การวิเคราะห์ข้อผิดพลาดในการเขียนบทคัดย่อรายงานการทดลองทางวิทยาศาสตร์เป็นภาษาอังกฤษของนักเรียนไทยโดยใช้คลังข้อมูลภาษา

CORPUS-BASED ERROR ANALYSIS OF THAI STUDENTS' LABORATORY SCIENTIFIC ABSTRACT WRITING IN ENGLISH

อานนท์ เอื้ออุมากุล
ANON UA-UMAKUL

วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาศิลปศาสตรมหาบัณฑิต
สาขาวิชาภาษาศาสตร์ประยุกต์ – ภาษาอังกฤษเพื่อวิทยาศาสตร์และเทคโนโลยี
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A THESIS SUBMITTED IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR THE DEGREE OF
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หัวข้อวิทยานิพนธ์	การวิเคราะห์ข้อผิดพลาดในการเขียนบทคัดย่อรายงานการทดลองทางวิทยาศาสตร์เป็นภาษาอังกฤษของนักเรียนไทยโดยใช้คลังข้อมูลภาษา
นักศึกษา	นายอานนท์ เอื้ออุมากุล
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อาจารย์ที่ปรึกษาวิทยานิพนธ์	รศ.ดร.จิราภา วิทยาภิรักษ์

บทคัดย่อ

การศึกษานี้มีวัตถุประสงค์เพื่อวิเคราะห์และเปรียบเทียบข้อผิดพลาดในการเขียนบทคัดย่อรายงานการทดลองทางวิทยาศาสตร์เป็นภาษาอังกฤษและตรวจสอบสาเหตุความผิดพลาดในการเขียนโดยใช้คลังข้อมูลภาษา กลุ่มตัวอย่างเป็นนักเรียนไทยระดับชั้นมัธยมศึกษาปีที่ 5 โรงเรียนวัดสุทธิวราราม กรุงเทพมหานคร ซึ่งแบ่งออกเป็นจำนวนสองกลุ่มโดยการสุ่มอย่างง่าย ได้แก่ กลุ่มนักเรียนที่ได้รับการสอนการเขียนบทคัดย่อรายงานการทดลองทางวิทยาศาสตร์เป็นภาษาอังกฤษ (กลุ่มทดลอง) จำนวน 135 คน และกลุ่มนักเรียนที่ไม่ได้รับการสอน (กลุ่มควบคุม) จำนวน 135 คน เครื่องมือวิจัยประกอบด้วย (1) แบบบันทึกและจัดประเภทข้อผิดพลาดในการเขียน (2) แผนการจัดการสอน เรื่อง การเขียนบทคัดย่อรายงานการทดลองทางวิทยาศาสตร์เป็นภาษาอังกฤษ และ (3) แบบสัมภาษณ์สำหรับตรวจสอบสาเหตุความผิดพลาดในการเขียน หลังจากรวบรวมงานเขียนบทคัดย่อของนักเรียนเสร็จแล้วนำมาจัดสร้างคลังข้อมูลภาษา วิเคราะห์และจัดประเภทข้อผิดพลาดและสาเหตุความผิดพลาดในการเขียน สถิติที่ใช้ได้แก่การคำนวณค่าความถี่และร้อยละของข้อผิดพลาดโดยใช้โปรแกรมสำเร็จรูป Markin 4.2.2 และ AntConc 3.2.4 การเปรียบเทียบความแตกต่างของความถี่ข้อผิดพลาดในการเขียนของนักเรียนสองกลุ่มใช้การทดสอบไคสแควร์ ผลการศึกษาพบว่า (1) ข้อผิดพลาดด้านหน่วยคำที่เกิดขึ้นมากที่สุด 3 อันดับแรก คือ การละคำนำหน้าคำนาม “the” (10.64%) การละคำนำหน้าคำนาม “a” หรือ “an” (8.44%) และความสอดคล้องกันของประธานและกิริยา (4.71%) (2) ข้อผิดพลาดด้านวากยสัมพันธ์ที่เกิดขึ้นมากที่สุด 3 อันดับแรก คือ การใช้วาจก (6.99%) การวางตำแหน่งของคำกิริยาในประโยค (4.56%) และการใช้โครงสร้างแบบคู่ขนาน (3.92%). (3) ข้อผิดพลาดด้านศัพท์ พบว่ามีการสะกดคำผิดพลาด (7.91%) ซึ่งมากกว่าการใช้คำที่พ้องเสียง (0.15%) (4) ข้อผิดพลาดด้านความหมายคำที่เกิดขึ้นมากที่สุด 3 อันดับแรก คือ การใช้คำที่มีความหมายเฉพาะเจาะจงเกินไป (1.00%) การใช้คำปรากฏร่วม (0.98%) และการใช้คำที่มีความหมายกว้างเกินไป (0.72%) (5) ข้อผิดพลาดเชิงกลไกที่เกิดขึ้นมากที่สุด 3 อันดับแรก คือ การใช้เครื่องหมายจุลภาค (9.97%) การใช้เครื่องหมายมหัพภาค (5.10%) และการใช้ตัวอักษรพิมพ์ใหญ่ (2.78%) (6) ความถี่ของข้อผิดพลาดในการเขียนของนักเรียนกลุ่มทดลองต่ำกว่าความถี่ข้อผิดพลาดในการเขียนของนักเรียนกลุ่มควบคุมอย่างมีนัยสำคัญทางสถิติที่ระดับ .01 (χ^2 = 39.62, df = 4) (7) สาเหตุหลักของความผิดพลาดในการเขียน คือ การนำกฎจากภาษาแม่มาใช้ (33.33%) มโนทัศน์ที่คลาดเคลื่อนเกี่ยวกับกฎเกณฑ์ทางภาษา (31.93%) และ อื่นๆ (34.74%)

Thesis Title	Corpus-based Error Analysis of Thai Students' Laboratory Scientific Abstract Writing in English
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Program	Applied Linguistics – English for Science and Technology
Year	2016
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ABSTRACT

The aims of this study were to analyze and compare the common errors in the laborarory scientific abstract writing in English, and investigate the main causes of written errors using corpus-based approach. The samples were the upper secondary school students (Grade 11) at Watsuthiwararam School, Bangkok. They were selected by simple random sampling into two groups: the 135 students who were taught the laboratory scientific abstract writing in English (the experimental group) and the 135 students who were not taught (the control group). The instruments were (1) an error classification recording scheme, (2) Lesson plans for teaching scientific abstract writing in English, and (3) a guided interview for investigating the causes of errors. After the corpus was compiled, the errors and causes of errors were categorized. The frequency and percentage of errors were counted and calculated using Markin 4.2.2 and AntConc 3.2.4 software. Chi–square test (χ^2-test) was used to compare the errors committed by the two groups of students. The results were as follows: (1) The top three morphological errors were the lack of article "the" (10.64%), the lack of article "a" or "an" (8.44%), and the subject-verb agreement (4.71%), respecitvely. (2) The top three syntactic errors were the misuse of voices (6.99%), the misplacement of verb (4.56%), and the incorrect form of parallel structure (3.92%). (3) For lexical errors, misspelling (7.91%) was found more than the misuse of homonym words (0.15%). (4) The top three semantic errors included the misuse of too specific term (1.00%), the misuse of collocations (0.98%), and the misuse of more general term (0.72%). (5) The top three mechanical errors were the lack of commas (9.97%), the lack of periods (5.10%), and the misplacement of capitalization (2.78%). (6) The frequency of errors made by the experimental group was less than the frequency of errors made by the control group at .01 level of significance (χ^2 = 40.493, df = 4). (7) The main causes of error were the L1 interference (33.33%), the misconception in language rules (31.93%), and other (34.74%)

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Anon Ua-umakul

TABLE OF CONTENTS

TABLE OF CONTENTS (CONTINUED)

LIST OF TABLES

LIST OF FIGURES

Figure **Page**

LIST OF FIGURES (CONTINUED)

Figure **Page**

LIST OF ACRONYMS AND ABBREVIATIONS

AIS	Artificial Immune System
AjP	Adjective Phrase
ANC	American National Corpus
AvP	Adverb Phrase
AWL	Academic Word List
BNC	The British National Corpus
C	Control Group
CEA	Computer-aided Error Analysis
CHILDES	Corpus which contains language used by children
CLC	Cambridge Learner Corpus
COCA	The Corpus of Contemporary American English
E	Experimental Group
EA	Error Analysis
EAP	English for Academic Purposes
ELT	English Language Teaching
ESP	English for Specific Purposes
ICLE	The International Corpus of Learner English
IEP	Intensive English Program
L1	A person's first language or mother tongue
L2	A person's second language
L3	A person's third language
LLC	Longman Learners' Corpus
LSA	The Corpus of Laboratory Scientific Abstract
LSWEC	Longman Spoken and Written English Corpus
M	Modifier
MICASE	Michigan Corpus of Academic Spoken English
MICUSP	Michigan Corpus of Upper-level Student Papers
NP	Noun Phrase
PP	Prepositional Phrase
Q	Qualifier
SST	Standard Speaking Test Corpus
VP	Verb Phrase

CHAPTER 1
INTRODUCTION

This chapter presents some background of this study and points out the research questions, research objectives, research frameworks, and research process in brief, the scope and limitations, the definition of terms used, and pedagic implications respectively.

1.1 Statement and Significance of the Problems

English and Science have important roles in many ways of life. For example, English is necessary for people to search the information on the internet informed in English around 80 percent. Science has given us so many benefits in that it helps us to construct tools and facilities for modern lives. Because of these important roles of both English and science, they were specified in the Thai Basic Education Core Curriculum as mains subject areas and Thai students have to learn in all levels of education.

The importance of English for Science is receiving special attention from the educators and policy makers in the field of teaching English as a Foreign Language. As we can see from Thai Basic Education Core Curriculum, it appears on Standard F3.1: Language and Relationship with other learning areas as follows (Ministry of Education, 2008: 274):

> *Standard F3.1: Usage of foreign languages to link knowledge with other learning areas, as foundation for further development and to seek knowledge and widen one's world view*

This description leads to the details of main English contents that learners have to study. For grade 10 – 12 students, they have to learn English by making a research, making records, summarising and expressing opinions about the data related to other learning areas, and presenting them through speaking and writing (Ministry of Education, 2008: 275). For science, it can be integrated to English by using learning resources from texts or websites that written in English, or designing learning acitivities which English is used in class such as writing laboratory report in English, oral presentation in English, practicing to use language related to science and technology with a vocabulary of around 3,600-3,750 words (Ministry of Education, 2008: 258 - 259).

According to standard F3.1, there are many ways to use English for linking knowledge with science; for example, the writing and presenting scientific report is one interesting learning activity. The Thai learners receive a good opportunity to use English for communication in this subject area and build up many related vocabularies as well. The abstract is one crucial part in scientific report because it helps the readers understand the main parts of report. They are introduction, method, result and discussion, and conclusion (Bazerman, 1995: 465-467 and Swales and Feak, 1994: 210-211). In order to properly write an abstract of scientific report, the learners need to understand the paragraph organization, the usage of English grammar, the usage of technical terminologies and scientific vocabularies. However, it practically appears that Thai learners have problems with writing. For example, Sattayatham and Ratanapinyowong (2008: 17-38) studied the problem about scientific paragraph writing in English made by medical students at Mahidol University. This study was concluded that the two main problems in scientific writing were no transitional words and lack of organization. Besides, my experience in teaching scientific writing in English can revealed some evidences about the scientific writing problems of Thai students. Several errors were found such as subject-verb agreement, the use of passive voice, the use of determiner, the use of plural form and so on.

To solve these writing problems and help students using English language correctly, one approach that teachers can use for identifying errors and analyze the causes of them is error analysis (Corder, 1981: 10-11). It was developed by Corder and his colleagues in 1981 and applied widely in English teaching. Error analysis is a useful approach theoretically and practically. The teachers can understand students' learning process and design syllabus and materials appropriated to their learning styles. Besides, the result of analysis can help students improve their skills and use language correctly. In this study, the students were asked to write two laboratory scientific abstracts in English. Then, the student's corpus is analyzed and identified the common errors by using software programs: Markin 4.2.2 and AntConc 3.2.4. The errors and causes of error were identified, analyzed and implied to teach English for science.

1.2 Objectives of the Study

The objectives of this study were as follows:

1.2.1 To analyze the common errors of writing skills in laboratory scientific abstracts in English made by Thai upper secondary school students.

1.2.2 To compare the errors in written laboratory scientific English abstracts between the students who were taught and were not taught scientific abstract writing in English.

1.2.3 To investigate the main causes of errors in written laboratory scientific English abstracts.

1.3 Research Questions

This study aimed to answer the following questions:

1.3.1 What are the top ten common errors that students make in their laboratory scientific abstract writing?

1.3.2 Are there the statistically significant differences of errors made by the students between the students who are taught and are not taught scientific abstract writing in English?

1.3.3 What are the main causes of errors in laboratory scientific abstract writing?

1.4 Theoretical Framework

The theoretical framework of this study was shown in Figure 1.1 below:

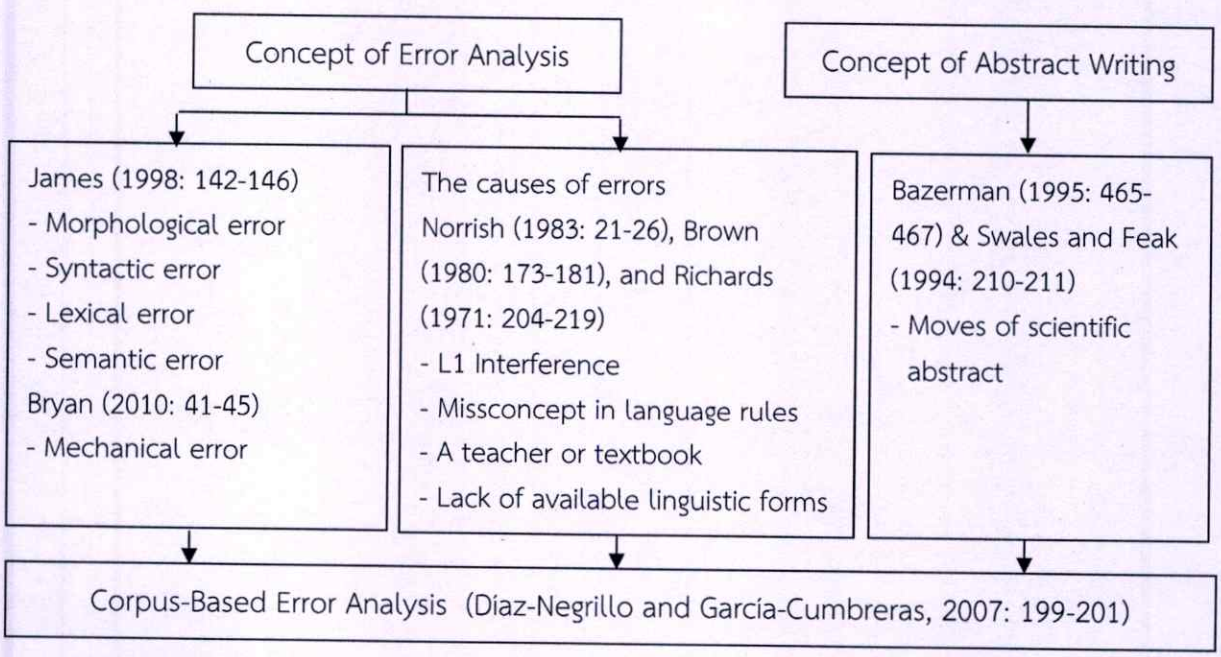


Fig.1.1 A theoritical framework of the research

1.5 Conceptual Framework

The conceptual framework of this study was shown in Figure 1.2 below:

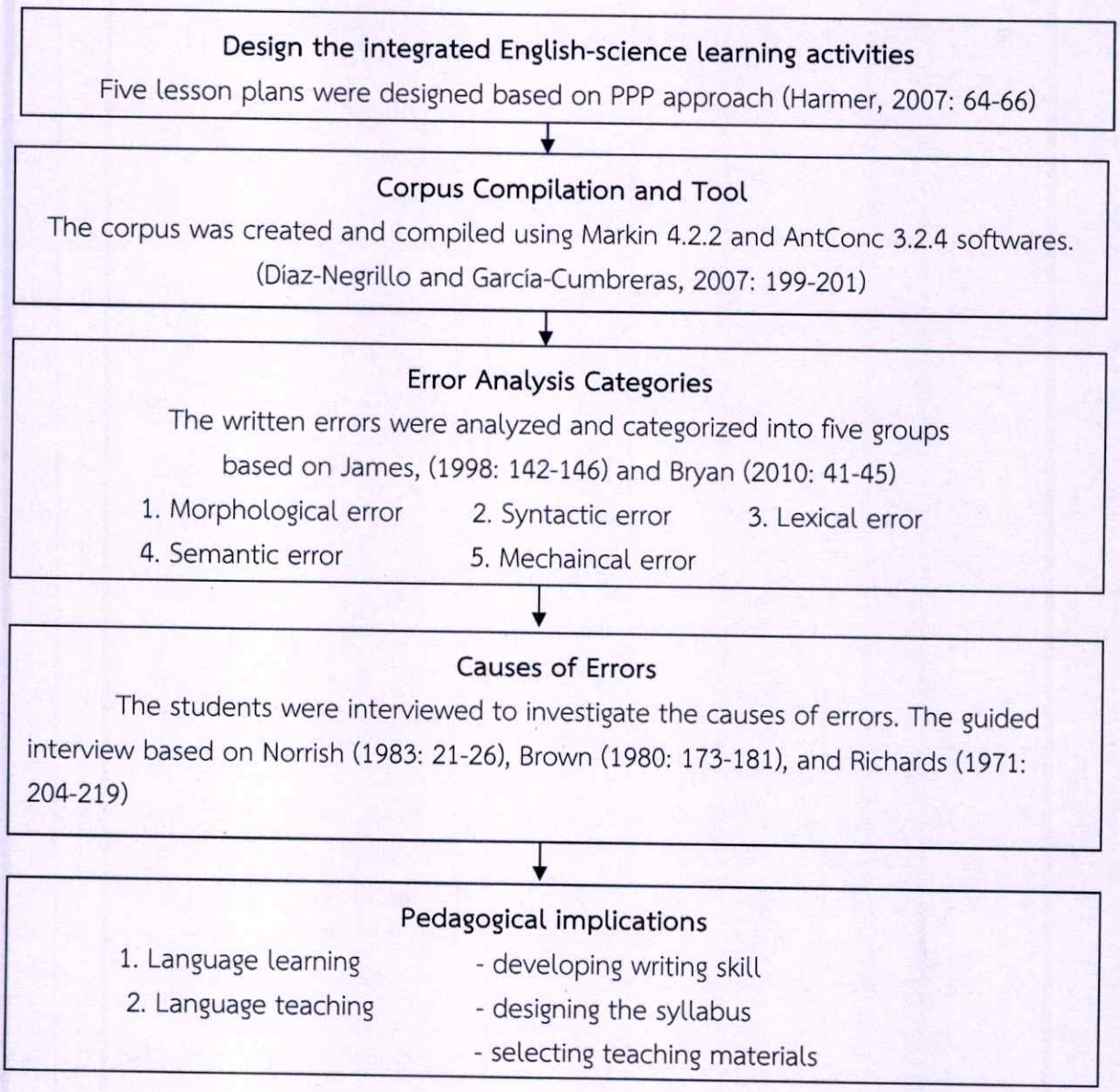


Fig. 1.2 A conceptual framework of the research

1.6 Scopes and Limitations of the Study

This study focuses on investigating the writing skills, not the abstract moves like introduction, method, result and discussion and conclusion. Besides, the students in this study were the upper secondary school students (grade 11) in science and mathematics program at Watsuthiwararam School, Bangkok Thailand. They enrolled in the Physics Laboratory Technique course (SCI 30263) in the second semester of academic year 2014. They were asked to do two scientific physics laboratory and write two English abstracts in these contents: force and electricity.

1.7 Process of the study

The process of the study is as follows:

1.7.1 The concepts of written error analysis, laboratory scientific abstract writing, lesson plan design, and corpus-based error analysis were studied from various resources.

1.7.2 The five lesson plans for teaching the scientific abstract writing were constructed.

1.7.3 The 140 scientific abstracts (approximately 17,000 words) were collected from the students' work in the previous semester of academic year 2013 and used to make a tagset.

1.7.4 The 270 students were classified into two groups by simple random sampling: (1) the experimental group (3 classes) and (2) the control group (3 classes). They were asked to writed two abstracts. So, the total abstracts were 540 pieces.

1.7.5 The 540 pieces of abstracts were compiled and analyzed based on a tagset.

1.7.6 The frequency and percentage of written errors were calculated by using software program: Markin 4.2.2 and AntConc 3.2.4.

1.7.7 The 88 analyzed abstracts (44 pieces from the experimental group and 44 pieces from the control group) were randomly selected by using Yamane Table and checked the validity by three experts (native speakers).

1.7.8 The χ^2 test was used to compare the statistically significant differences of errors made by the students between the experimental group and the control group.

1.7.9 The guided interview of 30 students was set on to analyze the causes of written errors by using content analysis.

1.7.10 The results were concluded and the further studies and pedagogic implication were recommended.

The process of this study was summarized in Figure 1.3 below:

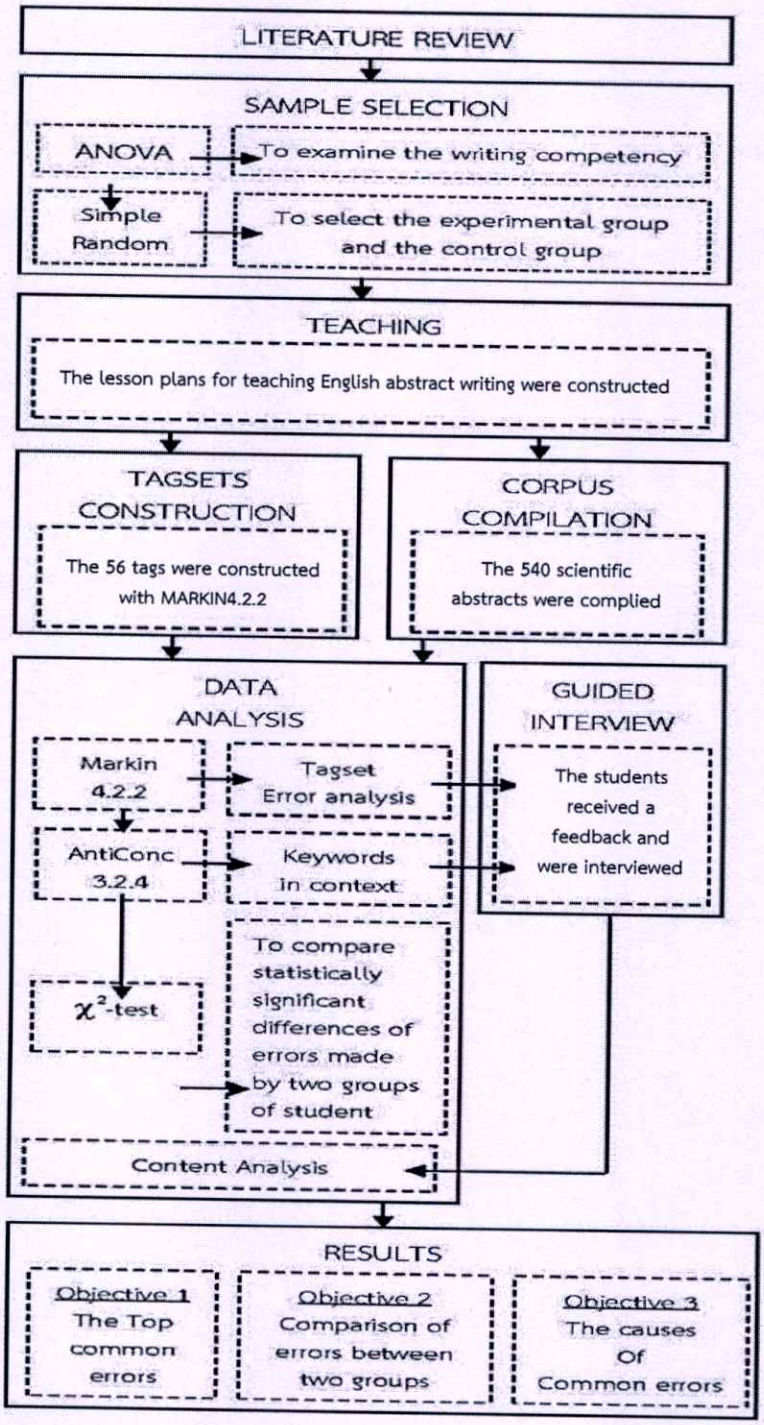


Fig. 1.3 The process of this study

1.8 Definitions of Terms Used

Corpus-based Error Analysis A comparison between the linguistic systems that has been developed by a learner of a foreign language (or L2) who has not become fully proficient in the language which learners are learning. The errors are analyzed by the following steps: 1) collection the learner corpora; 2) construction of tagset and error taxonomy; 3) identification of errors; 4) description of errors; 5) explanation of errors; 6) evaluation of errors. (Corder, 1973: 275; Ellis & Barkhuizen, 2005: 57-69; Díaz-Negrillo and García-Cumbreras, 2007: 199-201)

Errors The instance of language that is unintentionally deviant and is not self-corrigible by learners who have not yet mastered the rules of language. It is divided into five categories: morphological errors, syntactic errors, lexical errors, semantic errors, and mechanical errors. (James, 1998: 142-146 & Bryan, 2010: 41-45).

