical UELR could be from a structural perspective even within a single academic discipline (in this case Engineering). This could be because of diversity within the discipline or some other reasons. One of the possibilities could be that the British engineering curriculum has been changing rapidly in response to pressure from future employers. This study did not explore this possibility, but one outcome of this change is that universities have to introduce new 'laboratories' using more cutting edge technologies or multi-disciplinary practical work in addition to the traditional 'laboratories'. The author’s description of the physical context in which reports are largely produced reflected this and this may at least in part explain the production of laboratory reports which were somewhat different from the ‘prototypical’ structure of the UELR. Obviously this speculation would need to be further researched.

Can we then identify some conventional features of the UELR? The answer would be yes with some limitations. From the
overall research point of view, finding an answer to this question proved quite complicated and time-consuming. This was mainly because obtaining authentic UELR examples was the most challenging task to accomplish before identifying those conventional features. It was particularly difficult to obtain the authentic examples of UELR due to the copyright and Data Protection Act 1998. Furthermore the author needed the examples in a DOC or PDF format (not just in a simple TXT format) so that the author could see not only original linguistic features but also non-linguistic attributes. In other words, the author needed a near originally submitted form of the UELR examples. Once the author had found potential source corpora and solved the legal and ethical issues for the present study, another challenge presented itself, locating and extracting the specific examples of UELR from a large pool of diverse texts.

One of the most important conventional features of UELRs was that although UELRs had different titles, tasks, objectives, lengths and content, ultimately all of them were mandatory formal coursework and assessed strictly. In other words, the ultimate purposes (for students, it was 'to be assessed' and for course instructors, it was 'to assess') were the same despite the fact that they had slightly different linguistic and non-linguistic features. Primarily there were two participants (i.e., the student and course instructor) in the UELR genre. However, it was possible to have some other invisible participants such as technicians. Regarding community expectations, future employers had certain expectations about university graduates with a particular engineering degree title in terms of subject knowledge and communication skills. The UELR was one of the ways for the undergraduate students could practice their skills and prepare for their future work as professional engineers.

The move analysis the author has presented shows textual features of many UELRs within UELRC. As mentioned before, not all students had all the moves and steps in their reports.
Therefore it can be difficult to argue that this particular genre (i.e. UELR) must have these moves and steps. Having said that, many students have shown these features; hence this UELR move analysis may offer us a fair foundation upon which to found discussions of the prototypicality of the UELR. In view of the variety which the author and researchers like Carter et al. (2004, 2007) have identified and the extent to which this is apparent even in texts produced by the same classes in the same institutional context, it may be that this is the closest we can reasonably expect to get to prototypicality. If so, prototypicality, like genre itself for some researchers in the field, may need to be regarded as an abstract concept rather than as a practical descriptor. This also seems to add weight to the claim by NR scholars that since core features in a specific genre are not really fixed, the pedagogic focus should be on learning to write from a particular social role rather than learning how to write a specific type of text.

This study does not reveal all the aspects of highly successful UELRs which some undergraduate engineering students or ESP/EAP teachers may wish to know. However it might help them, think more about the situations of UELRs in the environment of engineering curricula in the context of British HE, and help them to use recurring linguistic and non-linguistic features strategically.

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Author's Biodata

Chae Kwan Jung is Associated Research Fellow at Korea Institute for Curriculum and Evaluation (KICE). He studied and conducted research in the field of Engineering, Effective Online Tutoring, Applied Linguistics and English Language Teaching at the universities of Birmingham, Oxford, and Warwick in the UK respectively. He is the author of Effective Technical Writing for Korean Scientists and Engineers (2007) and the co-author of Corpus Linguistics (2012). His research interests include Corpus Linguistics, English for Specific Purposes (ESP), Language Testing, Academic and Professional Writing.

Author's Address

Chae Kwan Jung  
Korea Institute for Curriculum and Evaluation  
21-15, Jeongdonggil, Jung-gu, Seoul 100-784, Korea  
Phone: 02-3704-5002  
Fax: 02-3704-3854  
Email: ckjung@kice.re.kr

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