Learner Corpus Tagset The details of error description and specificity to use on learner corpus (Díaz-Negrillo and García-Cumbreras, 2007: 197).

Morphological Errors The errors occurred from using the incorrect word structure (James, 1998: 154).

Syntactic Errors The errors occurred from using any incorrect items larger than word, i.e. phrase, clause or sentence (James, 1998: 156-161).

Lexical Errors The errors occurred from the use of words that look and/or sound similar (misselection), the literal translation from Thai words to English word (misformations), and misspelling (distortion) (James, 1998: 142-154)

Upper Secondary School Students	Thai Grade 11 students in science and mathematic program at Watsuthiwararam School who enrolled in course SCI30263 (Physics Laboratory Technique) in the second semester, academic year 2014
Experimental Group	The students who were taught the scientific abstract writing in English
Control Group	The students who were not taught the scientific abstract writing in English

1.9 Pedagogical Implications

The pedagogical implication of this study were as follows:

1.9.1 The findings revealed insights into the students' English learning process in laboratory scientific abstract writing skill that is integrated into real situations.

1.9.2 The findings were advantageous for the future students to develop English writing proficiency because the teacher has a better understanding of the problems in writing skill.

1.9.3 The findings were advantageous for the English teachers to consider the appropriate textbooks or other teaching materials. Besides, the teacher can design the syllabus appropriate to the students' learning abilities.

1.10 Chapter Summary

This chapter has highlighted the key current problem in written errors for Thai student, and discussed the research objectives, the theoretical framework, the conceptual framework, the research process, and the scope of this study. The next chapter will review the body of literature in error analysis, scientific abstract writing, corpus-base error analysis, and the synthesis of related researches in Thai and international researched to plan the research design, the data collection, and the data analysis.

The last term, slips, or alternatively lapses of the tongue or pen, or even fingers on the keyboard can quickly be detected and self-corrected by learners. In brief, it can be concluded that mistakes and lapses can be readily-self-corrected. They are random performances caused by fatigue, excitement, or lack of concentration, but the errors are systematic performances and cannot be self-corrected by themselves.

2.1.2 The Concept of Error Analysis

The original concept of the error analysis (EA) was established by Corder and his colleagues. Corder (1973: 275) explains that EA is a comparison between the linguistic system that has been developed by a learner of a second language (or L2) who has not become fully proficient and the language which learners are learning (target language). It is a genre of linguistic study in writing or speaking that focuses on errors the second or foreign language learners who misunderstand the rules of the new language make. The EA becomes a tool of studying second language analysis. In 1980, one concept of error analysis was given By Brown (1980: 166). EA is defined as the processes to observe, analyze, and classify the deviations of the rules of the second language and then to reveal the systems operated by the learner. Moreover, this concept of EA is the same as the one meant by Crystal (1987: 112) that the error analysis is one technique for systematically interpreting, identifying, classifying the errors produced by someone learning a foreign language, using any of the principles and procedures provided by linguistics. Ellis (1994: 68-69) suggests that EA is one of the first methods used to investigate learners. It consists of four stages: collect incidental sample of learner language, identify the errors, describe the errors, and explain them by linguistics ways. To summarize, the linguists in the past define EA is a method of analyzing and interpreting the errors in writing or speaking made by the second or foreign language learners and investigating the language learning process of them.

According to Corder (1974: 122-154), the error analysis has two objectives: the theoretical objective and the applied objective. The theoretical objective serves to explain what and how learners learn when they study a second language, whereas another serves to enable the learners to learn more efficiently by exploiting our knowledge of his dialect for pedagogical purposes. Similarly Richards and et al. (1985: 96), they point out that error analysis may be carried out in order to (a) find out how well someone knows a language, (b) find out how a person learns a language, and (c) obtain information on common difficulties in language learning, as an aid in teaching or in the preparation of teaching materials. In conclusion, EA has two functions: indicate the language learning process of learners and help learners improve their language abilities or skills, especially, writing and speaking skills.

According to Corder's study (1981: 10-11), the learner's errors provide evidence of the system of the language. They are significant in three respects. First to the teachers, they inform the teachers what need to be taught. Second, they provide to the researchers' evidence of how learners are learnt or acquired, and what strategies or procedures the learners are employing in their discovery of the language. Third to the learners, they are a device the learners use in order to learn a language and a way the learners use for testing their hypotheses about the nature of language learning. In addition to this, the errors also can be revealed in their underlying knowledge of the acquired language. Similarly Ferris (2002: 22), EA and corrective techniques are shown that they can help in effective learning and teaching of English because the foreign language is an imperceptible process, during which errors are to be expected at all levels of learning. They are a natural process of learning and must be considered as part of cognition. All of above, EA is an importance for both language teaching and learning. Not only enables teachers to find out the sources of errors, it takes a pedagogical cautions towards them.

2.1.3 Causes of Errors

Many linguists explain the causes of errors. This section presents and discusses the causes of errors as follows:

Norrish (1983:21-26) arranges the causes of error in three types: carelessness, first language interference, and translation. All types of causes of error will be discussed briefly.

1. Carelessness is often closely related to lack of motivation. Many teachers will admit that it is not always the learners' fault if he loses interest, perhaps the materials and/or style of presentation do not suit them. One way of reducing the number of careless errors in written work is to get learners to check each other's work. This will involve learners in an active search for errors and English can be used for a genuine communication while discussing these errors in class.

2. First language interference occurs when learners try to learn new language. The best way that a teacher can do is to re-teach a given structure or vocabularies, in a way which helps the learners to see the language item form as many point view as possible. It is also important that the learners have a chance to use the items in an appropriate situation. This is referred to as 'mother tongue interference'.

3. Translation happens because a student translates his first language sentence or idiomatic expression into the target language word by word. This is probably the most common cause of error. For example, German speaker may say "It makes me nothing out" (German language translation) instead of "I don't mind".

Brown (1980: 173-181) classifies sources of errors into 4 types: interlingual transfer, intralingual transfer, context of learning, and communication strategies.

1. Interlingual transfer is the negative influence of the mother tongue of learners.

2. Intralingual transfer is the negative transfer of items within the target language. It means the incorrect generalization of rules within the target language

3. The context of learning overlaps both interlingual and intralingual transfers. In a classroom context, the teacher or the textbook can lead the learner to make a wrong generalization about the language.

4. Communication strategy is a verbal mechanism for communicating an idea. When linguistic forms are not available to the learner for some reasons, errors may occur. For example, a learner cannot say "I lost my way" he might avoid the use of "way" and says "I lost my road" instead.

Richards (1971 : 204-219) categorizes some causes of error as followings: overgeneralization, incomplete application of rules, false concepts hypothesized, and ignorance of rule restriction. To make it clear, the four classifications above are explained briefly.

1. Overgeneralization generally involves the creation of one deviant structure in place of two regular structures, for examples, "She must goes". This sentence shows a blending of modal verb and the standard third person singular –s suffix are used. The overgeneralization is that by removing the necessity for concord, and overgeneralizing the rule which states that in the present simple there are no suffixes except for the third person singular.

2. Incomplete Application of rules can be seen in the question forms. Richards suggests 2 possible causes here. One is the use of questions in the classroom, where the learner is encouraged to repeat the question or part of it in the answer. For example, a teacher says that "Do you read much?". A student responses "Yes I read much.". Another possible cause is the fact that the learner may discover that he can communicate perfectly adequately using deviant form.

3. False concepts will be familiar to many language teachers, for instance, the use or the present continuous tense in the wrong situation. It occurs due to use English teaching materials to see a series or pictures illustrating a sequence of actions, with the caption in the present continuous although the use of the tense in this context is unnatural.

4. Ignorance of rule restriction often involves the construction of false analogy, that is, the application of rules to contexts where they do not apply. For instance, a learner may use the noun "discussion" and recalls that it is linked to another noun or noun phrase with the preposition "about" (e.g. "A discussion about nuclear energy").

Then, when the verb "discuss" occurs, the learner thinks that it is correct to use the same preposition, lead to "*We discussed about the oil crisis?". Or, similarly, "Ask him to write a letter" may lead to "*Make him to write a letter".

Sabbah (2015: 271) defined the the interference of the mother-tongue is also known as "transfer". Transfer is defined as the effect of the learners first language upon the learners target language. It is classified into two types: 1) positive transfer and 2) negative transfer.

1. The positive transfer refers to the process of using rules from L1 which facilitates or has a positive influence on learning L2. This transfer is mostly due to similarities between L1 and L2.

2. The negative transfer is the transfer of rules from L1 which impedes or has harmful influence on the command of rules of L2. This is due to differences between L1 and L2.

The causes of errors presented by lingusts were summarized into five items as shown in Table 2.1. It is used for defining the framework in this study and analyzing causes of errors.

Table 2.1 The students' causes of errors presented by linguists

Causes of errors	Norrish (1983: 21– 26)	Brown (1980: 173–181)	Richard (1971 : 204–219)
1. L1 Interference	✓	✓	
2. Missconcept in language rules		✓	✓
3. A teacher or textbook lead to errors		✓	✓
4. Lack of available linguistic forms		✓	✓

2.1.4 The Process of Error Analysis

Acorrding to Ellis (2005: 57-69), an error analysis can be distinguished into five steps:

1. Collecting a sample of learner language

Collecting a sample of learner language provides the data for the EA. The researcher needs to be aware that the nature of the sample that is collected may influence the nature and distribution of the errors observed. The learner, language and production factors shown in Table 2.2 can influence the sample collected. Researchers can take account of these factors in two ways. They can control for them, by narrowly specifying the sample they intend to collect. For example, they may define the sample in terms of advanced, instructed, and beginner. Such an approach allows for specific research questions to be addressed in the design of EA. For example, by collecting two such carefully defined sample that vary on a single variable, it would be

possible to investigate the effect of this variable on learner errors. Alternatively, researchers may wish to sample errors more generally by collecting a broad sample reflecting different learners, different types of language and different production conditions. In this case, however, it is advisable to provide full and explicit descriptions of the learner productions that make up the sample so that the effect of different variables on errors. The effect of different variables on errors can be examined by *Post-hoc test.*

Table 2.2 Factors affecting learner errors in samples of learner language (Ellis, 2005: 58)

Factors	Description
A. Learner	
1. Proficiency level	Elementary, Intermediate, or Advanced.
2. Other languages	The learner's L1, Other L2s
3. Language learning background	Instructed, Naturalistic, Mixed
B. Language	
1. Medium	Oral or Written
2. Genre	Conversation, Narrative, Essay
3. Content	The topic of the discourse
C. Production	
1. Unplanned	The discourse is produced spontaneously.
2. Planned	The discourse is produced after planning or under conditions that allow for careful online planning.

2. Identification of errors

The identification of errors involves a comparison between what the learner has produced and what a native speaker counterpart would produce in the same context. The basic procedure is as follows:

2.1 Prepare a reconstruction of the sample as this would have been produced by the learner's native speaker counterpart.

2.2 Assume that every utterance/sentence produced by the learner is erroneous and systematically eliminate those that an initial comparison with the native speaker sample shows to be well-formed. Those utterances/sentences remaining contain errors.

2.3 Identify which part(s) of each learner utterance/sentence differs from the reconstructed version.

3. Description of errors

The description of errors is essentially a comparative process, the data being the original erroneous utterances and the reconstructed utterance. Thus, description of learner errors involves specifying how the forms produced by the learner differ from those produced by the learner's native-speaker counterparts. It focuses on the surface properties of learner utterances. There are two steps:

3.1 The development of set of descriptive categories for coding the errors that have been identified.

3.2 Recording the frequency of the errors in each category.

Two criteria for the development of descriptive categories can be established. The system of categories must be well-developed and elaborated, and thus capable of describing errors with maximum delicacy; it must also be simple and self-explanatory. Two kinds of taxonomy have been used: (1) a linguistic taxonomy and (2) a surface structure taxonomy. It is also possible to combine these. A linguistic taxonomy is usually based on categories drawn from a descriptive grammar of the target language. Such a grammar will include general categories relating to basic sentence structure, the verb phrase, verb complementation, and so on. More delicate categories relating to each of these can then be developed. However, the categories finally chosen for the analysis need to be data driven. That is, rather than start with a fully-elaborated set of categories derived from a descriptive grammar, the analyst should develop categories to reflect the errors identified in the sample. Errors should be classified in terms of the target language categories that have been violated rather than the linguistic categories used by the learner. The latter, a surface structure taxonomy, is guilty of the comparative fallacy, as learners obviously do not set out to modify target language norms. It is possible, however, that learners carry out their cognitive comparisons by noticing how they have simplified, added, misinformed or misordered elements in their utterance, In this sense, then, such a taxonomy might also lay claim to psycholingustic validity. Such a taxonomy is, by self, of less obvious practical use as grammar teaching is organized in terms of traditional descriptive categories. However, it may still be of pedagogic use in helping teachers to show learners how their productions deviated from target language norms.

Table 2.3 An example of error description (Ellis, 2005: 63)

Error	Reconstruction	Linguistic description	Surface structure description
1) The big of them	The bigger of them	Noun phrase; Adjectives; Comparative form	Misinformation-regularization
2) You is watching.	You are watching.	Verb phrase; Subject-verb agreement (plural)	Misinformation-regularization
3) ...was in this corner...	...who was in this corner...	Complex sentence–relative clause–relative pronoun	Omission

Table 2.3 provides an example of a description of errors. It incorporates both linguistics and a surface structure categories. Table 2.4 illustrates how the second step in the description of errors–the recording of error frequency–can be presented. It shows that the majority of errors produced by learners

Table 2.4 An example of frequency of error types (Ellis, 2005: 64)

Error categories	Frequency	% of total errors
A. Descriptive		
1. Noun phrase	1	14.3
2. Verb phrase		
a. Subject-verb agreement	1	14.3
b. Simple past tense	4	57.1
3. Complex sentence	1	14.3
B. Surface structure		
1. Omission	1	14.3
2. Addition	0	0.0
3. Misinformation	6	85.7
4. Misordering	0	0
5. Blends	0	0

4. Explanation of errors

The explanation of errors involves determining their sources in order to account for why they were made. One obvious reason why learners make errors is the difficulty they experience in accessing their L2 knowledge when communicating. If L2

forms have not yet been automatized, they require controlled processing, which places a have demand on learners' information-processing systems. Traditionally, two major processes are identified, distinguishing interlingual errors and intralingual errors.

4.1 Interlingual errors are the result of mother tongue inflences. Here it is necessary to distinguish the effects of transfer and borrowing. Transfer relates to the introduction of a L1 form into the interlanguage system whereas borrowing involves the temporary use of L1 form as a communication strategy but does not entail incorporation of the form into the interlanguage system.

4.2 Intralingual errors reflect the operation of learning strategies that are universal, i.e. evident in all learners irrespective of their L1 such as, false analogy (a kind of over-generalization; an example is boy → boys, child →childs), misanalysis (the learner wrongly assume that the singular progressive pronoun *its* is plural because of the *–s*), incomplete rule application (a kind of under-generalization; the failure to utilize indicative word order in *Nobody knew where as Barbie.*)

5. Error evaluation

Error evaluation is not so much a stage in the analysis of learner errors as a supplementary procedure for applying the results of EA. It involves determining the gravity of different errors with a view to deciding which ones should receive instruction. Planning for an error evaluation study involves the following steps:

5.1 Select the errors to be evaluated. The errors are usually presented either in complete sentences but sometimes in a continuous text.

5.2 Decide the criterion on which the errors are to be judged. The most commonly chosen criterion is gravity (i.e. seriousness) but other criteria are possible (for example, intelligibility or irritability).

5.3 Prepare the error evaluation instrument. This will consist of a set of instructions, the erroneous sentences or text, and a method for evaluating the errors. Common methods used involve ranking the list of erroneous sentences or judging each sentence on a Likert scale (for example, from very serious to not at all serious).

5.4 Choose the judges. It is best to have at least two. The more judges, the better, as this increases the reliability an generalizability of the results. If native-speaker are chosen it is desirable to analyze their judgements separately.

2.1.5 The Taxonomy of Written Errors

The written errors can be categorized into 5 classes: 1) grammatical errors (prepositions, articles, singular/plural, adjectives/adverbs, tense and subject-verb agreement etc.), 2) syntactic errors (coordination, sentence structure, voice comparison etc.), 3) lexical error (distortion, misselections, and misformations), 4) mechanical errors (punctuation, capitalization, using numbers, acronyms, and abbreviation) and 5) semantic errors (confusion of sense relation and collocation). It is possible to discuss these as follows:

2.1.5.1 Morphological Errors

James (1998: 154) explains that morphological errors made when learners have to handle word structure. There are five word types in English: noun, verb, adjective, adverb and preposition. Therefore, a morphological error involves a failure to comply with the norm in supplying any part of some instance of these word classes. James classified the morphological errors according to the word classes as follows:

1. Noun morphological errors

- The determiner-noun agreement such as "six book* (six books)"
- The use of plural such as "childs* (children)"

2. Pronoun morphological errors

- The use of third-person singular such as "Hes* get up and open it (He)."

3. Verb morphological errors

- The verb form such as "bringed* (brought)"
- The progressive –ing such as "was drinken* (drinking)"
- The past tense such as "He cook* it yesterday. (cooked)"
- The voice such as "It cooked* by Fred. (was cooked)"

4. Adverb morphological errors

- The adverb form such as "soonly* (soon)"

5. Adjective morpgological errors

- The comparative degree such as "a colourfuller* scene (more colourful)"

Besides, James indicates that the aspects of erroneousness in morphology were three types: omission, misplacement, and overinclusions.

1. Omission

The error consists of not doing something the writer should have done, or not including something such as an amount or fact that should be included. For example, "The plastic cup is dropped into the water depth (of) 2.31 cm. (omission of preposition)", "A graph is analyzed from (the) y-intercept. (omission of articles)".

2. Misplacement

The error occurs when the writer put the words in the wrong place. For example, "Hes* open the hot water. (-s misplacement)".

3. Overinclusions

The error appears redundant when preceded by numerals and other quantifier as in *every teachers (teacher).

Wakkad (1980: 39-56) classified the morphological errors in eleven types. They were 1) the omission of " s" singular, 2) addition of suffers to infinitive, (3) lack of agreement between subject and verb, (4) lack of agreement between nouns and pronouns, (5) demonstratives, (6) agreement between numbers, (7) irregular verbs, (8) model auxiliaries occurred with simple past, (9) inappropriate plural ending, (10) using other parts of speech than objectives, 11) omission of relative pronouns.

2.1.5.2 Syntactic Errors

James (1998: 156-161) states that syntactic errors made when learners have to handle any items larger than word, i.e. phrase, clause or sentence. Errors in this category include sentence fragments, inappropriate use of relative clauses, inappropriate sentence construction, improper modification, lack of parallelism, and word order. The error types are explained as follows.

1. Phrase structure errors

Phrase structure errors involve violations in the internal relations between parts of phrases. There were as many phrase types: noun phrases (NP), verb phrases (VP), Adjective phrases (AjP), Adverb phrases (AvP) and Prepositional phrases (PP). For doing EA at phase level, he suggests using the tripartite structure: modifier + head + qualifier (HMQ) where M and Q can be refined in terms of positional subclasses M1, M2, M3,.... And Q1, Q2, Q3,... etc. In addition to this, heads also have Ms and Qs, for example, Misselection of the article of the sentence "*a cleverest boy in the class.". The errors are the position M1 in NP. M2 *cleverest,* Head *boy,* and Q *in the class* are unproblematic. The sentence "*no can swim" is misselection and misordering of negator in VP. *Not* is an allomorph of *no* that belongs in M2 position, not M1: can *no/ ✓not swim.

2. Clause errors

Clause errors involve whole phrases entering into the structure of clauses. It is considered in five conditions. Firstly, a clause is superfluous: He shaved himself [*the beard]. Secondly, a clause is omitted: Give *[NP] to the dog. Thirdly, a clause misordered: Watson sent [to him] the letter. Fourthly, a clause misselected: He seem *[crying / ✓to cry]. Lastly, It is a blend or hybrid: *You would be most likely get (first prize) which is an amalgam of ✓You would be likely to get and ✓You would most likely get.

3. Sentence errors

Sentence errors involve the selection and combination of clauses into larger units. The golden rule is only syntactic equals can be joined. The attempting conjoins

unequal clauses lead to broken sentence. For instance, They believe [they can become leaders in their $field_1$] and [a good secure job_2]. The two conjunctions are not equal: in fact the first is a clause and the second is an NP. They have in common is that both are objects of the verb believe.

4. Intersentence errors (Cohesion error)

Cohesion errors involve the reference and conjunctive types between sentences. The former is the relationship of one linguistic expression to another, in which one provides the information necessary to interpret the other. Here is an example of error in reference cohesion marking: Samneric insist that there is a beast. Jack being controlled by *[this fear]. There is no obvious referent of this fear. For the latter, it is an uninflected function word that serves to conjoin words or phrases or clauses or sentences. It may be identified to seven functional sub types: listing (first, next, then), summative (in short, thus, therefore), appositive (such as, for example), resultative (because, accordingly, as a consequence), inferential (otherwise, in that case), contrastive (in other word, on the other hand), and transitional (incidentally, meanwhile, finally). For example, *By the same token if you are too old I am too old also (✓ If you are too old, by the same token I am too old also.)

2.1.5.3 Lexical Errors

James (1998: 142-154) devotes some pages to the discussion of lexical errors and offers a taxonomy which rests on the distinction between form and content-oriented lexical errors. Among the formal errors of lexis, James distinguishes the follows:

1. Formal misselection

Formal misselection in which two existing target language words are confused because of look and/or sound similarity. For example; "It was a *genius (genuine) diamond."

2. Misformations

Misformations which involve the creation of a non-existing L2 word. Three main types of misformations are considered:

2.1 Borrowing. If the mother tongue word is used in the target language with no perception of any need to tailor it to its new host code, it is called "borrowing". For example,"I shoot him with a gun in (*kopf).(kopf = 'head' in German L1)

2.2 Coinage. If the new word (derived from L1) is tailored to the structure of the target language, presumably because the learners think there is a trusty friend, it is called "coinage". For example,"Smoking can be very (*nocive) to health."(nocive= 'harmful', L1 Portuguese= 'nocivo')

2.3 Calque. If the L2 word created is the result of literal translation of an L1 word, it is called "calque". For example,"America has (*made profit)."(benefited = 'profit machen', L1 German)

3. Distortions

Distortions mean misspelling that originating from letter omission, overinclusion (addition), miselection, misordering and blending such as, int(e)rest, fresh(er)man, *delitouse (delicious), *little (little), *deepths (depth + deeps).

2.1.5.4 Semantic Errors

The semantic error types that James (1998: 151-154) distinguishes are as follows:

1. Confusion of sense relations. They imply the confusion of semantically related words. The sub-types of semantic error are:

1.1 Using a more general term where a more specific one is needed. The result is an under the specification of the meaning. For example, "The flowers had a special *smell (scent).

1.2 Using too specific a term. For example, "The *colonels (officers) live in the castle."

1.3 Using the less apt of two co-hyponyms. For example, "She is my *nephew".

1.4 Using the wrong one from a set of near-synonyms. For example, "... a *regretful (penitent) criminal or sinner...."

2. Collocational errors. They result from the association of two words which in native usage do not go together. For example, "There is much turmoil in the Middle *(Orient) East."

2.1.5.5 Mechanical Errors

Bryan (2010: 41-45) states that the mechanical error may be classified as five are as follows:

1. Punctuation

Punctuation are symbols such as a quotation mark (?), a comma (,), a period (.), a hyphen (-), dash (–), colon (:), semicolon (;) that indicates the structure and organization of written language.Here are examples of error in punctuation marks: Japan will design the aircraft (*; /✓,) the United States will provide the technology. The results suggested hypertoxicity (;) however, our advisor disagreed.

2. Capitalization

Capitalization is writing a word with its first letter as a capital letter (upper-case letter) and the remaining letters in lower case. There are many rules of capitalization. For example, it is used for names of seasons whereas it is not used for

names of semesters: "Logically enough, the Spring semester was scheduled in the spring.", The capitalization is not used for directions. It is used for of geographical regions:"If you travel south far enough, you'll wind up in the south".

3. Numbers used as words

Numbers can be used as words in various situations. For examples, numbers that cannot be written in two words are not used in sentences. They use decimal notation to indicate very large or very small numbers: "The Earth has existed for 4.5 billion years.". Numbers are used for addresses, measurements (including temperatures), scores, ratios, page numbers, dates, or times: "Just before my computer crashed, I noticed that my processor was running at 91 °C".

4. Acronyms

An acronym is a formed from the initial components in a phrase or a word such as ATM (Automated Teller Machine), CD-ROM (Compact Disc Read-Only Memory).

5. Abbreviation

An abbreviation is a shortened form of a word or phrase. Usually, it consists of a letter or group of letters taken from a word or phrase such as minutes (min), kilometers (km).

To sum up, the error analysis in this study based on James (1998: 142 – 161) and Bryan (2010, 41 – 45). The errors were classified into five catagories: morphological errors, syntactic errors, lexical errors, semantic errors, and mechanical errors.

2.1.6 Techniques of Error Analysis

After knowing the categories of written errors, attention can be turned to the techniques of error analysis. It is suggested by Norrish (1983: 81-88). There are three different methods of carrying out the error analysis as follows:

1. The Pre-selected Category Approach

For this approach, firstly, the material from which the errors are taken should be representative of the student's standard work as possible. It must be free writing because guided writing will only allow certain errors and those may not be a representative selection. Secondly, teachers will be find the collection they make more flexible if the entries are cross referenced from one selection to another. For example, 'I saw the man was died', three cards are needed: card 1 : died (stored alphabetically in the vocabulary section), card 2 : dead, and card 3 : 'Pairs of words confused'. Finally, if the collection of errors is fair, it can indicate the success of the teacher's work or syllabus.

2. Let the Errors Determine the Categories

This approach is a process of recording errors onto separate cards, one error per card, and then grouping the cards together in boxes. Gradually the sorting produced smaller and smaller groups, until eventually all the cards were accounted

for apart from a handful, which appear in the final two categories in the list. It is suitable only for writing English. It is recommended that all the errors which the teacher records should be on the cards rather than in an exercise book because cards can easily be re-ordered and recategories, whereas the pages of an exercise book cannot easily be moved. If the teachers choose to use this approach, first, the errors should be sorted out from its immediate context. When the several overlapping deviations occur, they need to be isolated, for example, 'My sister and me are wanting brother'. Three cards are needed: card 1 : My sister and I want ... brother, card 2 : My sister and me want a brother, card 3 : My sister and I are wanting a brother. The deviation can be underlined on the card for ease of reference later. The first card would be categorized under 'Determiner' (The indefinite article 'a' is omitted). The second card would be assigned to 'Pronoun' (The form here should be 'I'). The third card would be assigned to a category 'Tense' (The present continuous tense has been used in the place of the normal present simple). However, the advantage of this method is that all the cards can be kept and checked later; the disadvantage of this method is that it is time-consuming.

3. The Quick Check Approach

This approach is more likely to be commonly used by classroom teachers who wish to check quickly. This technique could be used for either speech or writing. By this way, the teachers can note on a checklist where the errors occur and, given sufficient time, note what they are. But main aim here is to note quickly the correct or incorrect use of recently taught forms. The checklist gives the teacher an idea as to the ratio of correct to incorrect forms. In addition to this, it is easier for students to avoid using language items they are not certain about; in other word, to express what they need to write in ways other than those the teacher is hoping to check. If this avoidance is done easily and at no great loss to the students' ability to communicate meaning, this is a useful skill for the students and can be ticked on the checklist.

2.1.7 Error Correction

Error correction is the detection of errors and reconstruction of the original. It helps teachers know what the students have learnt, whereas the students know their own defect in language use.

Norrish (1983: 71-75) presents three ways in correcting written work: checking work in groups or pairs, integrated skill activities, and using a correcting code.

1. Checking work in groups or pairs. This way helps teachers save their time and encourages communication among the students. Students should be seated in such a way that it is easy for them to converse with each other while they look at each other written works. A group of four is convenient and allows quite a large number of communication possibilities.

2. Integrated skills activities. When a teacher feels that corrective work is necessary, the treatment will be much more successful if the written exercise involves the learner in activities that use all the language skills. For instance, a teacher inherits a class at the beginning of the term and discovers that comparative forms are generally wrongly used. The teacher reteaches the comparative, using fairly mechanical exercises taken from any book that the learners are not already familiar with. Then, the teacher devises a role-play exercise in which the comparisons can be used realistically. The construction of a new airport for a particular city or town is one example of role-play. Clearly this role-play would involve some preparation on the part of teachers, but reports of the various groups would include a lot of comparisons. Some groups could represent companies operating within cash and material limits set.

3. Using a correction code. The teachers have found a profitable approach to correction in the use of a code of indications written in the margins or over the errors such as T (tense), WF (word form), WO (word order), S (syntax), A (agreement), etc. This approach will lead learners, if they are given adequate time, to work out for themselves what is wrong, and to go some way towards correcting it.

Harmer (2004: 110-112) suggests the ways of correcting students' written work as follows: selective correction, using marking scales, using correction symbols, reformulation, referring students to a dictionary or grammar book, ask me, remedial teaching.

1. Selective correction. A way of avoiding the proliferation of red ink all over a student's work is through selective correction. This way of making selective correction really effective is to discuss with students what the teacher should be looking out for. If the teachers are going to employ a selective approach, students need to know about it. For example, when teachers tell them that time they are only to be looked at punctuation, they will then concentrate on that aspect of writing especially, something that otherwise they might not do. Selective correction is a good learning tool.

2. Using marking scales. Many teachers use a range of different marking scales when correcting written work and written tests. Teachers may want to give marks out of 10 for each category they have chosen for students (e.g. grammar, vocabulary, coherence, or cohesion). Together with indications of mistakes, such marking scales will help students to focus on the particular areas they need to work on.

3. Using correction symbols. This way has the advantage of encouraging students to think about what the mistake is, so that they can correct it themselves. There is no set list of symbols Different teachers have their own ways of expressing different concepts. However, the following symbols are frequently used:

Table 2.5 Correction symbols in written work (Harmer, 2004: 111)

Symbol	Meaning	Example error
S	A spelling error	The asnwer is obvius.
WO	A mistake in word order	I like very much it.
G	A grammar mistake	I am going to buy some furnitures.
T	Wrong verb tense	I have seen him yesterday.
C	Concord mistake	People is angry.
/	Something has been left out.	He told / that he was sorry.
WW	Wrong word	I am interested on jazz music.
{ }	Something is not necessary.	He was not {too} strong enough.
?M	The meaning in unclear.	That is a very excited photograph.
P	A punctuation mistake	Do you like London.
F/I	Too formal or informal	Hi Mr Frank, Thanks for your letter.

The teacher writes the symbol above or next to place in the student's writing where the problem occurs. The students make the necessary adjustment to their writing.

4. Reformulation. It is a way of showing students how they could write something error correctly. The teacher shows how students write the incorrect sentence. They learn by comparing correct and incorrect versions. Reformulation is extremely useful during drafting and re-drafting.

5. Referring students to a dictionary or a grammar book. Teachers indicate that a mistake has been made and then tell students to go and look the problem up in a dictionary or a grammar book. The advantage of this way is that it encourages students to look at the information with a purpose in mind. They will learn as they correct.

6. Ask me. Teachers can ask students to talk to students so that they can sort out the problem face-to-face.

7. Remedial teaching. This way will be necessary in case the correction can be effected by showing the whole class sentences produced by the students that exemplify the mistake and asking them to help to put them right. It is a good idea for the example mistakes to be anonymous so that no individual student feels held up to ridicule.

2.2 Scientific Abstract Writing in English

2.2.1 The Concept of Abstract

An abstract is one part of a paper that aims to assist reader to get through the whole paper quickly. It usually includes purpose, method, results, and conclusion. The abstract can be divided into two types: an indicative abstract and an informative abstract. Swales and Feak (1994: 210-217) explain that the former is found in review papers or reference reports of government documents or in literature. The main function of this abstract is to help the readers understand the scope of the article, the main finding of the paper, but it does not go into the detail. The latter is found in a conference paper or journal, or research paper. It informs the reader known what the paper contains. It will also include purposes, methods, paper's results, and conclusions. This abstract has three main functions. First, it shows readers what the article as a whole is about and to help them to decide whether to carry on reading. Second, it is to serve as a text itself but in a precise version to give readers a picture for determining whether the subject matter is related to their interests. Lastly, it is to prepare the reader for the main details should they decide to read the complete article.

However, Swales and Feak (1994) indicated that conference abstract can be indicative or informative, depending on whether the work has been finished. If the work has been finished, it is informative. For example, three experiments are planned, but a researcher has results from only two of them. The abstract may not be entirely informative, so it is indicative. Furthermore, it depends on the field of study. For instance, a scientist has to put information about the experiment in the abstract; therefore, it is to be informative.

According to Bhatia (1993), an English abstract includes four basic moves: purpose, method, results, and conclusions. This pattern is called "moves" and accepted by many linguists such as Swales. He states that abstracts usually contain information such as the followings: The first move (introducing proposes) clearly indicates the objectives of research and underlining hypothesis that forms the basis of the study. The second move (describing methodology) gives a precise description of the research design, including information on how data were collected and methods or procedures used. The next one, summarizing results, an author reports the findings. The last move (presenting conclusions) usually interprets results and makes inferences.

2.2.2 The Characteristics of Scientific Abstracts

Bazerman (1995: 465-467) explains that a scientific abstract provides an overview of the entire experimental report, particularly focusing on a brief description of the experiment, the results, and conclusion. It helps the reader to decide whether the article would be interesting to explore greater detail and to serve as a kind of guideline for readers oriented to the material. Cross and Oppenhiem (2006: 428-446) simply states that the scientific abstract is a condensed document and represents the main contents of a research article. It is an important part in a paper or an article. There are many reasons for the importance of abstracts. First, it saves reading time, as the reader is able to ascertain as to whether the full text document is likely to be of sufficient interest to warrant reading in its entirety. Second, they help overcome the language barrier. They allow the reader access to the central themes of an article written in a foreign language. Third, they can provide some language preparation for the text by using key words and ideas that are used in the full text document. Fourth, if they are well written abstracts, they can serve as a key to understanding fully the argument of the original article. Last, they serve the function of a current awareness tool.

Bazerman summarizes the elements of scientific abstract as follows: introduction, method, result and discussion, and conclusion.

1. The introduction. The introduction presents the background of previous work in both theory and experiments that led to the current hypothesis being tested. The hypothesis may be an original one or one taken from a previous researcher in the field. The introduction, which establishes the logic and purpose of the experiment in terms of prior work published in the field, helps the reader see exactly what the experiment is designed to prove.

2. The method. The experimental design should be explained in the section in procedure, materials, and apparatus in order to indicate how the experiment isolates those factors to be measured and eliminates any possible interfering factors. The description of the experimental design should also indicate a method of observation and measurement that will achieve precision and decrease personal bias. Finally, the description should be clear and precise enough to allow another experimenter to re-create the experiment and confirm your results.

3. The results and discussion. The report of results should, of course, be as accurate as the experiment allows. It means the experimenter should indicate the degree of accuracy. The result of percent error should be discussed and compared with known results.

4. The conclusion. It is a concise statement that answers the objective.In organizing information outward from the specifics of the experimental results to a

comparison with other published findings and then the conclusions about the original issues or problem, the concluding parts of a report reverse the organization of the introduction. The introduction moves in from the general problem with the literature to the specific research; the concluding section moves out from the specific research to its wider implications. Just as the introduction identifies a gap that current research fills, the conclusion integrates the research into the knowledge of the field.

2.2.3 Abstract Writing in English

According to Swales and Feak (1994: 210-211), they also offered two approaches to write abstracts in English which are "results-driven" abstract and "a research paper summarizing". The first approach is concentrated on the findings, and what might be concluded from them. The other approach summarizes the section of the research such as purpose, method, findings.

In addition to this, Graetz (1985: 212) gives these linguistic specifications as characteristics of abstracts: 1) The use of full sentence, 2) The use of the past tense, 3) The use of impersonal passive, 4) the absence of negatives, and 5) The avoidance of abbreviation, jargon, symbols and other language shortcuts that might lead to confusion. It seems clear that tense usage in abstracts is fairly complicated. First, the conclusions are nearly always in the present. Second, it often uses the present or present perfect for their opening statements, Third, there appears to be considerable disciplinary and individual tense variation with sentences dealing with the result.

2.3 The Corpus-based Error Analysis

2.3.1 The Concept of Corpus Linguistics

In linguistics, a corpus (plural corpora) or text corpus is a large and structured set of texts (nowadays usually electronically stored and processed). It is a principled collection of naturally occurring examples of language stored electronically (Bennett, 2010: 2). Corpora are the main knowledge base in corpus linguistics. They can contain written or spoken (transcribed) language, modern or old texts, texts from one language or several languages. The texts can be whole books, newspapers, journals, speeches, or consist of extracts of varying length. The kind of texts included and the combination of different texts varies between different corpora and corpus types. In general, corpora consist of general texts, texts that do not belong to a single text type, subject field, or register such as the British National Corpus. Besides, corpora can consist of texts in one language or language variety only or of texts in more than one language. If the texts are the same in all languages, translations, it is called a parallel corpus.

Corpus linguistics is used to analyze and research a number of linguistic questions and offers a unique insight into the dynamic of language which has made it one of the most widely used linguistic methodologies. In short, corpus linguistics serves to answer two fundamental questions: (1) What particular patterns are associated with lexical or grammatical features?, and (2) How do these patterns differ within varieties and registers?. Many corpus linguists have contributed to the development of modern-day corpus linguistics: Leech, Biber, Johansson, Francis, Hunston, Conrad, and McCarthy, to name just a few. However, they consider John Sinclair to be one of the influential scholar of modern-day corpus linguistics. Sinclair detected that a word in and of itself does not carry meaning, but the meaning is often made through several words in a sequence. This is the idea that forms the backbone of corpus linguistics.

2.3.2 The Characteristics of Corpus Approach

The corpus approach (Biber, Conrad, and Reppen, 1998: 4) is comprised of four major characteristics:

1. The corpus approach is empirical, analyzing the actual patterns of language use in natural texts. The key to this characteristic of the corpus approach is authentic language. The idea that corpora are principled has been mentioned but not what language a corpus is comprised of. Corpora are composed from textbooks, fiction, nonfiction, magazines, academic papers, world literature, newspapers, telephone conversations at home or work, cell phone conversations, business meetings, class lectures, radio broadcasts, and TV show, among other communication acts. In brief, any real-life situation in which any linguistic communication takes place can form a corpus.

2. The corpus approach utilizes a large and principled collection of naturally occurring texts as the basis for analysis. This characteristic of the corpus approach refers to the corpus itself. It involves to a written corpus, a spoken corpus, an academic spoken corpus, and so on.

3. The corpus approach makes extensive use of computers for analysis. Not only do computers hold corpora, but also they help analyze the language in a corpus. A corpus is accessed and analyzed by a concordancing program. In short, the linguist can not effectively utilize corpora, or employ the corpus approach, without a computer.

4. The corpus approach depends on both quantitative and qualitative analytical techniques. This characteristic of the corpus approach highlights the importance of the intuition as expert users of language. The quantitative results generated from the corpus and then analyze them qualitatively to find significance.

2.3.3 Type of Corpora

A corpus is a principled collection of authentic texts stored electronically that can be used to discover information about language that may not have been noticed through intuition alone. Because most published materials based on corpora make use of large, general corpora, many readers may believe this is the type of corpus that can be useful in the classroom. Actually, there are approximately four types of corpora: generalized, specialized, learner, and pedagogic. They are useful for employing the corpus approach directly in the classroom. (Bennett, 2010: 12-14).

1. Generalized Corpora

The broadest type of corpus is a generalized corpus. Generalized corpora are often very large, more than 10 million words, and contain a variety of languages so that finding from it may be somewhat generalized. Although no corpus will ever represent all possible languages, generalized corpora seek to give users as much of a whole picture of a language as possible. The British National Corpus (BNC) and the American National Corpus (ANC) are examples of large, generalized corpora. The Corpus of Contemporary American English (COCA) is also an example of a generalized corpus. These large generalized corpora contain written texts such as newspaper and magazine articles, works of fiction and nonfiction, as well as writing from scholarly journals; these corpora also contain spoken transcripts such as informal conversations, government proceedings, and business meetings. If generalizations about language as a whole are to be drawn, a large, general corpus should be consulted.

2. Specialized Corpora

A specialized corpus contains texts of a certain type and aims to be representative of the language of this type. Specialized corpora can be large or small and are often created to answer very specific questions. Examples of specialized corpora include the Michigan Corpus of Academic Spoken English (MICASE), which contains only spoken language from a university setting; the CHILDES Corpus which contains language used by children; the MICUSP, Michigan Corpus of Upper-level Student Papers, a collection of papers from a range of university disciplines; and a medical corpus containing language used by nurses and hospital staff. Specialized corpora are often used in ESP setting. The Academic Word List (AWL), for instance, was generated from a specialized corpus of academic texts

3. Learner Corpora

A learner corpus contains written texts and/or spoken transcripts of language used by students who are currently acquiring the language. Learner corpora are often tagged and can be examined, for example, to see common errors students made. A well-known learner corpus is the International Corpus of Learner English (ICLE), which contains essays written by English language learners with 14 different native languages.

While the ICLE is more generalized, containing writings from learners with 14 different native languages, other learner corpora are more specialized; for example, the Standard Speaking Test Corpus (SST), comprised of oral interview tests of Japanese learners. When a corpus is tagged, each word included in the corpus has a marker added to it that gives additional information. Often, tags are part of speech markers, enabling users of corpora to search not only for specific words, but also for specific words used as a particular part of speech. Targeted instruction can be developed for general language teaching or for specific language groups depending on the type of learner corpus.

4. Pedagogic Corpora

A pedagogic corpus is a corpus that contains language used in classroom settings. Pedagogic corpora can include academic textbooks, transcripts of classroom interactions, or any other written text or spoken transcript that learners encounter in an educational setting. Pedagogic corpora can be used to ensure students are learning useful language, to examine teacher-student dynamics, or as a self-reflective tool for teaching.

2.3.4 Corpora for Language Teaching

Over the past two decades, the corpora and corpus evidence have not only been used in linguistic research but also in the teaching and learning of languages. There is now a wide range of fully corpus-based reference workssuch as dictionaries and grammars available to learners and teachers, and a number ofdedicated researchers and teachers have made concrete suggestions on how concordance and corpus-derived exercises could be used in the language teaching classroom, thussignificantly enriching the learning environment. The corpora can be applied to the areas of language teaching: phraseology, lexicogrammar, registers, ESP, nuances of language, and appropriate syllabus design (Bennett, 2010: 8-12).

1. Phaseology

Phraseology is the study of phrases. It is a central element of corpus linguistics that determined the meaning of a word is found through several words in a sequence, through phrases. Phraseology includes the study of collocations, lexical bundles, and language occurring in preferred sequences.

1.1 Collocation

The most prominent way of study phrases in through collocation. Collocation is the statistical tendency of words to co-occur. This means that when one word is used, there is a high statistical probability that a certain word or words will occur alongside of it. Collocations can also help us better understand particular words used in a certain phrase. Studying collocations provides a deeper understanding of the meaning and use of a word, such as deal, than simple studying a word alone.

1.2 Lexical Bundles

Phraseology also looks at variation in somewhat fixed phrases, which are often referred to as lexical bundles. A lexical bundle as a recurring sequence of three or more words. In conversation, "Do you want me to" and "I don't know what" are among the most common lexical bundles. It is important to understand that lexical bundles are different from idioms. Idioms have a meaning not derivable from their parts, unlike lexical bundles, which do. Also, lexical bundles are not complete phrases. Most important, lexical bundles are statistically defined, and idioms are not. One type of lexical bundles is a frame that has set words around a variable word or words. One example of the use of frames is the expression of future time. In the Corpus of Contemporary American English, multiple words are used to express future time using the frame is....to: is going to, is likely to, is expected to, is supposed to, is about tom is due to. Is and to are the set words of the frame.

1.3 Preferred Sequence

Phraseology also includes the study of preferred sequences of words such as interested and interesting. The learners often confuse two words, and explanations of their different meanings do not usually help students use the words correctly. The corpus study can give students the ability to use the individual words correctly by providing an established pattern of use for each word.

2. Lexicogrammar

Another area of language teaching that corpus linguistics addresses is lexicogrammar. It is explained that there is no difference between lexis and grammar, or that lexis and grammar are so closely intertwined that they cannot be productively studied separately. Certain lexical items fall in certain patterns and certain patterns contain certain lexical items. An example of the idea of lexicogrammar includes certain words (lexicon) associated with certain verbs tenses (grammar): *know, matter, and suppose* occur more than 80 percent of the time in the present tense while *smile, reply, and pause* occur more than 80 percent in the past tense (Biber et al., 1999: 459).

3. Register

The third area of language teaching that corpus linguistics addresses is register. A register is defined as situation of use. It is used in different language with different audiences at different times and for different reasons. Register can be broadly defined –spoken versus written– or more narrowly defined –conversation versus news or even separate parts of a research paper. Corpus linguistics addresses language teaching through the study of registers by illustrating the various phraseology and lexicogrammar used from register to register. For example, 90 percent of lexical bundles in conversation are declarative or interrogative clauses (Biber et al., 1999: 999).

In dirrerent registers, corpora present the differences of use in language such as word frequency, word meaning and use, and grammatical frequency.

4. English for specific purposes (ESP)

ESP is probably one of the most obvious and pointed applications of corpus linguistics. The areas of register, lexicogrammar, and phraseology can all be applied to specific purposes. The Academic Word List (AWL) is a well known example of using corpus linguistics to address ESP, in this case, academic purposes. By investigating a corpus comprised of academic language. It is presented the most frequent vocabulary words used in academic texts; the list is made for instructors to help students focus their vocabulary study. A project is also underway to further that study by investigating the phraseology and lexicogrammatical patterns of the top words in the AWL. Like the corpus created using academic texts to compile the AWL, corpora can be created and investigated for a myriad of purposes. Right now corpora exist for nurses and health care professionals, air traffic controllers, and switchboard operators, just to name a few. Iowa State University has used a corpus of research articles for each major of its graduate students in order to help them write research articles in their designated field.

5. Nuances of Language

Another area that corpus linguistics addresses in language teaching is nuances of language; like ESP, they are also a sort of combination of the area of language teaching addressed by corpus linguistics. Nuances of language refer to questions that students might ask that teachers just do not know the answers to. Often, the questions specifically related to areas of collocation and frequency. For example, when do you use *is not* versus *isn't*? The teachers likely to tell students that there is probably not really any difference between them. But corpus linguistics can answer the question. It was found that *is not* being used more with pronoun and *isn't* with the noun.

6. Syllabus Design

The final area of language teaching that corpus linguistics addresses is syllabus design. Phraseology, lexicogrammar, register. ESP, and nuances of language can be used to more accurately and effectively design syllabi by helping us see what students really need to know about language: frequency and collocation for vocabulary, grammar patterns for different registers, and specific knowledge for specific purposes. For example, the present perfect appears in almost every grammar textbook. It is usually defined as "recent past" or "completed action." However, a corpus study revealed that more than 80 percent of the time, the present perfect is used to signify "indefinite past". The statistics of this kind help textbook writer, course designers, and teachers set priorities for the classroom. The teacher is armed with this kind of

knowledge, and design materials with information that is relevant for students.

The examples of corpus-based activities and ideas for material design are shown as follows (Al Saeed, Neveen and Salma, 2019):

6.1 Elementary students: Collocations: make/do

Example 1: *Verb pairing game*

The verb pairing game can be done after the teacher highlights some collocations to the students. After that, students will be divided into two groups. Group 1 will have some corpus-derived sentences without the verbs make and do. Group 2 will have the verbs make or do. Students in both groups will stand in lines facing each other. The ones carrying verbs will take turns trying to pair their verbs with the sentences the other group has.

Example 2: *Screen shot analysis*

After introducing the idea of corpus in class, a data show could be used to illustrate how frequent nouns occur with certain verbs and not others.

6.2 Lower intermediate students: Modal verbs

Example: *Contextual Analysis*

Students will be given a number of sentences obtained from any of the two corpora used in this analysis. They should try to analyze the context of each to see why one modal verb is used rather than the other. For example, students could be given the following sentence and asked why *have to* is used instead of must. This activity can be done in pairs or small groups. For instance:

1. You *should* be out there doing something for somebody else instead of just feeling sorry for yourself.

2. You *must* be angry at him. Laura, what are you saying to people now?

3. I *have to* go to Pittsburgh on Wednesday. I will be admitted on Monday and Wednesday.

6.3 Upper intermediate students: Phrasal verb

Example: *Cloze activity*

Students will be given a worksheet with some sentences from the corpus. Phrasal verbs will be deleted. They have to fill in the blanks with the family-related phrasal verb that is suitable to the text. After they finish, they will compare their answers with a partner. The teacher will then display the correct answers to the whole class and they can all discuss why certain phrasal verbs are used. For instance:

Fill in the gaps with the correct form of the phrasal verbs below.

1. The little girl said that when she_____, she wanted to be a flight attendant.

2. Many parents don't like to punish their children by hitting them; they prefer to _____ the children _____ instead.

6.4 Advance students: Idiomatic Expressions

Example1: *Concordance Analysis*

After training students on how to use online corpora, you can ask them to search for the idiomatic expressions and analyze the concordance lines to see how these idioms are contextualized and used by native speakers. Following are some idiomatic expressions with the verb break.

1. Break a leg meaning to wish good luck With luck, I will break a leg or something.

2. Break bread meaning to eat together Joshua Morris had not invited him to break bread in Clungunford.

3. Break the mould meaning to do something in different way. This seemed a refreshing attempt to break the mould of British politics.

Example 2: *Situation analysis*

This activity could be done after students are introduced to the different uses and meanings of apologies. For this activity, students will be divided into groups. Each group will receive corpus-based dialogues on flash cards, and students will decide the meaning and the level of sincerity of the apology. Examples of corpus-based dialogues:

1. We apologize for the delay, which has been caused by traffic jam.
2. I am sorry but you will have to leave.
3. I am sorry, the table is reserved.

2.3.5 The Learner Corpora related to Error Analysis

A learner corpus is a computerized textual database of the language produced by foreign language learners. Generally, learner corpora are important because they show the needs of learners. For example, by examining a computerized error corpus, the language teachers have access not only to learner errors, but also to learners' total interlanguage (Granger, 1998: 6). There are the learner corpora that involve the error analysis as described below:

1. International Corpus of Learner English (ICLE)

One of the most important learner corpora is ICLE, which provides a computer collection of essays written by advanced learners of EFL, such as university students of English in the third or fourth year of study from different native language backgrouds. ICLE was launched in 1990 by Dylviane Granger. It is important because it was the first learner corpus created in an academic setting and used as dependable evidence on learners' errors in many researches (Pravec, 2002: 83-84).

2. Cambridge Learner Corpus (CLC)

The Cambridge Learner Corpus is a 16 million-word corpus of Learner English collected by Cambridge University Press in collaboration with the University of

Cambridge Local Examinations Syndicate (now Cambridge ESOL). It comprises English examination scripts, transcribed retaining all errors, written by learners of English with 86 different mother tongues. The scripts range across 8 EFL examinations and cover both general and business English. A 6 million-word component of the corpus has been error coded to date, using an error-coding system devised at CUP specifically for the Cambridge Learner Corpus. The Cambridge Learner Corpus, with the error coding and corpus tools developed for its exploitation, is providing lexicographers, researchers, ELT authors and examiners with easy, direct access to a fund of information which they can interpret and use for widely varying applications (Nicholls, 2003: 572).

3. Longman Learners' Corpus (LLC)

The students and teachers throughout the world send in essays and exam scripts to help create the Longman Learners' Corpus, a 10 million word computerized database made up entirely of language written by students of English from over 70 different countries. Every nationality, every language level is represented in the corpus and this provides an unprecedented insight into learner English. Each student essay is coded by nationality and language level, and then entered into the computer to form part of the corpus. A word or a phrase and view the errors made by the entire gamut of students are focused on. The Longman Learners' Corpus offers so much invaluable information about the mistakes students make and what they already know, that it is the perfect resource for lexicographers and material writers who want to produce dictionaries and textbooks that address students' specific needs. The Longman Learners' Corpus was used to write the Usage Notes in the Longman Active Study Dictionary, evidence from the corpus showed that there was 100% errors in the meaning and the use of the word *cloth* (Turton and Heaton, 2009: V; Turton and Heaton, 2013: Online).

2.3.6 Creating Corpora

Bennett (2010: 14-16) explained that creating a corpus, there must be a focus on three factors. Firstly, the corpus must be principled, it must use authentic texts, and it must have the ability to be stored electronically. A corpus is principled, meaning that the language comprising the corpus cannot be random but chosen according to specific characteristics. Having a principled corpus is especially important for more narrow investigation; for example, if the teachers want their students to look at the use of signal words in academic speech, then it is important that the corpus used is comprised of only academic speech. A principled corpus is also necessary for larger, more general corpora, especially in instances where users may want to make generalizations based on their finding. In creating the Longman Spoken and Written English Corpus (LSWEC), a forty million-word corpus created to identify and understand

grammatical patterns in English –the corpus that the information in the Longman Grammar of Spoken and Written English is based on– the compilers included a representative sampling from conversation, fiction, news, and academic prose. Whatever the purpose of the corpus, it must be principled.

Secondly, a corpus must also include authentic texts. Although there is debate over the definition of "authentic" texts in second language teaching, for purposes of this discussion, authentic texts are defined as those that are used for a genuine communicative purpose. In the Michigan Corpus of Academic Spoken English (MICASE), only speech acts that naturally occurred in the course of routine daily events at a university are included. The Longman Spoken and Written English Corpus (LSWEC) includes texts from daily newspapers that were distributed and conversations that took place during participants' weekly routines. The main idea behind the authenticity of the corpus is that the language it contains is not made up for the sole purpose of creating the corpus.

Lastly, a corpus is stored electronically. Corpora can be saved in text format (.txt), rich text format (.rtf), and/or web-based format (.html), or others, depending on the concordancing program used to access texts. The electronic storage and easy accessibility of texts is one of the major factors that allows corpus linguistics to be applied in the classroom.

To create a corpus, one way to gather principled, authentic texts that can be stored electronically is through various resources. Textbooks can be used to create a pedagogic corpus to investigate the language of academic textbooks. This would be especially useful for students enrolled in an Intensive English Program (IEP) or an English for Academic Purposes (EAP) program. *Learner corpora* can be created from the compilation of student work taken from one particular class, for one particular student, or from a series of students and classes. Students can analyze their own language use and pinpoint areas that need further instruction or document progress that has been made.

An important aspect related to creating corpora is the issue of copyright, especially if finding from a corpus will be distributed via a handout or published in any form. Contact Internet sites for their permissions policy, and always get students' written permission before using their work for any purpose.

2.3.7 Using Computer and Learner Corpus for Error Analysis

The computers and media have been used widely in language learning and teaching for many decades including the error analysis. They are used for analyzing the errors automatically in both written and spoken and called that Computer-aided Error Analysis (CEA). The main elements of error analysis by using CEA are a learner corpus and an error tagset for annotation of errors in the corpus. The error tagset or tagging

system is aimed at details of error description and specificity to use on learner corpora (Díaz-Negrillo and García-Cumbreras, 2007: 197).

Descriptive details are reached in this taxonomy by the incorporation of several sets of information in tags consisting of (Díaz-Negrillo and García-Cumbreras, 2007 : 198):

1. Identification of the units under description. The unit where the error is found and identified on the tag with, for example, a punctuation mark for punctuation errors, information for grammatical and lexical errors, syntactic functions for syntactic errors, and so on.

2. Distinction between internal and external errors. They are under the major category of word grammar, where the former refers to errors involving flawed construction of a unit, e.g. *childs, and the latter refers to errors involving incorrect use of an existent realization or item, e.g. *everybody in the world have access to it.

3. The narrow linguistic subcategorization of errors. In each of the cases, linguistic information is provided alongside a linguistic level definition, relating surface structure modifications (omission, substitution, misordering and misselection), and/or a subcategorization of the linguistic level.

Díaz-Negrillo and García-Cumbreras (2007: 199-201) presented that the error analysis, in practice, relies on the evidence found in learner corpora collected from students around 40,000 words. The learner corpora are analyzed to build the tagset and the error taxonomy with CEA. The process for analyzing the errors is divided into two stages. At the first stage, the sample corpus around 17,000 words is analyzed for errors and a pilot taxonomy. Then, tagset is built. This stage is annotated with a preliminary rudimentary version of the tagset so as to have a closer look at the errors of actual data. Based on the preliminary annotation of the sample, at a second stage, the whole learner corpora are analyzed by using computer software. There are many computer tools have been used for error analysis and development for a decade.

Wang and Lin (2003: 608-615) presented "Two Distance Applications Support English Distance Learning" that was developed through multimedia database and Internet Technologies called English multimedia corpus. English articles, dialogs, and videos were included in this system. The system concentrated to teach English grammar and allowed teachers to understand the most frequent mistakes. The main function of this system was to query the English sentence pattern through keywords from the English multimedia corpus and detect grammatical errors in written English.

Naber (2003: 3-5) designed a Rule-Based Style and Grammar Checker. It was a project aimed to provide an open source style and grammar checker for the English language. This tool uses Rule-based checking technique. In this approach, the system generates a text and returns a list of possible errors. For its purposes, each of the

words in the text is assigned its part-of-speech tag and each sentence is split into chunks. The results are processed further by matching all the checker's pre-defined error rules. Each rule includes an explanation of error and is shown to user.

Amoah, Lupiana and Ghemri (2006: abstract) used a Sentence Analyzer and Viewer for Detecting Grammatical Errors system, which aimed to identify grammatical errors in a sentence and has been implemented using Prolog language. This system was able to detect agreement errors in sentence and display helpful messages to learners. The tool used the stages in natural language processing which accesses tokenization, lexical analysis and syntactic analysis to analyze the learners' input.

Kumar and Nair (2007: 348-357) constructed English Grammar Checking that was a system that applied Artificial Immune System (AIS) based technique as an approach for grammar checking. This grammar checker has been implemented using JAVA (a computer programming language). It used Reuters-21578, Distribution 1.0 text as a corpus and was tagged for part of speech. It could detect any grammatical construct outside the corpus and identify it as an error.

Omar, Razali, and Daras (2009: 475-482) developed Markin 3.1 for was used to speed up the process of analyzing the essays of errors. The annotation buttons in the software were first customized accordingly based on the error classification scheme. Markin 3.1 was a correction tool that allows instructors to mark written work submitted by students in the form of electronic documents. It provided five marking facilities; annotation buttons, add feedback, add comment, add a grade, and compile error statistics.

Givon (2011, online) suggested the advent of computer spell checkers proved to be a very useful tool for writers, enabling them to produce texts with lower error rates. Ginger was a software which provided a contextual grammar and spell checker which uses advanced artificial intelligence techniques to correct entire sentences based on context. It was developed by Karov, a professional in the field of natural language processing and machine learning. Ginger was designed as a writing and learning platform. In addition to, correcting the errors that users made Ginger also provided reports of the users' frequent errors over time. Ginger did this by looking at the whole sentence, and working out from context which words were incorrect. It automatically corrected unusual spelling mistakes, misused words and grammar errors. Ginger software can also be worked in MS Word, Outlook, Chrome as well as Firefox.

In summary, CEA tools of corpus linguistics can be used to generate comprehensive lists of specific error types, count and sort them in various ways and view them in their context and alongside instances of non-errors. It is a powerful technique which will help ELT materials designers produce a new generation of pedagogical tools.

2.4 Research Related to Error Analysis

Research on written error analysis have been examined by many linguists or educators. The following are summaries of some studies which have been done in written error analysis.

2.4.1 International Research

The summary of international research was shown in Table 2.6 below.

Table 2.6 The Summary of Error Analysis (EA) International Research (2009-2013)

Author(s) Year, country	EA Theory / Genre	Title	Participants / Instrument	Finding
Zhang (2013), China	- Based on Corder (1978), Selinker (1985), James (2001) - The learner corpus of descriptive essays	A Corpus-based Error Analysis of Students' Writing in Graded Teaching Classes	Participants: The students in graded English teaching classes in Shanghai Publishing & Printing College. (The students are classified into two classes, higher level (A) and the lower level. (B)) Instruments: AntConc software	1. The three most significant errors by the students are sentence errors, wording errors and collation errors. 2. The causes for the errors are communication strategy, mother tongue interference, and overgeneralization. 3. The number of CC errors by the students in class B is less than that by those in class A. 4. The students in class A can get high scores in writing, when they make less mistakes in spelling, sentence structure and conjunction words.
Zawahreh (2012), Jordan	- Based on Wakkad (1980) - Narrative essays	Applied Error Analysis of Written Production of English Essays of Tenth Grade Students in Ajloun Schools, Jordan	Participants: 350 students selected randomly from group of schools in Ajloun.	1. The most morphological errors within was errors of lack of agreement between subject and the main verb. 2. The most function word errors was the insertion of prepositions. 3. The most syntactic errors were omission of the main verb. 4. The most errors of tense were errors of using present instead of past. 5. The most lexical errors were errors of lexical items wrongly used in place of others.

Table 2.6 The Summary of Error Analysis (EA) International Research (2009 – 2013) (Continutued)

Author(s) Year, country	EA Theory / Genre	Title	Participants / Instrument	Finding
Abushihab, El- Omari and Tobat (2011), Jordan	- Based on Dulay, Burt and Krashen (1982) - Argumentative Essays	An Analysis of Written Grammatical Errors of Arab Learners of English as a Foreign Language at Alzaytoonah Private University of Jordan	Participants: 62 students of the Department of English Literature and Translation at Alzaytoonah Private University of Jordan.	1. The largest group in the number of errors was the errors of prepositions (26%) 2. The next largest was morphological errors. (24.6%) 3. The third was articles errors (21.7%)
Sarfraz (2011) , Pakistan	- Based on Ellis (1994) - Argumentative Essays	Error Analysis of the Written English Essays of Pakistani Undergraduate Students: A Case Study	Participants: 50 undergraduate Pakistani students	1. The percentage of Interlanguage errors is 46.36% 2. The percentage of errors based on MT interference is 11.4%
Mungungu (2010), Nabibia	- Based on Ellis (1995) - Letter	Error Analysis: Investigating the Writing of ESL Namibian Learner	Participants: 360 Nabibian students divided into three groups: Oshiwambo, Afrikaans and Silozi	The most errors occurred in all groups was spelling errors (55%), the second was tenses (18%)
Sun and Shang (2010), China	- Based on Corder (1974) - Learner corpus of descriptive eassay	A Corpus-based Study of Errors in Chinese English Majors' English Writing	Participants: Chinese English Majors in Ludong University. Instrument: Computer software	The proportion of grammatical errors ranks the highest, followed by wrong usage, syntactic errors and errors of discourse constructions and content
Saadiyah (2009), Malaysia	- Based on Corder (1974) - Learner corpus of descriptive essays	Error Analysis of the Written English Essays of Secondary School Students in Malaysia: A Case Study	Participants: 72 Form Four Malay students. Instrument: Markin software (developed by Martin Holmes) for analyzing data	Six most common errors: 1. Singular/plural form (13.3%) 2. Verb tense (11.2%) 3. Word choice (10.5%) 4. Preposition (9.3%) 5. Subject-verb agreement (7.0%) 6. Word order. (7.0%)

Zhang (2013: 551-557) used the software such as PatCount, AntConc, and SPSS 19 to analyzed the learner errors based on corpus of 76 pieces of writing by the vocational college students in graded English teaching classes in Shanghai Publishing & Printing College. The students are classified into two classes, class A and class B, according to their English level, the former of whom are at the higher level while the latter at the lower level. All the writings were typed, tagged, and categorized into errors according to the error tagging system in Chinese Learner English Corpus. They are: word form (Fm), verb phrase (VP), noun phrase (NP), pronoun (Pr), adjective phrase (AP), adverb (Adv), preposition phrase (PP), conjunction (Cj), word (Wd), collocation (CC), and sentence (Sn). The findings show that (1) The three most significant errors of the students are sentenceerrors, wording errors andcollation errors. (2) The main causes of the errors are communication strategy, mother tongueinterference, andovergeneralization. (3) The number of CC errors by the students in class B is less than that of those in class A. (4) The students in class A can get high scores in writing, when they makeless mistakes in spelling, sentence structure and conjunction words. (5) The student poor in English is often poor in sentence structures and collocations, and those who have a better command of the verbs often have a worse command of pronouns.

Zawahreh (2012: 280-299) investigated the written English errors of tenth grade students in schools in Ajloun, Jordan and found the causes of the written errors in English. The sample of study consisted of 350 students selected randomly from a group of schools in Ajloun. The students were asked to write a free essay about "A journey to the ancient city of Jerash in Jordan. Next, the essays were collected and analyzed the errors. The findings were: First, the most predominant morphological errors were lack of agreement between subject and the main verb (52%). Second, the most predominant errors with function words were the insertion of prepositions (38%). Third, the most predominant syntax errors were the omission of the main verb (71%). Fourth, the most predominant tense errors were the using present instead of past (51%). Fifth, the most predominant lexical errors were the lexical items wrongly used in place of others (53%). Lastly, the main causes of the written errors were mother tongue interference and interlingual interference. The researcher suggested that language teachers adopt approaches to writing and specific activities that can make writing easier and more enjoyable for both learners and teachers. Moreover, teachers should focus on grammatical rules and provide their students with these limitations or restrictions of these rules and teach them how to use in a variety of meaningful contexts.

Abushihab, El-omari, and Tobat (2011: 543-552) conducted in order to investigate and classify the grammatical errors in the writings of 62 students of the

Department of English Literature and Translation at Alzaytoonah Private University of Jordan.These essays were collected, analyzed, and classified into six major categories and then they were divided into subcategories. The findings were: the category that included the largest number of errors was the errors of prepositions (26.08%). The following most problematic areas were respectively: morphological errors (24.6%), articles (21.7%), verbs (11.59%), active and passive (8.69%), and tenses (7.2%). The researcher suggested that English teachers should let learners identify and correct their errors themselves as a good technique in avoiding such errors later and have a better understanding of their errors.

Sarfraz (2011: 29-51) examined the causes of errors in fifty English essays written by undergraduate Pakistani students who are non-native speakers of the English language. Moreover, they come from the Intermediate background where English is taught as a subject course, hence their weak English language proficiency. The instrument was written argumentative essays in the English language with a minimum of 300 – 350 words. The procedural analysis of errors was collection of sample of learner language, identification of errors, description of errors, and evaluation of errors in analyzing these essays. Furthermore, the occurrences of two types of errors; Interlanguage errors and mother tongue (MT) interference errors had been compared The results shown that the percentage of the occurrences of Interlanguage errors are higher than those of errors resulting from the interference of the mother tongue (MT). The study served as a useful guide for English teachers to design an effective curriculum for teaching and learning of English as a second language.

Mungungu (2010: Abstract) studied the common 360 written English language errors made by Oshiwambo, Afrikaans and Silozi (First Language speakers in Namibia), and compared the type of errors between the three groups and their frequency of occurrence. Errors were analyzed into various categories by using these processes: data collection, identification of errors, classification of errors into error types, a statement of error frequency. The instruments used for this study were the English written essays produced by the subjects of the study during their Grade 12 end-of-year examination in 2007. Two written texts with 150 words, an article and a letter, were studied from each participant. The four most common errors committed by the participants were tense, prepositions, articles and spelling. The results shown that the most errors occurred in all groups was spelling errors (55%), the second was tenses (18%). Moreover, Afrikaans speakers had the highest number of error types, followed by Oshiwambo, and Silozi. This study important to educators and study material developers who should become aware of the kind of errors that their target learners

make. The finding can help English teachers train and guide the learners to apply the right strategies to become better language users.

Sun and Shang (2010: 86-94) analyzes the errors in Chinese English Majors' English writing and the reasons resulting in the errors. They based on the corpus of English Majors' Composition of Ludong University (EMC corpus). The corpus consists of compositions of English Majors in Ludong University. The compositions originate from the final exam on comprehensive English of Grade 2008, 2007 and 2006 respectively in the first semester of the school year 2008-2009. The token of the corpus is 87,606 words, with 31,348 words in Grade 2008, 30,381 words in Grade 2007,and 25,877 words in Grade 2006. Four steps are included. In the first place, compositions are input into computers manually and saved as documents (.txt). Secondly, all the errors found inthe compositions are collected and classified into four categories, which are "Errors of words", "Grammatical errors", "Syntactic errors", and "Errors of discourse constructions and content". Last but not least, data are collected and calculated and features revealed. The research reveals that in the EMC corpus the proportion of "grammatical errors" ranks the highest (55.38%), followed by "wrong usage"(23.46%), "syntactic errors" (19.13%) and "error of discourse constructions and content"(2.03%); with the increasing time of learning, learners' language proficiency has improved and is reflected by their error rate which has been decreasing year by year.

Saadiyah (2009: 483-495) conducted a research with the error analysis of the written English essays of secondary school students in Malaysia. This study examines six types of error in 72 essays written by Form Four Malay students who were studying at a secondary school and had experienced approximately the same number of years of education through primary and secondary education in Malaysia. Besides, the participants come from non-English speaking background and hardly communicated in English outside the school. All of the 72 participants were administered a writing assignment that involved essay writing in title "Cleanliness of the school canteen" within a period of 60minutes and a minimum of 200-250 words. It is a guided writing. They were typed using Microsoft Word 2003 so that they were computer readable. After that, the three steps of EA specified by Corder (1974) were followed: collection of sample errors, identification of errors, and description of errors. The instrument used for this study was participants' written essays. The results of the study shown that six most common errors committed by the participants were singular/plural form (13.3%), verb tense (11.2 %), word choice (10.5%), preposition (9.3%), subject-verb agreement (7%) and word order (7%). This study had shown insight into language learning problems. It can be a guideline for English teachers for the preparation of effective teaching materials because it provided information on common trouble-spots in language learning.

2.4.2 Research in Thailand

The summary of research on Thailand as shown in Table 2.7 below:

Table 2.7 The Summary of Error Analysis (EA) Research in Thailand (2008-2012)

Author(s) And Year	EA Theory / Genre	Title	Participants / Instrument	Finding
Ratchwicha (2012)	- Based on Corder (1967), Richards (1971), Dulay, Burt and Krashen (1982), and Ellis (1994) - Guided descriptive composition	An Error Analysis of Mattayom 3 Students' Guided Compositions at Saint Anthony School, Chachoengsao Province	Participants: The 60 Mattayom 3 students	1. The top three common grammatical errors: punctuation (17%), noun phrase (14%), and word choice (13%), respectively. 2. The main causes of errors are interference of the mother tongue and lack of grammar rules.
Yamput (2011)	- Based on Corder (1967), Richards (1971), Dulay, Burt and Krashen (1982), Norrish (1983) and Ellis (1994)	An Error Analysis of the Use of Past Simple and Past Continuous Tenses by First Year Students At Silapakorn University	Participants: The 60 first-year students Instrument: The Mutiple choices English Grammar Test	1. Grammatical errors were tense, omission, addition, and misformation. 2. The most frequent tense error was past continuous tense.
Nopjirapong (2010)	- Based on Richards (1971) and Chakorn (2005) - Descriptive eassay	The Analysis of Aritricle Errors in Thai University Students' Compositions	Participants: The 20 second-year English major students at Srinakharinwirot University	1. The mother tongue interference as the main causes of errors 2. The highest frequency of article errors was the omission of "the" before nouns.
Bumroongthai (2010)	- Based on Corder (1967) - Descriptive eassay	An Error Analysis in English Paragraph Writing by Students of the Faculty of Liberal Arts, Rajamangala University of Technology PhraNakhon.	Participants: The 36 fouth-year students	1. Errors in grammar and sentence structure were most frequently found (58.72%). 2. The top five types of errors in the order of frequency found as follows: word choice, verb forms, determiners, sentence fragments, prepositions.

Table 2.7 The Summary of Error Analysis (EA) Research in Thailand (2008-2012) (Continutued)

Author(s) And Year	EA Theory / Genre	Title	Participants / Instrument	Finding
Sattayatham and Patanapinyowing (2008)	- Based on Kitao and Kitao (2000), Corder (1981), James (1998) - Opinion paragraph	Analysis of Errors in Paragraph Writing in English by First Year Medical Students from the Four Medical Schools at Mahidol University	Participants: The 134 first-year medical students	1. The high percentage of errors were found: no transitional word (90.30%), lack of organization (85.07%), no conclusion (82.84%) 2. Praboromchanok Medical Students had the highest percentage of errors. 3) There was no statistical difference between the Sirirajmedical students and Ramathibodi Medical students. 4)Praboromchanok medical studentsawere the weakest group in writing opinion paragraph followed by BM students.

Ratchwicha (2012: 12-21) investigated errors are often found in Mattayom three students' guided composition and the cause of errors. The research sample was 124 guided compositions written by sixty Mattayomsuksa 3 students in the second academic year 2009 at Saint Anthony School in Chachoengsao province. The findings revealed the top three common grammatical errors: punctuation (17%), noun phrase (14%), and word choice (13%), respectively. These errors resulted from interference of the mother tongue and lack of grammar rules. The researcher recommended that the teachers' pay attention to the students' language errors, train them to apply grammatical rules and to choose the right choice of words in order to reduce their errors and become successful in writing English.

Yamput (2011: Abstract) analyzed the grammatical error types in the use of past simple and past continuous tenses made by sixty first year students at Silapakorn University, and find out the frequency and causes of errors. The participants were students majoring in English and non-English. The instrument for data collection was composed of an English grammar test that was divided into three sections: sentence completion, conversation and cloze passage. The data analysis of this study was categorized into three main parts: an analysis of error categories, the frequency of error production, and the causes of problems in the production of the past simple and past continuous tenses. The results of the study revealed that grammatical errors were

based on the four types of errors: tense, omission, addition, and misformation. The most frequent tense error was past continuous tense produced by the non-English major students, while past simple tense errors were produced less often. The finding of this study could be useful for Thai students to enhance their English grammar proficiency in these tenses.

Nopjirapong (2010: Abstract) studied the errors of twenty English essays written by 20 second-year English major students at Srinakharinwirot University. The errors were focused on article usage. All essays were examined in order to identify and categorize article errors. Nineteen article error categories adapted from Richard (1971) and Chakorn (2005)'s error categories were used for analyzing the data. The results exhibited mother tongue interference as the main factor that caused the participants to commit article usage errors. Of all 19 categories, the highest frequency of article errors was the omission of "the" before nouns made particularly in context, comprising 28 percent of the article errors found in the analysis. The finding of this study revealed the need for developing materials to reduce errors of article usage.

Bumroongthai (2010: 2) studied an error analysis in paragraph writing of the students of the faculty of Liberal Arts, Rajamangala University of Technology PhraNakhon. The sample was 36 fourth-year students in the academic year 2010. The tools were a paragraph-writing worksheet and a form prepared to record the frequency of each type of errors of each sample. The results of the study indicated that errors in grammar and sentence structure were most frequently found (58.72%). This included 11 types of errors in the order of frequency found as follows: word choice, verb forms, determiners, sentence fragments, prepositions, singular and plural nouns, verb-tenses, run-on sentences, subject-verb agreement, wrong word order, and use of reference terms accordingly.

Sattayatham and Ratanapinyowong (2008: 17-38) identified the types of errors in scientific paragraph writing in English made by one hundred and thirty four first year medical students from four medical schools at Mahidol University. They were assigned to write an opinion paragraph in English on medical ethics based on a reading passage chosen from the Internet. The frequency of errors was calculated as a percentage. In addition to this, the written errors made by four school students were compared by using the χ^2-test with p-value of < 0.05. The result shown that 1) a high percentage of errors were found in 3 out of 10 criteria: no transitional word (90.30%), lack of organization (85.07%), no conclusion (82.84%) and 2) Praboromchanok Medical Students had the highest percentage of errors. 3) In comparing the Siriraj Medical students group (SI) with Ramathibodi group (RA), there was no statistical difference in any criteria. However, when the SI group was compared with Praboromchanok group (PI) and Bangkok Metropolitan group (BM), it was found that the PI group committed

more significantly errors for criteria lack of main ideas, lack of development of the main ideas, accumulation of errors in sentence structure and/or usage, and no conclusion and the BM group committed more errors for lack of main ideas. 4) PI students were the weakest group in writing opinion paragraph followed by BM students. From these findings, all medical students at Mahidol University should be taught to write a standard opinion paragraph. Furthermore, transitional words should be taught and emphasized. These findings will be used as a reference point for developing materials appropriate to what the students need.

2.4.3 Synthesis of related research

From the previous studies, it is shown that there are many studies addressing error analysis in second language learning. Most studies analyze data gathered from learners who study English as a second language (L2). Some of the studies, for example, Zawahreh (2012), focus on causes of errors made by L2 learners. Some of the studies, for example, Mungungu (2010), emphasized the L2 learners with different backgrounds. In addition, some studied identified written errors from paragraph writing, essay writing, and writing letters. In Thailand, most studies focus on grammatical errors, such as tense, article and so on, in written works of undergraduate students. Not only have few error analysis studies in secondary school student, but also it is very few studies in abstract writing made by Thai learners. Besides, the corpus-based method for error analysis has never been used in Thailand at all.

2.5 Chapter Summary

From the literature reviews and the study of related research, the researcher has understood the related theories in depth, i.e. the concept of error analysis, the concept of the scientific abstract writing, the corpus-based error analysis, and the synthesis of related research, together with the data in order to design and construct the research method designing. The theories used to analyse errors in this study were (1) the errors classification based on James (1998) and Bryan (2010), (2) the causes of errors based on Norrish (1983), Brown (1980) and Richards (1971), (3) The abstract writing based on Bazermann (1995), and Sweal and Freak (1994), (4) Corpus-based error analysis based on Diaz-Negrillo and Garcia-Cumbreras (2007). The researcher therefore set the research methodology and research instrument as shown in the next chapter.

CHAPTER 3
METHODOLOGY

In this chapter, the overview of theories were used to design the research methodology for corpus-based error analysis. It was divided into four sections: population, samples and corpus, the instrument construction, the data collections, and the data analysis, respectively.

3.1 Population, Samples and LSA Corpus

3.1.1 Population

The population of this research was the upper secondary school students in the schools under the Office of The Basic Education Commission, Ministry of Education, Bangkok Metropolis

3.1.2 Samples

In this study, the multistage sampling method was used to select the school and students, and grouped the student into the experimental group and control group. The sampling procedure was shown below:

3.1.2.1 The purposive sampling was used for selecting the school in this research. It was Watsuthiwararam School, a large public school grades 7 – 12 located in Bangkok. This school was selected because of three reasons. Firstly, the laboratory instruments were well-prepared. Secondly, a number of students or participants were sufficient for using as the research instruments. Lastly, the school administrators and academic staffs willingly supported this research.

3.1.2.2 The samples were the upper secondary school students (grade 11) in science and mathematics program that were divided into six classes. They may be different in an English competency. Hence, ANOVA was used to examine the difference of English competency by using the English learning achievement scores from the midterm exam of course "ENG 32202 Wring and Reading English". The result was used for selecting the classes that students were not different in English competency as the samples.

Table 3.1 The number of students, average scores ($\bar{X}$), standard deviation (SD) of English learning achievement scores of Grade 11 students, six classes

Class	N	$\bar{X}$	SD
5/1	46	13.54	4.32
5/2	47	12.98	4.87
5/3	49	12.11	3.94
5/4	40	11.98	3.78
5/5	44	12.55	4.16
5/6	44	12.67	4.56
Total	270	12.62	4.25

Table 3.1 shown the number of students in each class and the statistic data. It shown that the average of English learning achievement scores is 11.98–13.54. The 5/1 students had the highest average scores whereas the 5/4 students had the lowest average scores. Besides, the standard deviation of English learning achievement scores was 3.78 – 4.87.

Table 3.2 The result of ANOVA testing of English learning achievement scores

Source	df	SS	MS	F
Between	5	78.54	515.71	0.86
Within	264	4,817.77	18.25	
Total	269	4,896.31		

*$p < .05$ ($.05\ F_{5,264} = 2.25$)

The differences of English learning achievement scores were examined by using ANOVA with p-value of < 0.05. In Table 3.2 the result shown that there were no significance of English writing competency in all groups at .05 level. Hence, all students in each class can be used as samples in this research.

3.1.2.3 The six classes were divided into two groups: (1) three classes (5/1, 5/3 and 5/4) were taught in scientific abstract writing in English (the experimental group) and (2) three class (5/2, 5/5, 5/6) were not taught (the control group). They were selected into two groups by simple random sampling.

3.1.3 Laboratory Scientific Abstracts Corpus (LSA Corpus)

The LSA corpus consisted of 540 laboratory scientific abstracts. They originated from the laboratory work. The 270 students were asked to write two abstracts, so the total written works were 540. They consisted of four moves: introduction, method, result and discussion, and conclusion (Bazerman, 1995: 465-467).

3.2 Construction of the Instrument

This study had three instruments: the error classification scheme recording form, the five lesson plans for teaching scientific abstract writing in English, and the guided interview form for investigating the causes of errors. The procedures of construction of these instruments were described as follows:

3.2.1 The concepts and theories concerning error analysis, scientific abstract writing included related research, both Thai and foreign were studied from the following sources:

3.2.1.1 The Library of the school of Liberal Arts, King Mongkut's University of Technology Thonburi

3.2.1.2 The Library of the Faculty of Industrial Education, King Mongkut's Institute of Technology Ladkrabang

3.2.1.3 The central library of Mahidol University

3.2.1.4 The central library of Burapha University

3.2.2 The error classification scheme recording form was constructed by following related concepts of error analysis. These errors were first classified into five main categories. They were morphological errors, syntactic errors, lexical errors, semantic errors, and mechanical errors (James, 1998: 142-161, Bryan, 2010: 41-45). Each of them was divided into various sub-categories following to the created tagset or error tagging system. The error tagging system or tagset was created by analyzing the errors of the 140 abstracts (around 17,000 words). They were sufficient for creating a tagset, correspondense to the theory (Diaz-Negrillo and Garcia-Cumbreras, 2007: 199 – 201). These abstracts were collected from the students who enrolled the course "Physics Laboratory Technique" in academic year 2013 (previous semester). The example of tagset can be seen in Appendix A.

3.2.3 The five lesson plans for teaching scientific abstract writing in English were constructed and based on the scientific abstract moves: introduction, method, result and discussion, and conclusion (Bazerman, 1995: 465-467) and a research paper summary approach that focused on the section of the study such as purpose, method, findings consistent with the structure of scientific abstract (Swales and Feak, 1994: 210-211). The procedure for constructing the lesson plans were as follows:

The five plans were designed and constructed by the researcher. They were based on PPP approach: Presentation, Practice, and Production (Harmer, 2007: 64-66). The contents were given in Table 3.3. The components of these plans were as follows: (1) Content, (2) The Time Length of Class, (3) Instructional Objectives, (4) Teaching Method and Procedure, (5) Teacher role, (6) Teaching and Learning Activities, (7) Skills/ Knowledge Assessment. The example of plan can be seen in Appendix B.

Table 3.3 The five lesson plans

Lesson Plan	Topic	Time duration (min)	Language Focus
1	Introduction	50	Infinitive with to
2	Method	50	Passive voice
3	Result and discussion	50	Modal verb : can & may
4	Conclusion	50	Simple past tense
5	Linking Part	50	Linking words

After the lesson plans were constructed completely and examined for quality by three experts. Then, they were improved and corrected for errors.

3.2.4 The guided interview form was designed and constructed for studying the causes of written errors based on Norrish (1983: 21-26), Brown (1980: 173-181), and Richards (1971: 204-219). The interview form was tried out with the 10 students who did not a sample in this research and they enrolled in this course in previous semester. The tried out showed that an interview form needed to add item "other" because some causes in written work can not be categorized into group. For example, the students said "I don't know", "I am forgot the language rules". The interview form was presented in Appendix C.

3.3 Data Collection

The data collection was as the follows:

3.3.1 The experimental group were taught in topic "abstract writing" that followed up by five lesson plans based on Presentation, Practice, and Production approach in 5 periods (250 minutes). This section used two weeks in the beginning of the semester.

3.3.2 Next two weeks, the experimental group and the control group were assigned to complete two scientific laboratories, and then they were asked to write two scientific abstract writings around 120-150 words in class after they finished their experiments.

3.3.3 The 140 scientific abstracts (approximately 17,000 words) were collected from the students' work in the previous semester of academic year 2013 and used to make a tagset. (See in Appendix A)

3.3.4 The written work was analyzed the error based on the tagset by two software: Markin 4.2.2. and AntConc 3.2.4 (Freeware).

3.3.5 The 88 abstracts were randomed by using Yamane Table (1967: 886) and checked for the validity by three experts.

3.3.6 The teacher sent a feedback to all students. All students' work scores were used for ranking an abstract writing ability of students into 3 groups. They were a group with high score (70-100 scores, ten students), a group with moderate score (50-69 scores, students), and a group with low score (less than 50 scores, ten students). After that, the ten students in each group were selected by using the simple random sampling with lottery method. Then, they were interviewed about causes of error in writing works.

3.4 Data Analysis

A sample LSA corpus was compiled in order to check the reliability of tool, i.e. tagsets. Then, pieces of student's written paper were collected and analyzed. The procedures of data analysis is as the followings steps:

3.4.1 The LSA corpus was tagged, categorized into errors, and described the errors according to the created error tagging system by using Markin 4.2.2 (See Appendix D). Figure 3.1 shown the marked learner corpus using Markin 4.2.2 and Figure 3.2 shown the counted errors and student's work score.

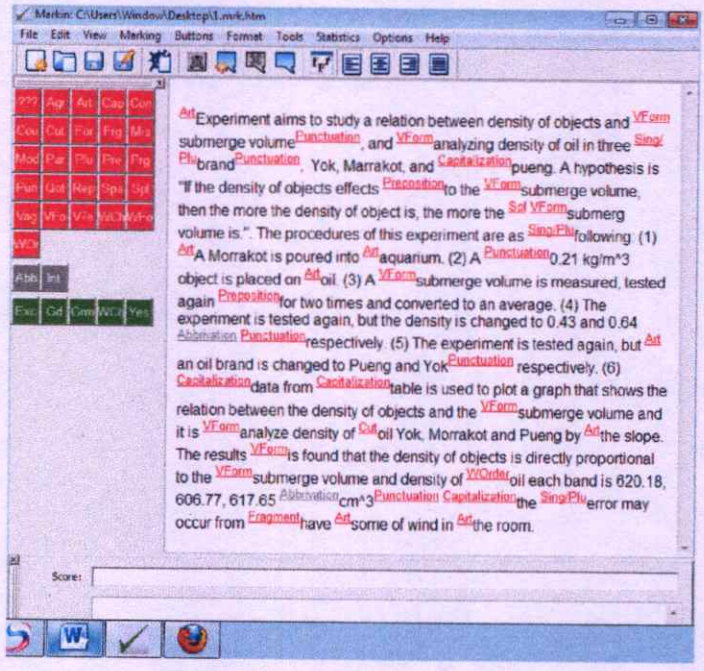


Fig. 3.1 The marked written work by using Markin 4.2.2

Statistics

Instances	Annotation	Explanation	Help link	Categories	Value	Points lost	Points gained
2	Abbrivation	Abbrivation		Mechanics	-1	-2	
8	Art	Article error		Grammar	-1	-8	
4	Capitalization	Capitalization error		Punctuation	-1	-4	
1	Cut	Cut -- this text is not necessary		Sense	-1	-1	
1	Fragment	Sentence fragment		Grammar	-1	-1	
3	Sing/Plu	Singular/plural error		Grammar	-1	-3	
2	Preposition	Wrong or misused preposition		Grammar	-1	-2	
6	Punctuation	Punctuation		Punctuation	-1	-6	
1	Spl	Spelling		Spelling	-1	-1	
9	VForm	Verb form		Grammar	-1	-9	
1	WOrder	Word order		Syntax	-1	-1	
					Totals	-38	0

Fig.3.2 The counted errors and student's work score by using Markin 4.2.2

3.4.2 The data were calculated the occurrence of errors of each category and sub-category compared to the total number of errors by frequency and percentage with using Markin 4.2.2. The example of data analysis was shown in the Table 3.4.

Table 3.4 The example of ten LSA corpus analysis

Annotation	Explanation	Categories	Instance	(%)
Art	Article error	Morphological error	57	19.52
Punctuation	Punctuation	Mechanical error	45	15.41
Wchoice	Poor word choice	Semantic error	41	14.04
Spl	Spelling	Lexical error	36	12.33
Fragment	Sentence fragment	Syntactic error	26	8.90
Sing/Pul	Singular/Plural error	Morphological error	16	5.48
Capitalization	Capitalization error	Mechanical error	15	5.14
VForm	Verb form	Morphological error	13	4.45
Conj/Trans	Conjuction/Transition error	Syntactic error	9	3.08
Parallel	Parallel construction	Syntactic error	9	3.08
VTense	Verb Tense	Morphological error	9	3.08
Preposition	Wrong or misused preposition	Morphological error	8	2.74
S/V Agree	Subject-Verb agreement	Morphological error	3	1.03
Run on	Run on	Syntactic error	3	1.03
Adj/Adv	Adjective/Adverb error	Morphological error	2	0.58
Total			292	99.89

3.4.3 The keywords in context were analysed by AntConc 3.2.4. The example of analysis was shown in Figure 3.3.

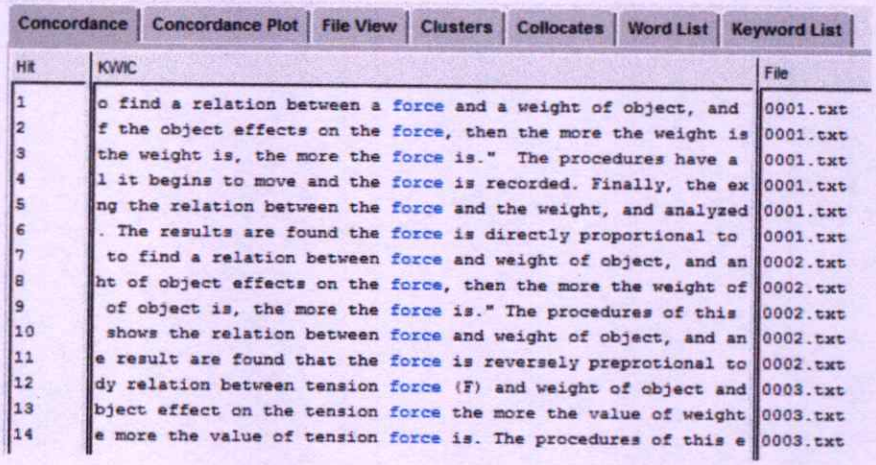


Fig. 3.3 The analyzed keyword in context by using AntConc 3.2.4

3.4.4 The frequency of errors for each catagories were compared between the experimental group and the control group by using χ^2-test. A P-value of < 0.05 is considered statistically significant. The data were analyzed by software program.

3.4.5 The qualitative data from interviews were analyzed by a content analysis.

3.4.6 The results were presented with tables and a bar chart.

3.5 Chapter Summary

This chapter shows the research design, the description of the participants, the construction of research instruments, the data collection and analysis procedures. The researcher has done the process of the study step by step using Markin 4.2.2 and AntConc 3.2.4. to analyze the written errors. Then, the students were interviewed to investigate the causes of errors. The research findings were revealed and presented in the next chapter.

CHAPTER 4
RESEARCH FINDINGS

This chapter presented the results of the corpus-based error analysis found in the LSA corpus made by the 270 students who were taught (the experimental group) and were not taught the laboratory scientific abstract writing in English (the control group). The results were presented in 3 parts as follows:

4.1 The top ten common errors found in the LSA corpus

4.2 The written errors comparising between the two groups of students

4.3 The causes of errors

4.1 The Top Ten Common Errors Found in the LSA Corpus

The LSA corpus was analyzed and the top ten common errors in LSA corpus were ranked to answer the research question 1. The total number of errors investigated was 9,143. A number of errors made by the experimental group was 4,239 whereas a number of errors made by the control group was 4,904. The errors were analyzed and arranged them in order. They were shown in Table 4.1 below:

Table 4.1 The analysis of LSA corpus of the top ten common errors

Rank	Type of errors	Sub-type of errors	Instance	%
1	Morphological error	The lack of article "the"	962	10.64
2	Mechanical error	The lack of commas	901	9.97
3	Morphological error	The lack of articles "a or an"	763	8.44
4	Lexical error	Misspelling	715	7.91
5	Syntactic error	The misuse of the voices	632	6.99
6	Mechanical error	The lack of periods	461	5.10
7	Morphological error	Subject-verb agreement	426	4.71
8	Syntactic error	The misplacement of verbs	412	4.56
9	Syntactic error	Incorrect form of parallel structure	354	3.92
10	Morphological error	The misuse of articles "a or an"	309	3.42
Total			9,038	65.66

The results indicated that the top ten common errors made were 1) the lack of articles "the" (10.64%), 2) the lack of commas (9.97%), 3) the lack of articles "a or an" (8.44%), 4) misspelling (7.91%), 5) the misuse of voices (6.99%), the lack of periods (5.10%), subject-verb agreement (4.71%), the misplacement of verbs (4.56%), incorrect

form of parallel structure (3.92%), and the misuse of articles "a or an" (3.42%), respectively. The instances of these errors in sentences were analyzed by AntConc 3.2.4 and presented in Fig.4.1 to 4.10 as below.

Example 1: The lack of article "the"

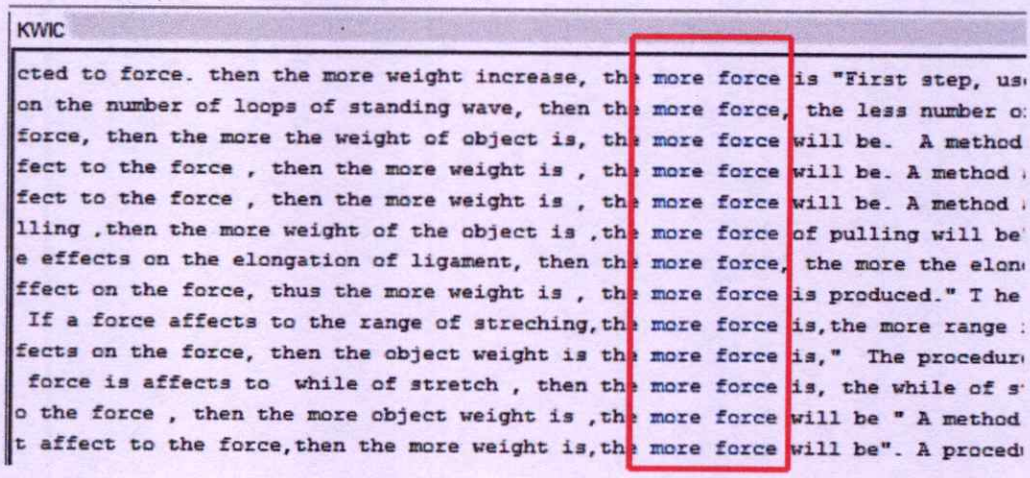


Fig.4.1 The examples of the lack of articles "the" found in LSA corpus (Rank1)

The article "the" is used when something that has been mentioned is reffered to again. In these examples, "force" is mentioned in the previous sentences, so the article "the" has to be inserted in these sentences as "the more the force is ..."

Example 2: The use of commas

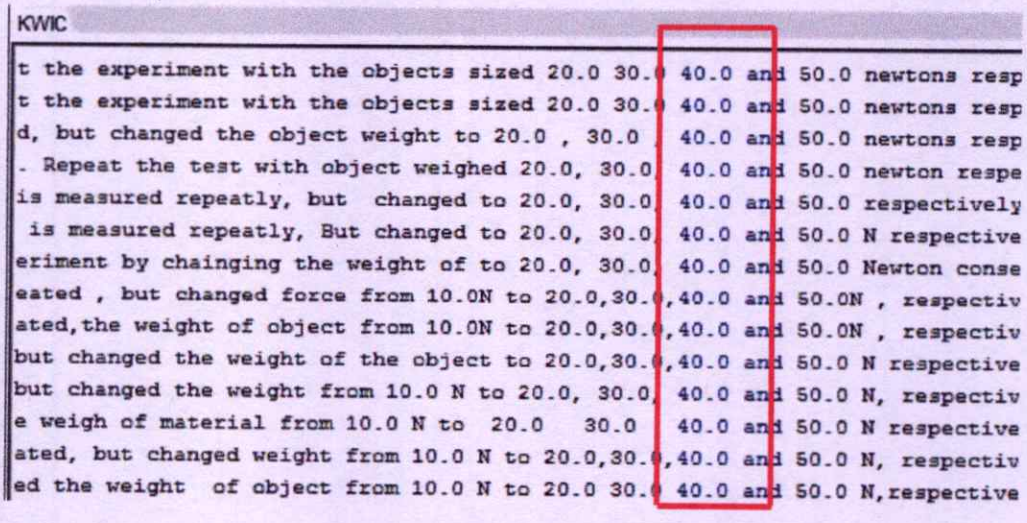


Fig.4.2 The examples of the lack of commas found in LSA corpus (Rank2)

Commas are used to separate the elements in a series. In these examples, the student did not insert commas between number.

Example 3: The lack of articles "a" or "an"

KWIC

ized 20.0 30.0 40.0 and 50.0 newtons respectively	plot graph	between Force(F)
0000 3.0000 and 4.0000m. Bring data from Table to	plot graph	relation betwee
.0,40.0 and 50.0N , respectively.Data are used to	plot graph	shown the relati
40.0 and 50.0 N, respectively. Data are used to	plot graph	shown the relati
, 40.0 ,and 50.0 N,respectively. Data are used to	plot graph	shown the relati
, 40.0 ,and 50.0 N,respectively. Data are used to	plot graph	shown the relati
,40.0 and 50.0 N , respectively. Data are used to	plot graph	shown the relati
rface area. The data from each table are taken to	plot graph	shown the relat
2.00 m, respectively. Bring data trom a table to	plot graph	And analyze rea
.0, 40.0 and 50.0 N respectively Data are used to	plot graph	that shows the r
0, 40.0 and 50.0 N respectively, Data are used to	plot graph	that shows the r
0, 40.,0 and 50.0 N respectively Data are used to	plot graph	that shows the r
.0., 40.0 and 50.0 N Respetively Data are used to	plot graph	that show the Re
0 , 40.0 and 50.0 N respectively Data are used to	plot graph	that shows the r

Fig.4.3 The examples of the lack of articles "a" found in LSA corpus (Rank3)

The article "a"or "an" are used before a countable noun mentioned for the first time. In these examples, "graph" is a countable noun and mentioned at first, so the article "a" has to be inserted in these sentences as "...to plot a graph..."

Example 4: Misspelling

KWIC

esults are found that restoring force is directly	propotional	to the weight c
ults are found that the tension force is directly	propotional	to the weight c
that the squares of the period of oscillation is	propotional	to the radius c
The results are found that the force is directly	propotional	to the weight a
.The results are found that the Force is directly	propotional	to the Weight a
shows that the squares of the shrinking phase is	propotional	to the force ar
experiment shows that the value of inductance is	propotional	to the value of
lt are founded that the pulling force is directly	propotional	to the weight c
graph. The result show that the force s directly	propotional	to the object's
sult are found that the pulling force is directly	propotional	to the weight c
ults are found that The pulling force is directly	propotional	to the weight c
.The result is found that the stretch is directly	propotional	to the pulling
is found that the vertical distance is directly	propotional	to the time,and
t is found that the stretch of spring is directly	propotional	to tension and
ults are found that the tension force is directly	propotional	to the weight c

Fig.4.4 The examples of the misspelling found in LSA corpus (Rank4)

In these examples, the student spelt the word "proportional" insetead of "propotional".

Example 5: The misuse of voices

KWIC

oo." The first method is using the HDPE plasti	stick with	tilted floor f
he method of this experiment (1)take SDPE plasti	stick with	60 degree bev
ent has six step : (1) convey plastic sheets HDP	stick with	the inclined p
of the experiment Frist: lead plastic sheet HDP	stick with	slope tilted a
his experiment : (1) take plastic sheet type HDP	stick with	incline surfac
is measured and recorded. Second, the iron cup i	stick with	tyre, and fix
n between sandbag mass(m) and mass of object tha	stick with	rope and conne
he sandbag mass is effects on mass of object tha	stick with	rope and conne
he sandbag mass increases, the mass ofobject tha	stick with	rope and conne
and put on plastic sheet.(3) mass of object tha	stick with	rope are conne
n the sandbag mass(m) and the mass of object tha	stick with	rope and conne
he results are found that the mass of object tha	stick with	rope and conne
this experiment has 6 step: First HDPE plastic i	stick with	inclined plane

Fig.4.5 The examples of the misuse of the voices found in LSA corpus (Rank5)

In these examples, the student used the active voice instead of passive voice. The object can not stick by itself so, the verb "stick (active form)" has to be changed to "was sticked (passive form)".

Example 6: The lack of period

KWIC

orth but changed to used 2 sandbags and 3sandbags	respectively	Next t
st to fifth but changed plastic LDPE type and PS	respectively	When finish Th
ic coefficient of plastic rather is LDPE and SDPE	respectively	The results m
-4 but changed to used sand bag 2 bags and 3 bags	respectively	Lastly repeated
point 1-5 but changed to used Ldpe plastic and Ps	respectively	when expirement
ial from 10.0 N to 20.0 30.0 40.0 and 50.0 N	respectively	data are use to
M2, then M1 and M2 are specified as 20 and 10 g	respectively	(2) A mass of
ne again but varies mass of M1 30,40,50 and 60 g	respectively	(5) M1 and M2 h
tested again but change mass to 200,300,400,500 g	respectively	(5) The results
f mass.(5)repeated step 1-4, use 2 and 3 sandbags	respectively	(6)repeated step
ed step 1-5, but replace the plastic LDPE and PS,	respectively	The data ar
coefficient of static friction than LDPE and HDPE	respectively	The results ma
eatly, but changed to 20.0, 30.0, 40.0 and 50.0 N	respectively	Data are used t
atly, but changed to 20.0, 30.0, 40.,0 and 50.0 N	respectively	Data are used t
tly, but changed to 20.0 , 30.0 , 40.0 and 50.0 N	respectively	Data are used t

Fig.4.6 The examples of the lack of periods found in LSA corpus (Rank6)

In English, periods are used at the end of a complete sentence. In these examples, the students did not insert period at the end of the sentences.

Example 7: The subject-verb agreement

KWIC

e coeffictient of friction by a reverse of slope.	The result are	found the pulli:
ed the coefficient of static friction by a slope.	The result are	found that the :
ictient of static friction by a reverse of slope.	The result are	found that the :
yzed coefficient of static friction from a slope.	The result are	found that the :
the coefficient of static friction from a slope.	The result are	found that the :
zed the static friction coefficient from a slope.	The result are	found that are :
icient of static friction by a reverse os slope.	The result are	found that the :
the coefficiend of static friction from a slope.	The result are	founded that th
the coefficient of static friction from a slope.	The result are	found that the :
nt of static friction from an inverse of a slope.	The result are	found that the :
was defined as the static resistance coefficient.	The result are	found that the :
lyzed the Young's modulus by an inverse of slope.	The result are	found that a le:
ficient of friction on three material by a slope.	The result are	found that a lo:
lyzed the spring constant by an inverse of slope.	The result are	found that a le:
fficient of static fiction by a reverse of slope.	The result are	found that the :

Fig.4.7 The examples of the subject-verb agreement found in LSA corpus (Rank7)

In thes examples, the word "result" is a singular noun and verb "are" did not use with a singular noun. So, it has to be changed to the verb "is".

Example 8: The misplacement of verb

KWIC

recorded.Fourth,the method is repeated again,then	calculate	the average of
measure, then record the time about 10 times and	calculate	the mean. After
ag starts to move ,repeat fourth step 5 times and	calculate	the mean. (5) t
nd reckon time and take note of time 10 time and	calculate	medien , next t
r that, recorded the time absolutely 10 times and	calculate	for average. Fi:
and recorded.Then,the experiment is repeated and	calculate	the average str
ct is moving and timer,then recorded 10 times and	calculate	for find the av
on time. Then,time is recorded about 10 times,and	calculate	mean. Finally,t
ckon time . Next, record to the time for 10 times	calculate	average .Finall
ntil the mass begins to move, Repeat 5 times and	calculate	the average of
ckon times. Next, times are recorded 10 times and	calculate	mean. Lastly th
sand bag start to move, and repeated 5 times and	calculate	mean. (5), the
sand bag start to move, and repeated 5 times and	calculate	mean. (5), the
red. Next, the experiment is repeated 3 times and	calculate	mean. Lastly th

Fig.4.8 The examples of misplacement of verbs found in LSA corpus (Rank8)

In these examples, the subject in these sentences are "mean" or "average". So, the verb "calculate" has to be inserted after these subjects, not in front of them.

Example 9: Incorrect parallel structure

KWIC

then, the pulling force is measured repeatly, but	change	the weight of the obj
), The weight of object is measered repeatly, but	change	to 20.0, 30.0, 40.0 a
on object is laid dowm on the plain repeatly, but	change	to 20.0, 30,0, 40.0 a
the force. The the force is measured repeatly but	change	object to 20.0 30.0 4
nd recorded Then, the experiment is repeated but	change	the weight of object
and recorded. (4) The experiment is repeated but	change	the weight to 20.0 ,
pulling force then the experiment is repeated but	change	the weight of object
s calculated.(4): the experiment is reapeated but	change	the mass to 200.00 30
s done again,(3):the experiment is done again but	change	a mass to 200.00,300.
respectively.(6):the experiment is done again but	change	a type of plastic pla
and recored (4):the experiment is done again but	change	a tension force to 1
force. Then, the force is measured repeatlym but	change	to 20.0 30.0 40.0 and
etch is calculated.The last is done it again but	change	size of force to 15.

Fig.4.9 The examples of incorrect parallel structure found in LSA corpus (Rank9)

In these examples, the passive voice structure is used in these sentences. So, the form of verb "change" has to be changed to "changed".

Example 10: The misused of ariticle "a" or "an"

KWIC

The experiment aims to study	the relation	between force and
The objectives of this experiment is to study	the relation	between force and
The objectives of the experiment are to study	the relation	between tensile fo
This experiment purposes to study	the relation	between objects we
This experiment has objectives to study	the relation	between electric c
The experiment has objectives to study	the relation	between thermal en
The experiment aims to study	the relation	between the surfac
The experiment aims to study	the relation	between force and
This experiment aims to study	the relation	between an area of
The experiment aims to study	the relation	between tensile fo
The experiment aims to study	the relation	between the mass a
The purposes of this experiment are to study	the relation	between the veloci
This experiment purposes to study	the relation	between the densit
The experiment has objectives to study	the relation	between a buoyant
The experiment aims to study	the relation	between tension fo

Fig.4.10 The examples of the misused of ariticle "a" or "an" found in LSA corpus (Rank10)

The article "a"or "an" are used before a noun mentioned for the first time. In these examples, "relation" is mentioned at first, so the article "a" needs has to be inserted in these sentences instead of the article "the".

4.2.1 The analysis of morphological errors

A number of errors in each sub-type by arranging them in order were summarized. It was found that there were 20 types of morphological errors:

1. Lack of article "the"
2. Lack of articles "a, an"
3. Subject-verb agreement
4. Misuse of article "a, an"
5. Misuse of adjective
6. Misuse of preposition
7. Misuse of gerund
8. Misuse of idiom
9. Misuse of apostrophes
10. Misuse of verb
11. Misuse of participle
12. Determiner-noun agreement
13. Misuse of Infinitives
14. Incorrect form of verb
15. Misuse of article "the"
16. Misuse of conjunction
17. Lack of apostrophes
18. Misuse of adverb
19. Misuse of modal & auxillary
20. Incorrect form of adverb

Table 4.2 presented the sub-types and number of morphological errors shown as below.

Table 4.2 The number of morphological errors made by groups of student (E = the experimental group, and C = the control group)

Rank	Sub-types of morphological errors	The number of errors in each move of abstract								Total number of errors			
		Introduction		Method		Result		conclusion					
		E	C	E	C	E	C	E	C	E	C	Total	%
1	Lack of article "the"	70	109	209	292	77	123	31	51	387	575	962	27.35
2	Lack of articles "a, an"	342	300	44	67	2	4	2	2	390	373	763	21.69
3	Subject-verb agreement	109	83	72	86	40	29	1	6	222	204	426	12.11
4	Misuse of article "a, an"	28	197	14	14	8	45	0	3	50	259	309	8.79
5	Misuse of preposition	28	52	32	48	16	18	2	3	78	122	200	5.69
6	Misuse of adjective	12	13	58	44	15	13	4	12	89	82	171	4.86
7	Misuse of gerund	10	6	55	42	4	0	3	1	72	49	121	3.44
8	Misuse of idiom	0	0	64	50	0	0	0	0	64	50	114	3.24
9	Misuse of apostrophes	8	22	13	26	2	10	3	5	26	63	89	2.53
10	Misuse of verb	5	6	5	24	10	4	1	10	21	44	65	1.85
11	Misuse of participle	15	9	21	8	1	2	4	1	41	20	61	1.73
12	Determiner-noun agreement	6	9	25	17	1	1	0	0	32	27	59	1.68
13	Misuse of Infinitives	20	6	4	22	1	0	0	0	25	28	53	1.51
14	Incorrect form of verb	15	3	20	3	3	0	0	2	38	8	46	1.31
15	Misuse of article "the"	2	3	4	14	2	4	0	3	8	24	32	0.91
16	Misuse of conjunction	0	9	4	0	4	2	0	0	8	11	19	0.54
17	Lack of apostrophes	0	2	3	1	4	1	0	0	7	4	11	0.31
18	Misuse of adverb	0	1	0	4	0	1	0	1	0	7	7	0.20
19	Misuse of modal & auxillary	0	1	0	2	0	3	0	0	0	6	6	0.17
20	Incorrect form of adverb	0	0	0	0	0	0	3	0	3	0	3	0.09
Total		**670**	**831**	**647**	**764**	**190**	**260**	**54**	**101**	**1561**	**1956**	**3517**	**100.00**

As shown in Table 4.2, Table 4.2 identified the number of morphological errors made by both experimental group and control group. The top three morphological errors made by both groups were the lack of article "the" (27.35%), the lack of indefinite articles "a" or "an" (21.69%), and the subject-verb agreement (12.11%), respectively. Besides, it was found that the experimental group made the errors less than the control group. The examples of top three morphological errors were analyzed by AntConc 3.2.4 and presented in Fig. 4.11 to Fig. 4.16 below:

Example 1: The lack of article "the"

KWIC			File
d length of stretch,and	analyze Young's modulus	The hypothesi	0001.txt
distance of stretch,and	analyze Youngs modulus.	This hypo	0003.txt
orces and stretches and	analyze Youngs modulus.	The hypothesis	0079.txt
nsion and stretch ,and	analyze young modulus.	The hypothesis	0085.txt
ion force perlenght and	analyze Young'modulus.	he hypothesis	0097.txt
d stretching phase ,and	analyze Young's modulus	The hypothesi	0109.txt
nd while of stretch and	analyze Young-modulus.	The hypothesis	0130.txt
and stretch length, and	analyze Youngs modulus.	The hypothesis	0143.txt
the stretch length, and	analyze Youngs modulus b	y an inverse o	0143.txt

Fig.4.11 The examples of the lack of article "the" made by the experimental group

The article "the" is used for specifying a person, or thing. In these sentences, the word "Young" refer to the name of physicist. Therefore, the article "the" has to be inserted before the word "Young".

KWIC
weight a affected to force. then the more weight increase, the more force is
effects on restoring force, then the more weight of object is the more resto
he elongation of the rubber, then the more weight, the more elongation of the
ffect to the tension forces, then the more weight is,the more the tension for
weight affect to the force , then the more weight is , the more force will be
weight affect to the force , then the more weight is , the more force will be
weight affect to the force, then the more weight of objects is, the more th
ect to the force of pulling ,then the more weight of the object is ,the more
e volume of the sink object, then the more weight, the more volume is. The me

Fig.4.12 The examples of the lack of article "the" made by the control group

The article "the" is used when something that has been mentioned is reffered to again. In these examples, "weight" is mentioned in the previous sentences, so the article "the" has to be inserted in these sentences as "the more the weight is ..."

Example 2: The lack of article "a" or "an"

KWIC

nd 50.0 N respectively Data are used to plot	graph	that shows the relation be
d 50.0 N respectively, Data are used to plot	graph	that shows the relation be
nd 50.0 N respectively Data are used to plot	graph	that shows the relation be
and 50.0 N Respetively Data are used to plot	graph	that show the Relation. Be
nd 50.0 N respectively Data are used to plot	graph	that shows the relation be
and 50.0 N. Data from table are used to plot	graph	that shows the relation be
.00 g,respectively.The data are used to plot	graph	that is shown the relation

Fig.4.13 The examples of The lack of article "a" or "an" made by the experimental group

KWIC

0 and 4.0000m. Bring data from Table to plot	graph	relation between height
d 50.0N , respectively.Data are used to plot	graph	shown the relation betwe
50.0 N, respectively. Data are used to plot	graph	shown the relation betwe
d 50.0 N,respectively. Data are used to plot	graph	shown the relation betwe
d 50.0 N,respectively. Data are used to plot	graph	shown the relation betwe
50.0 N , respectively. Data are used to plot	graph	shown the relation betwe
espectively. Bring data trom a table to plot	graph	And analyze reaction ti

Fig.4.14 The examples of The lack of article "a" or "an" made by the control group

The article "a"or "an" are used before a countable noun mentioned for the first time. In these examples, "graph" is a countable noun and mentioned at first, so the article "a" has to be inserted in these sentences as "...to plot a graph..."

Example 3: Subject-verb agreement

KWIC

nged to LDPE ,and PS,respectively. The	data is	used to record in Table a
and 50.0 newton respectively. Finally,	Data is	used to plot a graph to s
and 50.0 newton respectively. Finally,	Data is	used to plot a graph the
.0 and 50.0 respectively. (4) A set of	data is	used for plotting a graph
0000, and 4.0000 metre,respectively.The	data is	are used to record in Tab

Fig.4.15 The examples of subject-verb agreement made by the experimental group

KWIC

2) This experiment is tested again 4 times.The	data is	averaged. (3) The r
d. (3) The radius of the ring is measured. The	data is	in recorded. (4) The
cillation and the radius of the ring. (6) The	Data is	analyzed for find g
electric current is measured from ammeter. The	data is	recorded and this p
to 1000, 1500, 2000, 2500 g respectively. The	data is	taken and plotted a

Fig.4.16 The examples of subject-verb agreement made by the control group

In these examples, the word "data" is a plural noun and verb "is" did not use with a plural noun. So, it has to be changed to the verb "are".

4.2.2 The analysis of syntactic errors

A number of errors in each sub-type by arranging them in order were summarized. It was found that there were 18 types of syntactic errors:

1. Misuse of voices
2. Misplacement of verb
3. Incorrect parallel structure
4. Lack of verb
5. Misplacement of noun
6. Lack of object
7. Lack of relative pronoun
8. Lack of connector
9. Incomplete sentence
10. Lack of "that" in that-clauses
11. Lack of subject
12. Misplacement of adjectives
13. Incorrect comparative form
14. Incorrect superlative form
15. Misuse of connectors
16. Incorrect form of voice
17. Misplacement of participles
18. Misplacement of connectors

Table 4.3 presented the sub-types and number of syntactic errors shown as below.

Table 4.3 The number of syntactic errors made by groups of students (E = the experimental group, and C = the control group)

Rank	Sub-types of syntactic errors	The number of errors in each move of abstract								Total number of errors			
		Introduction		Method		Result		conclusion					
		E	C	E	C	E	C	E	C	E	C	Total	%
1	Misuse of voices	33	30	241	303	1	8	10	6	285	347	632	27.43
2	Misplacement of verb	0	3	137	270	1	0	1	0	139	273	412	17.88
3	Incorrect parallel structure	36	42	189	86	0	0	0	1	225	129	354	15.36
4	Lack of verb	17	68	13	51	15	14	20	14	65	147	212	9.20
5	Misplacement of noun	6	8	34	49	8	7	16	5	64	69	133	5.77
6	Lack of object	4	3	4	19	41	38	4	12	53	72	125	5.43
7	Lack of relative pronoun	4	6	16	27	12	54	0	2	32	89	121	5.25
8	Lack of connector	7	6	18	33	7	15	0	1	32	55	87	3.78
9	Incomplete sentence	2	4	32	35	3	0	0	0	39	39	78	3.39
10	Lack of "that" in that-clauses	0	8	0	1	31	15	0	0	31	24	55	2.39
11	Lack of subject	0	1	6	13	7	6	3	0	16	20	36	1.56
12	Misplacement of adjectives	0	0	23	0	0	0	0	0	23	0	23	1.00
13	Incorrect comparative form	2	3	0	0	0	3	0	1	2	7	9	0.39
14	Incorrect superlative form	0	1	0	0	3	5	0	0	3	6	9	0.39
15	Misuse of connectors	2	3	0	0	1	0	0	2	3	5	8	0.35
16	Incorrect form of voice	1	2	0	1	0	2	0	0	1	5	6	0.26
17	Misplacement of participles	0	0	1	2	0	0	0	0	1	2	3	0.13
18	Misplacement of connectors	0	0	0	0	0	0	0	1	0	1	1	0.04
Total		114	188	714	890	130	167	54	45	1014	1290	2304	100.00

As shown in Table 4.3, Table 4.3 indentified the number of syntactic errors made by both experimental group and control group. The results were found that the top three syntactic errors were the misuse of voice (27.43%), the misplacement of verbs (17.88%), and the incorrect form of parallel structure (15.36%), respectively, and the experimental group made the errors less than the control group.

For the analysis of syntactic errors made by experimental group, the data were indicated that the top three syntactic errors were the incorrect form of parallel structure, the misuse of the active voice (the use of active voice instead of passive voice) and the misplacement of verbs (word order), respectively. The examples of errors of top three syntantic errors were presented in Fig. 4.17 to Fig. 4.19 below:

Example1: The incorrect parallel structure

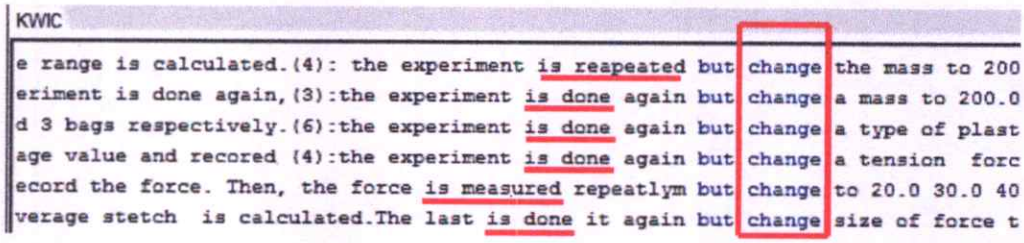


Fig.4.17 The examples of incorrect parallel structure made by the experimental group

In these examples, the passive voice structure is used in these sentences. So, the form of verb "change" has to be changed to "changed".

Example 2: The misuse of voice

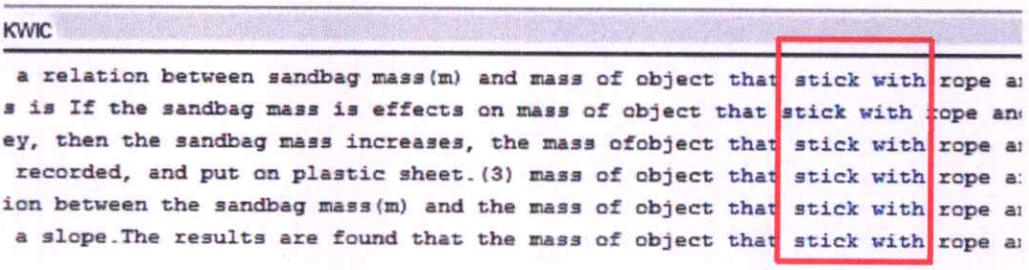


Fig.4.18 The examples of the use of voice made by the experimental group

In these examples, the student used the active voice instead of passive voice. The object can not stick by itself so, the verb "stick (active form)" has to be changed to "was sticked (passive form)".

Example: 3 The misplacement of verb

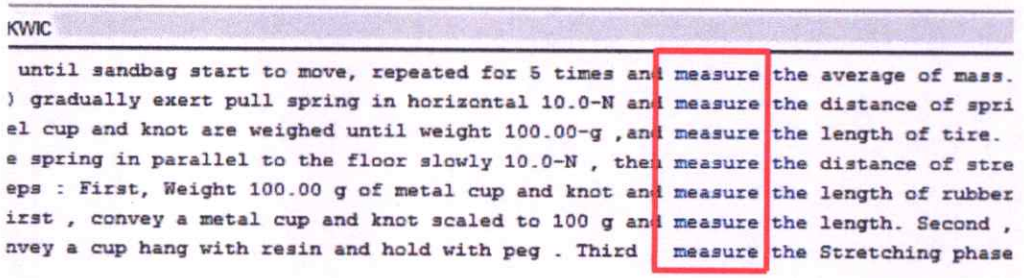


Fig.4.19 The examples of misplacement of verb made by the experimental group

In these examples, the subject in these sentences are "distance" or "length". So, the verb "measure" has to be inserted after these subjects, not in front of them.

For the analysis of syntactic errors made by the control group, the data were indicated that the top three syntactic errors were the misuse of active voice (the use of active voice instead of passive voice), the misplacement of verbs (word order), and the omission of verbs, respectively. The examples of errors were presented in Fig. 4.20 to Fig. 4.22 below:

Example 1: The misuse of voice

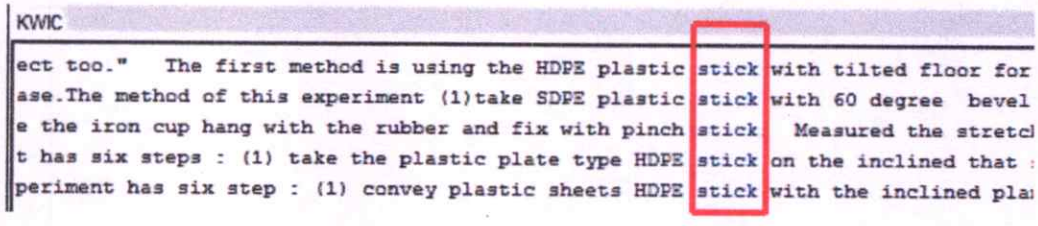


Fig.4.20 The examples of misuse of voice made by the control group

In these examples, the student used the active voice instead of passive voice. The object can not stick by itself so, the verb "stick (active form)" has to be changed to "was sticked (passive form)".

Example 2: The misplacement of verb

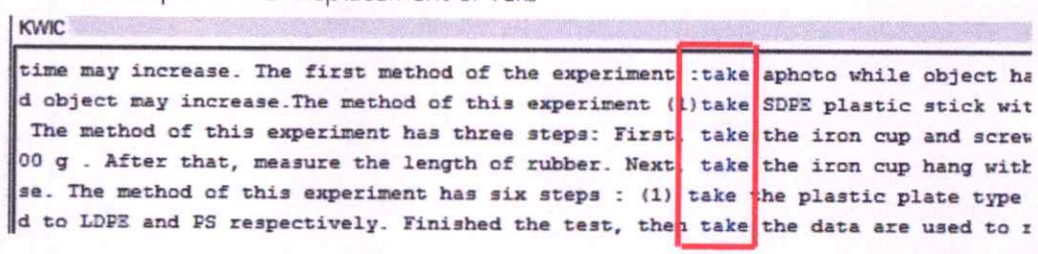


Fig.4.21 The examples of misplacement of verb made by the control group

In these examples, the subject in these sentences are "cup" or "plastic". So, the verb "take" has to be inserted after these subjects, not in front of them.

Example 3: The lack of verb

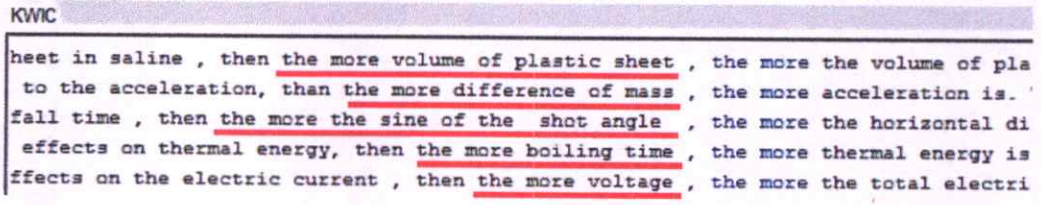


Fig.4.22 The examples of lack of verb made by the control group

In these examples, the sentences appear only subjects. Thus, the verb has to inserted after subject. For instance, "The more the voltage is, the more the elelctricity is."

4.2.4 The analysis of lexical errors

A number of errors in each sub-type by arranging them in order were summarlized. It was found that there are 2 types of lexical errors:

1. Misspelling
2. The misuse of homonymn

Table 4.4 presented the sub-types and number of lexical errors shown as below.

Table 4.4 The number of lexical errors made by groups of students

(E = the experimental group, and C = the control group)

Rank	Sub-types of Lexical errors	The number of errors in each move of abstract								Total number of errors			
		Introduction		Method		Result		conclusion					
		E	C	E	C	E	C	E	C	E	C	Total	%
1	Misspelling	102	81	185	185	41	35	57	29	385	330	715	98.08
2	The misuse of homonym	0	0	8	3	1	2	0	0	9	5	14	1.92
Total		102	81	193	188	42	37	57	29	394	335	729	100.00

As shown in Table 4.4, Table 4.4 indentified the number of lexical errors made by both experimental group and control group. The results were found that the most number of lexical errors in both groups was the misspelling (98.08%), and the experimental group made the errors more than the control group. The examples of errors were presented in Fig. 4.23 to Fig. 4.24 below:

Example 1: Misspelling

KWIC

```
y horizontal. Second, weigh the one sand bag and put on the plastic. Next, t:
 plastic. Next, tie the rope to the sand bag and hook through the reel that
g the loaded-slope slowly until the sand bag start to move. Do these again f
of the relation between the mass of sand bag and the loaded-object and compa
s direct variation with the mass of sand bag. And a PS-plastic is the most c
 the experiment, but changed to use sand bag 2 bag and 3 bag, respectively.
```

KWIC

```
cient of static friction force from a slop. The results are found that the
e the coefficient of friction from a slop.The results are found that the t
d the power of the electric kettle by slop. The result shows that the therm
 static friction from an inverse of a slop. The results are found that the
 six steps (1) the HDPD plastic is on slop that is 60 degree with horizonta
fficient ststic frictional force from slop of the graph.The results are fou
```

Fig.4.23 The examples of misspelling made by the experimental group

In these examples, the experimental group spelt the word "sand bag" and "slop" instead of "sandbag" and "slope", respectively.

Example 2: Misspelling

KWIC

ults are found that restoring force is directly propotional to the weight o
ts are found that the tension force is directly propotional to the weight o
hat the squares of the period of oscillation is propotional to the radius o
he results are found that the force is directly propotional to the weight a
he results are found that the Force is directly propotional to the Weight a
hows that the squares of the shrinking phase is propotional to the force an
xperiment shows that the value of inductance is propotional to the value of

KWIC

study a relation between tensile force (F) and weigth (W) and analyze coeff
study a relation between tensile force (F) and weigth (W) and analyze coeff
o study a relation between tensile force(F) and weigth(W) ,and analyze coef
riction. A hypothesis of experiment is "If the weigth effect on the tensile
the weigth effect on the tensile force,then the weigth increases,the tensile
. (3)this experiment is repeated,but change the weigth from 10.0 N to 20.0,3

Fig.4.24 The examples of misspelling made by the control group

In these examples, the control group spelt the word "propotional" and "weigth" instead of "proportional" and "weight", respectively.

4.2.5 The analysis of semantic errors

A number of errors in each sub-type by arranging them in order were summarized. It was found that there were 4 types of semantic errors:

1. The misuse of a more general term
2. The misuse of too specific term
3. The misuse of synonyms
4. The misuse of collocation words

Table 4.5 presented the sub-types and number of semantic errors shown as below.

Table 4.5 The number of semantic errors made by groups of students
(E = the experimental group, and C = the control group)

Rank	Sub-types of semantic errors	The number of errors in each move of abstract								Total number of errors			
		Introduction		Method		Result		conclusion					
		E	C	E	C	E	C	E	C	E	C	Total	%
1	The misuse of too specific term	10	31	11	12	11	4	9	2	41	49	90	33.83
2	The misuse of collocation words	2	14	9	13	16	17	1	17	28	61	89	33.46
3	The misuse of a more general term	8	3	4	14	18	10	1	7	31	34	65	24.44
4	The misuse of synonyms	2	0	1	1	12	2	3	1	18	4	22	8.27
Total		22	48	25	40	57	33	14	27	118	148	266	100.00

As shown in Table 4.5, Table 4.5 indentified the number of semantic errors made by both experimental group and control group. The results were found that the top three semantic errors were the misuse of too specific term (33.83%), the misuse of collocation words (33.46%), and the misuse of a more general term (24.44%), respectively, and the experimental group made the errors less than the control group. The examples of errors were presented in Fig. 4.25 to Fig. 4.30 below:

Example 1: The misuse of too specific term

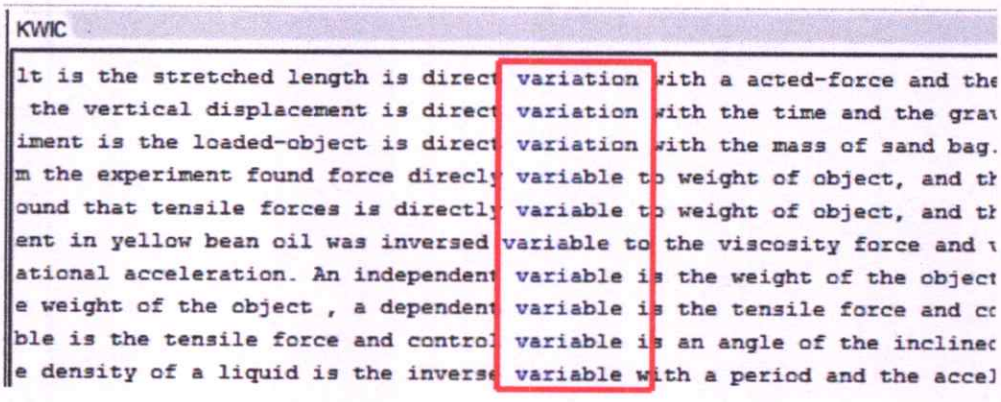


Fig.4.25 The examples of the misuse of too specific term made by the experimental group

In these examples, the word "variable" is too specific term, because it describes the change of population of organism or living thing only. But, in this context, it is to describe the change of physical quantities. Thus, the word "proportional to" is more appropriate in meaning.

Example 2: The misuse of collocation

KWIC

The procedures of this experiment are as	following	: First, using the object th
The procedures of this experiment are as	following	: first put 10.0 N object on
The procedures of this experiment are as	following	: First use object 100 N. pu
The precedures of this experiment are as	following	: First, Ten-newton object i
The procedures of this experiment are as	following	: first put 10.0 N object on
The procedures of this experiment are as	following	; First, An object which wei
the procedure of this experiment are as	following	1st put 10 N object on the g
is." The procedures of this study are as	following	First, heave use of 10.0 ne

Fig.4.26 The examples of the misuse of collocation made by the experimental group

A collocation is a combination of words that are commonly used together. In these examples, the word "as following" is a wrong collocation whereas the word "as follows" is used in writing work.

Example 3: The misuse of a more general term

KWIC

ound until the object starts to move	save	the tension force,(3)this experir
until the object starts to meve, then	save	the value of tensile strength. Th
lel ground. Until object began moving	save	tention,this experiment is repeat
until the object starts to meve, then	save	the value of tensile strength. Th
lel ground. Until object began moving	save	tention,this experiment is repeat

Fig.4.27 The examples of misuse of a more general term made by the experimental group

In these examples, the word "save" is more general term, because it describes the keeping general something from being lost such as money. But, in this context, it is to describe the keeping of data in experiment. Thus, the word "record" is more appropriate in meaning.

Example 4: The misuse of too specific term

KWIC

periment is intended to study the	relationship	between the object and
e table to write a graph with the	relationship	between tensile strengt
this experiment are to study the	relationship	between Force and Weigh
f this experiment is to study the	relationship	between Force (F) and w
f this expreiment is to study the	relationship	between Force(F) and we
the table. Then a graph shown the	relationship	between the changing he
pectively.Sixth, the graph of the	relationship	between the velocity an
Experiment aimed to study of the	relationship	between the square of w

Fig.4.28 The examples of the misuse of too specific term made by the control group

In these examples, the word "relationship" is too specific term, because it describes the the way in which two or more people are connected or a state of affairs existing between those having shared dealings. But, in this context, it is to describe the an aspect or quality that connects two or more things or parts as being or belonging or working together such as the relation of time and space. Thus, the word "relation" is more appropriate in meaning.

Example 5: The misuse of collocation

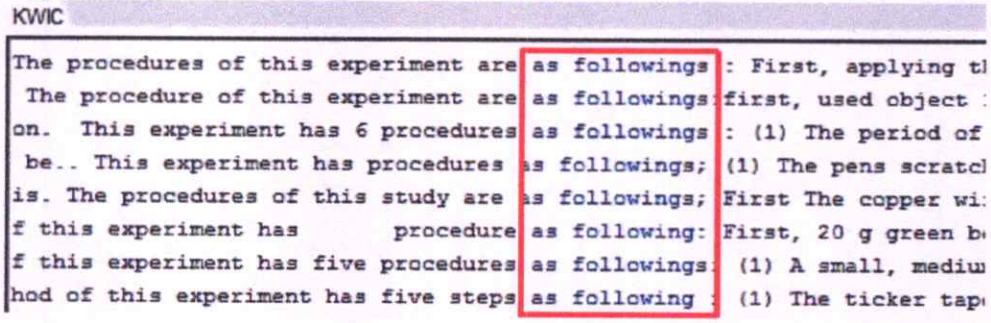


Fig.4.29 The examples of the misuse of collocation made by the control group

In these examples, the word "as following" is a wrong collocation whereas the word "as follows" is used in writing work.

Example 6: The misuse of a more general term

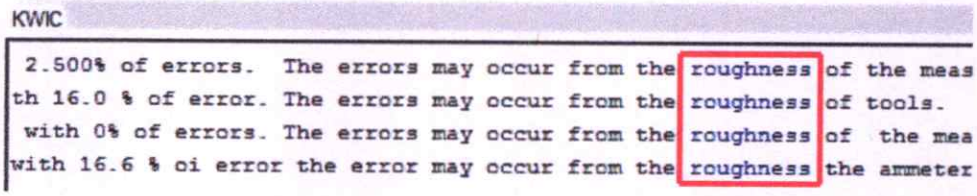


Fig.4.30 The examples of the misuse of a more general term made by the control group

In these examples, the word "roughness" is more general term, because it describes the uneven surface or not smooth surface. But, in this context, it describes the ability of a device in experiment to show an image clearly and with a lot of detail. Thus, the word "resolution" is more appropriate in meaning.

4.2.6 The analysis of mechanical errors

number of errors in each sub-type by arranging them in order were summarized. It was found that there were 12 types of mechanical error:

1. The lack of periods
2. The lack of commas
3. The lack of hyphens
4. The lack of colons
5. The lack of semicolons
6. The lack of quotation marks
7. The uncapitalization of words at the begining of sentence
8. The misplacement of capitalization words
9. The uncapitalization for a proper noun
10. The incorrect form of the acronyms
11. The incorrect form of the abbreviation
12. The misuse of numbers if such number occur close together

Table 4.6 presented the sub-types and number of mechanical errors shown as below.

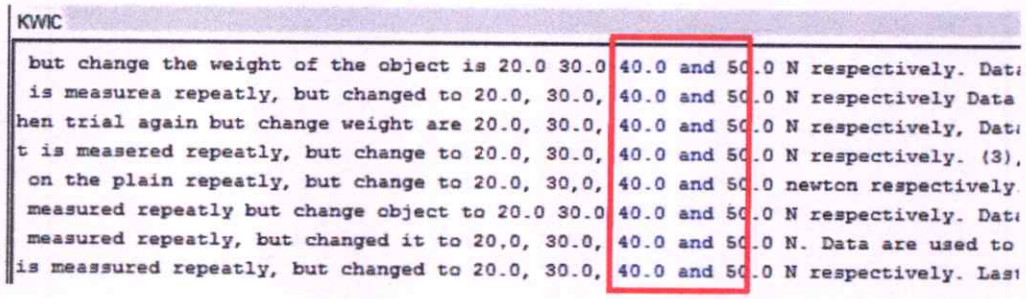
Table 4.6 The number of mechanical errors made by groups of students (E = the experimental group, and C = the control group)

Rank	Sub-types of mechanical errors	The number of errors in each move of abstract								Total number of errors			
		Introduction		Method		Result		conclusion					
		E	C	E	C	E	C	E	C	E	C	Total	%
1	The lack of commas	84	64	412	314	15	12	0	0	511	390	901	40.55
2	The lack of periods	67	96	39	52	22	21	53	111	181	280	461	20.75
3	The misplacement of capitalization words	43	38	49	78	14	24	1	4	107	144	251	11.30
4	The uncapitalization of words at the begining of sentence	8	10	95	38	22	19	3	2	128	69	197	8.87
5	The lack of hyphens	10	6	34	56	6	1	3	4	53	67	120	5.40
6	The uncapitalization for a proper noun	9	8	23	51	7	11	0	0	39	70	109	4.91
7	The lack of quotation marks	28	37	1	0	0	0	0	0	29	37	66	2.97
8	The lack of colons	8	2	27	6	0	1	0	1	35	10	45	2.03
9	The incorrect form of the acronyms	0	7	2	9	2	6	0	0	4	22	26	1.17
10	The lack of semicolons	4	0	12	5	0	2	0	0	16	7	23	1.04
11	The incorrect form of the abbreviation	0	0	3	1	3	9	0	2	6	12	18	0.72
12	The misuse of numbers if such number occur close together	0	0	0	5	0	0	0	0	0	5	5	0.23
Total		261	268	697	615	91	106	60	124	1109	1113	2222	100.00

As shown in Table 4.6, Table 4.6 indentified the number of mechanical errors made by both experimental group and control group. The results were found that the top three of mechanical errors were the lack of commas (40.55%), the lack of periods (20.75%), and the misplacement of capitalization words (11.30%), respectively, and the experimental group made the errors less than the control group.

For the analysis of mechanical errors made by experimental group, the data were indicated that the top three mechanical errors were the lack of commas, the lack of periods, and The uncapitalization of words at begining of sentence, respecitively. The examples of errors of top three mechanical errors were presented in Fig. 4.31 to Fig. 4.33 below:

Example 1: The lack of commas

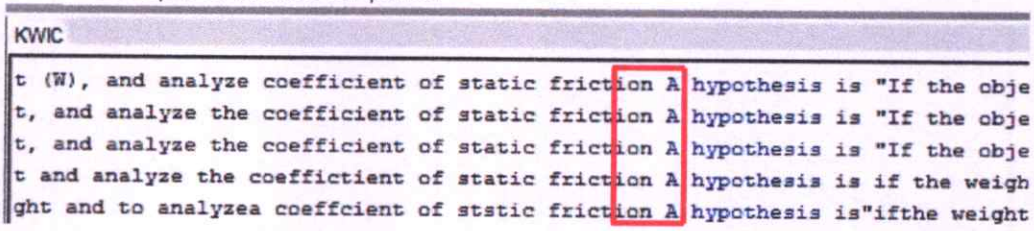

KWIC

but change the weight of the object is 20.0 30.0 40.0 and 50.0 N respectively. Dat
is measurea repeatly, but changed to 20.0, 30.0, 40.0 and 50.0 N respectively Data
hen trial again but change weight are 20.0, 30.0, 40.0 and 50.0 N respectively, Dat
t is measered repeatly, but change to 20.0, 30.0, 40.0 and 50.0 N respectively. (3),
on the plain repeatly, but change to 20.0, 30,0, 40.0 and 50.0 newton respectively
measured repeatly but change object to 20.0 30.0 40.0 and 50.0 N respectively. Dat
measured repeatly, but changed it to 20.0, 30.0, 40.0 and 50.0 N. Data are used to
is meassured repeatly, but changed to 20.0, 30.0, 40.0 and 50.0 N respectively. Las

Fig.4.31 The examples of lack of commas made by the experimental group

Commas are used to separate the elements in a series. In these examples, the experimental group did not insert commas between number.

Example 2: The lack of period


KWIC

t (W), and analyze coefficient of static friction A hypothesis is "If the obje
t, and analyze the coefficient of static friction A hypothesis is "If the obje
t, and analyze the coefficient of static friction A hypothesis is "If the obje
t and analyze the coeffictient of static friction A hypothesis is if the weigh
ght and to analyzea coeffcient of ststic friction A hypothesis is"ifthe weight

Fig.4.32 The examples of use of period made by the experimental group

Periods are used at the end of a complete sentence. In these examples, the experimental group did not insert period at the end of the sentences.

Example 3: The uncapitalization at the beginning of sentence

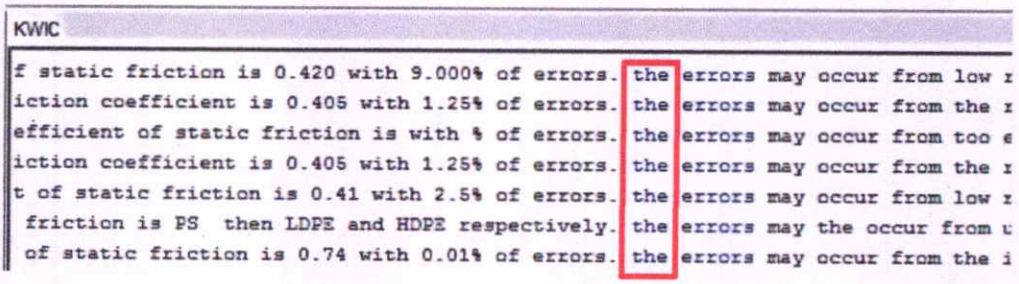


Fig.4.33 The examples of uncapitalization at the beginning of sentence made by the experimental group

In these examples, the experimental group did not capitalized the letter at the beginning of the sentences.

For the analysis of mechanical errors made by the control group, the data were indicated that the top three mechanical errors were the use of commas, the use of periods, and the capitalization of words at misplaced position, respectively. The examples of errors were presented in Fig. 4.34 to Fig. 4.36 below:

Example 1: The lack of commas

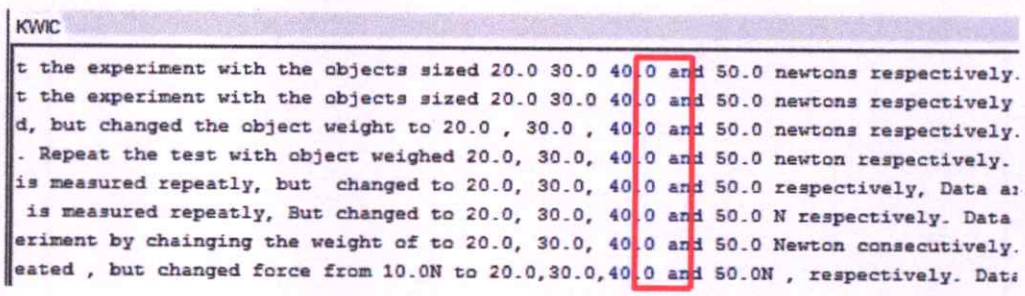


Fig.4.34 The examples of use of commas made by the control group

In these examples, the control group did not insert commas between number.

Example 2: The lack of commas

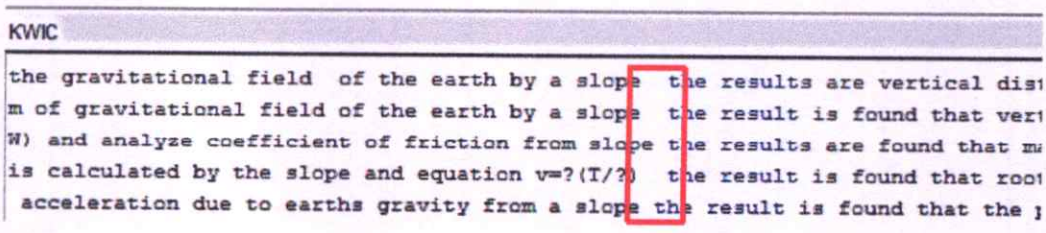


Fig.4.35 The examples of use of period made by the control group

In these examples, the control group did not insert period at the end of the sentences.

Example 3: The uncapitalization at the beginning of sentence

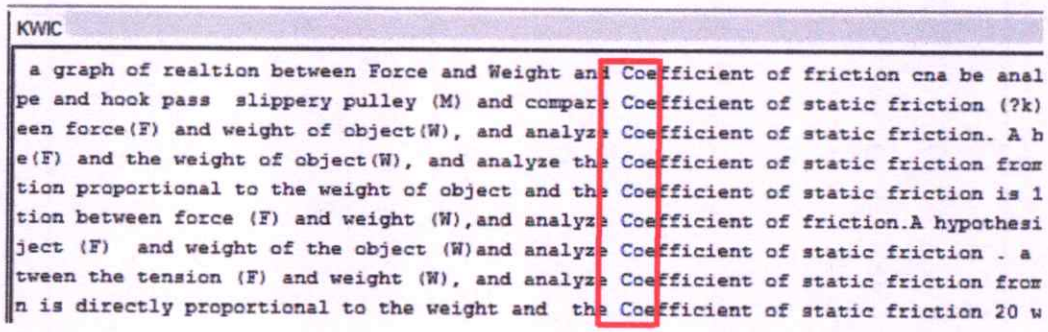


Fig.4.36 The examples of the capitalization of words at misplaced position made by the control group

In these examples, the control group did not capitalized the letter at the beginning of the sentences.

The summary of errors analysis can be seen in Table 4.7 shown as below:

Table 4.7 The summary of the top three common errors analysis in LSA corpus

Rank	Type of errors	Sub-type of errors	instance	%
1	Morphological error	1. The lack of article "the"	962	10.64
		2. The lack of articles "a, an"	763	8.44
		3. Subject-verb agreement	426	4.71
		Total	**3,517**	**38.91**
2	Syntactic error	1. The misuse of the voices	632	6.99
		2. The misplacement of verb	412	4.56
		3. The incorrect parallel structure	354	3.92
		Total	**2,304**	**25.49**
3	Lexical error*	1. Misspelling	715	7.91
		2. The misuse of homonym	14	0.15
		Total	**729**	**8.07**
4	Sematic error	1. The misuse of too specific term	90	1.00
		2. The misuse of wrong collocation	89	0.98
		3. The misuse of more general term	65	0.72
		Total	**266**	**2.94**
5	Mechanical error	1. The lack of commas	901	9.97
		2. The lack of periods	461	5.10
		3. The misplacement of capitalization	251	2.78
		Total	**2,222**	**24.59**
Total			**9,038**	**100.00**

* There are only two tags in the lexical error.

4.2 The Written Errors Comparing between Two Groups of Students

The written errors was compared between two groups of students to answer the research question 2. The comparison of the errors in written scientific English abstracts between the experimental group and the control group as shown in Table 4.8.

Table 4.8 The chi-square test of the deference between two groups of students (The total frequency of error is 9,038)

Groups of students	Frequency of error					χ^2-test
	Morphological error	Syntactic error	Lexical error	Semantic error	Mechanical error	
Experimental	1,561	1,014	394	118	1,109	
Control	1,956	1,290	335	148	1,113	39.62**
Total	3,517	2,304	729	266	2,222	

*p < .05, **p < .01, df = 4, p = 0.000000005

The highest frequency of errors in all groups was the morphological error (3,517), followed by syntactic error (2,304), mechanical error (2,222), lexical error (729), and semantic error (266), respectively. The result indicated statistically significant difference of errors between two groups of students at .01 level.

4.3 The Causes of Errors

The causes of errors was analyzed to answer the research question 3. The causes of erros in this research were based on Norrish (1983: 21– 26), Brown (1980: 173–181), and Richard (1971 : 204–219). They were L1 interference, the misconception in language rules, the carelessness in writing, the incomprehensiveness of target language, the lack of linguistic form, and the teacher or textbook leading to errors. To understand the overall view about causes of errors in LSA corpus, the researcher interviewed the students. The causes of error were presented in Fig. 4.37 as below:

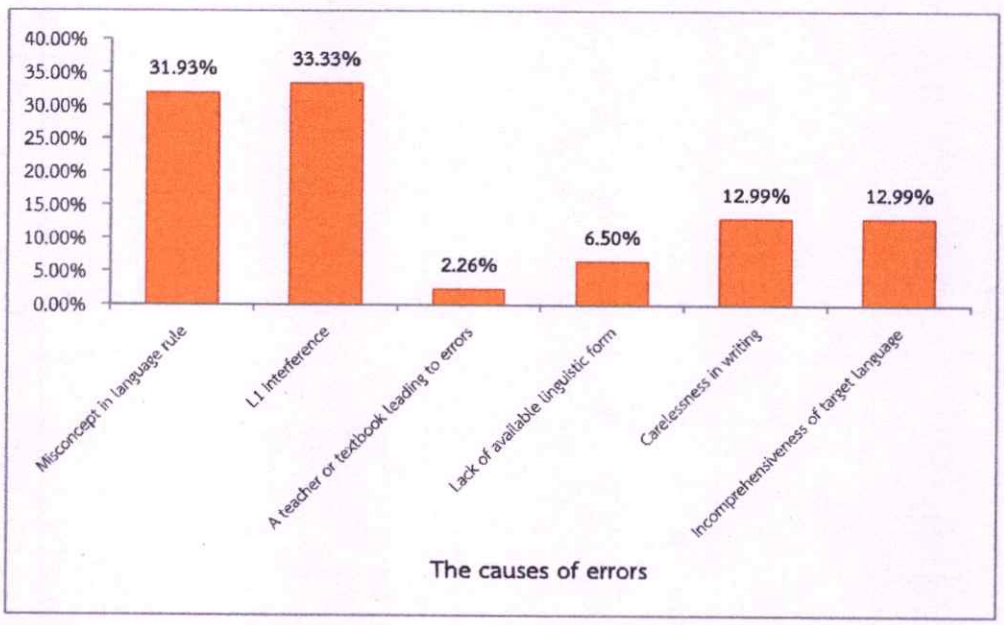


Fig. 4.37 The percentage of causes of errors occurred in the LSA corpus

According to the students' interview, it was found that the main causes of errors made were the L1 interference (33.33%), the misconception in language rules (31.93%), the carelessness in writing (12.99%), the incomprehensiveness of target language (12.99%), the lack of linguistic form (6.50%), and the teacher or textbook leads to errors (2.26%), respectively.

4.4 Chapter Summary

This chapter presented the findings of the study according to each research questions; that is, (1) What are the top ten common errors that students make in their laboratory scientific abstract writing? (see in 4.1 to 4.6), (2) Are there the statistically significant differences of errors made by the students between the students who are taught and are not taught scientific abstract writing in English? (see in 4.7), and (3) What are the main causes of errors in laboratory scientific abstract writing? (see in 4.8). The next chapter shown the discussed the research outcomes in relation to the results and findings of previous literature and studies. Besides, the implications of the results of this study as well as recommendations for further research was discussed.

CHAPTER 5
SUMMARY OF RESULTS, DISCUSSIONS, AND RECOMMENDATIONS

The previous chapter presented the results of the corpus-based error analysis in the LSA corpus. These findings of the study were summarized, discussed in this chapter, and followed by the research recommendations to the future works and the implications to English for science teaching.

5.1 Summary of Results

The findings were concluded according to the research questions as follows:

5.1.1 The top ten common errors found in the LSA corpus were lack of article "the" (10.64%), the lack of commas (9.97%), the lack of articles "a, an" (8.44%), misspelling (7.91%), the misuse of voices (6.99%), the lack of periods (5.10%), subject-verb agreement (4.71%), the misplacement of verbs (4.56%), incorrect parallel structure (3.92%), and the misuse of articles "a, an"(3.42 %), respectively.

5.1.2 The morphological errors found in the LSA corpus were the lack of article "the" (10.64%), the lack of articles "a, an" (8.44%), and subject-verb agreement (4.71%), respectively.

5.1.3 The syntactic errors found in the LSA corpus were the misuse of voices (6.99%), the misplacement of verb (4.56%), and the incorrect parallel structure (3.92%), respectively.

5.1.4 The lexical errors found in the LSA corpus were misspelling (7.91%) and the misuse of homonymn (0.15%), respectively.

5.1.5 The sematic errors found in the LSA corpus were the misuse of too specific term (1.00%), the misuse of collocation word (0.98%), and the misuse of general term (0.72%), respectively.

5.1.6 The mechanical errors found in the LSA corpus were the lack of commas (9.97%), the lack of periods (5.10%), and the misplacement of capitalization (2.78%), respectively.

5.1.7 The frequency of errors made by the experimental group was less than the frequency of errors made by the control group at .01 level of significance.

5.1.8 The main causes of errors were the L1 interference (33.33%), the misconception in language rules (31.93%), the carelessness in writing (12.99%), the incomprehensiveness of target language (12.99%), the lack of linguistic form (6.50%), and the teacher or textbook leads to errors (2.26%), respectively.

The summary of results was presented in Table 5.1 below:

Table 5.1 The summary of results

Researh Objectives	Research Questions	Proven from Instruments	Major Findings
<u>Research Objective 1</u> To analyze the common errors in laboratory scientific abstracts in English made by the Thai upper secondary school students.	<u>Research Question 1</u> What are the top ten common errors that students make in their laboratory scientific abstract writing?	<u>Instrument 1</u> The scheme of error classification recording	<u>Major Finding 1</u> The top common errors found in the LSA corpus were 1) the lack of articles "the" (10.64%), 2) the lack of commas (9.97%), 3) the lack of articles "a or an" (8.44%), 4) misspelling (7.91%), 5) the misuse of voices (6.99%), the lack of periods (5.10%), subject-verb agreement (4.71%), the misplacement of verbs (4.56%), incorrect form of parallel structure (3.92%), and the misuse of articles "a or an" (3.42%), respectively.
<u>Research Objective 2</u> To compare the errors in written scientific English abstracts between students who are taught and are not taught scientific abstract writing in English.	<u>Research Question 2</u> Are there the statistically significant differences of errors made by the students between the students who are taught and are not taught scientific abstract writing in English?	<u>Instrument 2</u> The five lesson plans for teaching scientific abstract writing in English	<u>Major Finding 2</u> The frequency of errors made by the experimental group was less than the frequency of errors made by the control group at .01 level of significance.
<u>Research Objective 3</u> To investigate the main causes of errors in written scientific English abstracts.	<u>Research Question 3</u> What are the main causes of errors in laboratory scientific abstract writing?	<u>Instrument 3</u> The guided interview	<u>Major Finding 3</u> The main causes of errors were the L1 interference (33.33%), the misconception in language rules (31.93%), the carelessness in writing (12.99%), the incomprehensiveness of target language (12.99%), the lack of linguistic form (6.50%), and the teacsher or textbook leads to errors (2.26%), respectively.

5.2 Discussions of Major Findings and Teaching Implications

The major findings of this study can be discussed in relation to the results and findings of previous studies. The discussion was divided into three parts as follows:

5.2.1 Top ten common errors found in LSA corpus according to the research objective 1 and implication for teaching

This research revealed that the morphological errors were the most frequently found in LSA corpus. They was approximately 40% of the number of errors, espectially, the lack of article "the" (rank 1), the lack of articles "a, an", and the misuse of article "a, an" (rank 10). Most students ignored the use of articles in sentences. This result was corresponding to Nopjirapong's study in 2010. This study confirmed that the omission of "the" was the highest frequency of written errors of Thai students. Besides, the L1 interference may be the main cause of this error because in Thai language, it did not have articles in contrast to English. This L1 interference is defined as the negative transfer (Sabbah, 2015: 71) or intralingual transfer (Brown, 1980: 173-181).

In addition, the subject-verb agreement (rank 7) was found in LSA corpus approximately 5%. Most students can not use the verb form corresponding to the subject such as the adding of -s or -es for singular subject. It comfirmed to Bumroongthai's study (2010) that Thai students frequently made the wrong verb forms in their writing work. The L1 interference in type of negative transfer may be the causes of this error because in Thai language, it did not change verb form at all in contrast to English. From the student's interview, the high writing performance students accepted that the errors occured in their writing because of their carelessness whereas the poor writing performance students did not known this grammatical rules. To decrease the morphological errors, Harmer (2004 : 110-112) suggested that the teacher ought to use the correction symbol when the student made the written error. For example, the teachers write "A" when the students do not insert the appropriate article or write "P" when the student do not insert the -s or -es for singular subject. This way can encourage student think about what the errors are and try to correct them by selves.

As for the syntactic errors, the top errors found in the abstract writing were (1) the misuse of voices (rank 5), (2) the misplacement of verb (rank 8), and (3) incorrect parallel structure (rank 9). The results conformed to Bumroongthai's study (2010) that errors in grammar and sentence structures were most frequently found in Thai student writing. In this study, the main reason supported why the students made syntactic errors was the negative transfer in L1 interference. Thai language used the passive

voice in the negative meaning such as "เขาถูกตี" "ฉันถูกใส่ความ" whereas English language used the passive voice to focus on a happening which is more importance than who or what causes the happening such as "The data were recorded in three times". The passive voice in English language can be used in both positive and negative meaning contrast to Thai language (Alexander, 1992: 241 – 1246). From the interview, it was apparent that low performance students did not know how to use passive voice in abstract writing, whereas passive voice was used often by the native speakers, especially, the method parts. To solve this problem, the teachers need to review the structure of passive voice and give some examples to the students before drafting or re-drafing an abstract.

According to the interview, most of the lexical errors that the students made was a lot of misspelling (Rank 4). From the interviewing, they occured due to their own carelessness and lack of concentration in writing. For example, they wrote "a sand bag" instead of "a sandbag", or wrote "proprotional" or "propotional" instead of "proportional". This results corresponded with Zhang's corpus-base study (2013) which presented that EFL students frequently made the spelling mistake in their writing. Harmer (2004: 110-112) recommended the using dictionary to help the student spell the word correctly.

As for the mechanical errors, it was frequently found the misuse of the comma (rank 2), and misuse of period (rank 6). It was in line with Ratchawicha's study (2012) that most students omitted comma, and period, in English writing because of the intralingual transfer or negative transfer. Thai language does not use a comma in sentence. Besides, Thai language does not use a period at the end of sentence but it appears in the abbreviated words only. Norrish (1983: 71-75) suggested that the checking in pairs can be used to investigate the use of punctuation in their writing work. This way encourages the communication among the students. They can learn through the mistake in their work and the friends' written work.

In terms of the semantic error, it was found that the students used the too specific terms and wrong words. For example, they use "varied" instead of "proportional" in sentence. The word "varied or variation" were used in meaning of the changes that occur in populations of living organism over time whereas proportional was used in mathematic or physics for presenting the ratio of quantities. It indicated that Thai students cannot select and use the appropriated words to create a sentence in English or they do not know the exact meaning of specific terms and how to use them correctly. Therefore, teachers need to pre-teach the meaning of scientific terminology and how to use them practically.

5.2.2 The comparison of common errors found in LSA corpus between the experimental group and the control group according to the research objective 2 and implication for teaching

In this research, it was found that the experimental group made less errors than the control group. This finding indicated that the teaching process can help the students decrease the errors in writing and the students need to get some inputs such as vocabulary and grammar focus before they perform the writing tasks, because the teaching process made the students aware of the important language point of abstract writing such as the use of modal verbs, and the linking words. However, it is interesting to find out that the experimental group made more spelling mistakes than the control group. This might be because in the process of teaching, the students in experimental group were taught how to write the abstract and new vocabulary and/or terminology. That means this group got some chances to use the new vocabulary or terminology in their written work. Therefore, they have more chances to make the misspelling than the control group who were not taught. To solve this problem, teachers should also pre-teach spelling apart from other language points mentioned.

5.2.3 The main causes of error according to the research objective 3 and implication for teaching

Based on LSA corpus, the top three main causes of errors were the L1 interference, the misconception in language rules, and the carelessness, respectively. They were discussed in this parts as follows:

The results indicated that mother tongue interference in negative transfer was the major cause of error, especially, morphological errors, sytanctic errors, and mechanical errors mentioned in 5.2.1. It indicated that the students tended to use the Thai language pattern or rule which led to the errors in the English writing. For instance, in method part, they wrote *"Second, repeat the experiment with the objects sized 20.0 30.0 40.0 and 50.0 newtons respectively."* instead of *"Second, the experiment is repeated and changed the objects to 20.0, 30.0, 40.0, and 50.0 Newtons, respectively."*. To solve this problem, Norrish (1993: 21-26) suggested that the best teaching method was to re-teach the problematic English structures. It can help the students to see the language item and give the students a chance to use the English language patterns or rules in the appropriate situations. Moreover, Harmer (2004: 110-112) recommended the remedial teaching for solving this problem. The teachers ought to exemplify the errors in their writing work and ask them to help to learn through their errors.

In addition to L1 interference, Thai learners tended to acquire the misconception in the English language rules. For instance, in discussion part, they wrote *"The errors may occur from the instrument has too small scales."* instead of

"The errors may occur from the less resolution instrument.". The students made the sentential error from using the subordinate clause after preposition instead of using noun or gerund. Harmer (2004: 110-112) suggests the teaching method to decrease the errors by using a dictionary or a grammar book. Teachers have to point out the errors in the students' written work and tell them to look it up in the recommended grammar books. He stated that this way can encourage students to look at the information and learn until they created the correct sentences. Besides, he recommended the reformulation technique to help the student get the right concept in language rules. The teachers have to show two sentences; that is, (1) the incorrect sentences made by the students and (2) the correction. Then, the teachers point out and explain the errors occurred in students' work whereas the students learn by comparing correct and incorrect sentences.

According to the interview, the carelessness was a main cause of errors found in LSA corpus, especially the misspelling and the use of punctuation. Norrish (1983: 21-26, 71-75) explained that the carelessness occurred because of the lack of concentration. He suggested that one way of reducing the number of careless errors in written work was the group discussion. The students got a role as an editor. They have to check the careless errors in their group. Norrish explained that this way made the students to be active to search for errors and get the chance to discuss these errors with their partners or groups. Besides, a group of four was convenient and appropriate for making a small group discussion.

5.3 Recommendations

As summarized and discussed above, this section presented recommendations for further researches. Table 5.2 showed the limitations of this study and the corresponding recommendations for the future research.

Table 5.2 Limitations of this study and recommendations

Limitations of this study	Recommendations for future research
1. Limited scope of sample	Wider scope of sample with varying grades, English proficiency levels, study program, types of educational institutions and so on.
2. Genre of scientific text	Other genres of scientific texts such as the body of scientific laboratory report, the chemistry laboratory abstract, the biology laboratory abstract, etc. should be explored.
3. Corpus size	Increase the number of abstracts in corpus.

Firsly, there was the limitation in scope of samples in this study. The samples were the science and mathematic program students in Mathayomsuksa 5 of public school. Therefore, it is recommended that the future research can be focused on the lower secondary school students, the students in other study programs, the different English proficiency levels students, or the students who learnt in other types of educational institutions such as the private school, the demonstation school, or the vocational school.

Secondly, this scientific text used in this research emphasized on physics laboratory abstract in content force and electricity only. Thus, the future research could study the corpus-based error analysis in other physics contents or other genre of scientific texts such as the introduction, the body, or the other part of scientific laboratory report, the chemistry laboratory abstract, the biology laboratory abstract.

Lastly, the number of LSA corpus in this study was 540 pieces with 61,595 words. The corpus size was rather too small when compared with other learner corpus. For instance, the number of words in Cambridge Learner Corpus (CLC) was 16 million-word (Nicholls, 2003: 572) and the number of words in Longman Learners' Corpus (LLC) was 10 million-word (Turton and Heaton, 2009: V; Turton and Heaton, 2013: Online). Because of this, it is recommended that future research could be conducted in a larger scale of corpus.

In summary, the improvement in these limitations of this research would be necessary to future works in order to make firmer and more valid conclusions applicable to EST or EFL teaching for Thai students.

5.4 Chapter Summary

In conclusion, this study has shown the common errors in the laboratory scientific abstract writing of Thai students by using corpus-based analysis. It was found that five main important errors were morphological, syntactic, lexical, semantic, and mechanical errors, respectively. The results have the pedagogical implications for scientific abstract writing. For instance, the teacher can use top common errors to design a syllabus to help the student avoid common errors in writing such as the omission of articles "the", the use of commas, misspelling, and misused of the active and passive voice. Besides, the results can be used as a guideline for the English teacher to improve teaching method in writing for Thai students or the EFL students.

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APPENDECES

Appendix A: Tagsets in LSA Corpus
Appendix B: Lesson Plan and Teaching Material
Appendix C: Guided Interview Form
Appendix D: Example of LSA Corpus
Appendix E: Yamane Table

APPENDEX A
Tagsets in LSA Corpus

Table A.1 The tagsets in LSA Corpus

Major Errors	Type of Errors	Sub-Types of Errors	Examples	Tags
Morphological Errors	1. Use of agreement	Subject-verb agreement	The data from Table is (are) taken to plot a graph.	MO11
		Determiner-noun agreement	The results (result) is found that the surface tension is 0.06457 N/m.	MO12
	2. Use of preposition	Misuse of Prepositions	Ethyl alcohol is filled in a beaker for (to) the height of 1.00 cm.	MO21
	3. Use of determiner	Lack of article "the"	A graph is analyzed from ... (the) y-intercept.	MO31
		Lack of article "a" or "an"	A pen's scratch is marked by ..... (a) permanent pen on a plastic cup's surface.	MO32
		Misuse of article "a" or "an"	This experiment has objectives to analyze the speed of light in an (X) ethanol.	MO33
		Misuse of article "the"	This experiment purposes to analyze the density of water by the (a) relation between object's weight and tension.	MO34
	4. Use of verbs	Misuse of gerund	The coefficient of static friction is measured by pull (pulling) sandbag.	MO41
		Misuse of Infinitives	This experiment purposes find (to find) the relation between	MO42
		Misuse of Modal and Auxiliary	The electric current is (does) not pass to R5.	MO43
		Incorrect form of verb	The spring is hanged (hung) by the object.	MO44
		Misuse of verb	The catapult may loses the elasticity. (may lose)	MO45
		Misuse of participle	The errors was occur from count (counted) time.	MO46
	5. Use of possessives	Misuse of apostrophes	The experiment purposes to analyze the power's sound. (power of sound)	MO51
		Lack of apostrophes	The result is found that the Young modulus (Young's modulas) of the plastic band is 4.55×10^{9} N/m^{2}	MO52
	6. Use of adjectives	Misuse of adjectives	The error may occur because the eyesight is uncertainly (uncertain).	MO61

Table A.1 The tagsets in LSA Corpus (Continued)

Major Errors	Type of Errors	Sub-Types of Errors	Examples	Tags
Morphological Errors (Continued)	7. Use of adverb	Misuse of adverb	The length is direct (directly) proportional to the force.	MO71
		Incorrect form of adverb	The diameter of spring is invertly (inversely) proportional to the spring constant.	MO72
	8. Use of conjunction	Misuse of conjunction	If the weight of an object affect the tensile, so (then) the tensile will increase when the weight increases.	MO81
	9. Use of idiom	Misuse of idiom	The procedures of this experiment are as following: (follows)	MO91
Syntactic error	1.Incomplete Sentence Structures	Incomplete sentence	The refractive index values is ... (The refractive index values is 1.34.)	SY11
		Lack of verbs	The more object's weight .... (is), the more tension is.	SY12
		Lack of subjects	... (The experimenter) records data to analyze the spring constant.	SY13
		Lack of object	The object was moved out from ..... . (the water surface)	SY14
	2.Compound Sentences	Lack of connectors	The experiment aims to study the relation between cross-sectional area and velocity ..... (and) compare volume flow rate of solution.	SY21
		Misplacement of connectors	The length was measured mass while oscillating. (while thje mass was oscillating)	SY22
		Misuse of connectors	If the height affects to the falling time also, (then) the falling time may increase.	SY23
	3. Word order	Misplacement of noun	The errors may occur from the room light. (the light in the room)	SY31
		Misplacement of adjectives	The errors may occur from the usage of water with colored agent and some antioxidant additive in oil. (additive antioxidant)	SY32
		Misplacement of verbs	Recorded the period of oscillation is. (The period of oscillation is recorded)	SY33
		Misplaced participles	A mass effect on the time of spring oscillated. (oscillated spring)	SY34

Table A.1 The tagsets in LSA Corpus (Continued)

Major Errors	Type of Errors	Sub-Types of Errors	Examples	Tags
Syntactic error (Continued)	4. Complex sentences	Lack of relative pronoun	The water is filled into beaker below plastic round ring ... (that) touch with water surface.	SY41
		Lack of "that" in that clause	A experiment is hypothesized, ... (that) the radius of the...	SY42
	5. Voices	Misused of voices	The result found (was found) that the height of oil in manometer is	SY51
		Incorrect form of voice	The wind is blow (blown) through a laboratory room.	SY52
	6. Run-on Sentences	Lack of connector	The experiment aims to study the relation between cross-sectional area and velocity ..... (and) compare volume flow rate.	SY61
	7. Comparison	Incorrect comparative form	The cube foam is pushed down 2.00 cm lower from (lower than) the balance level.	SY71
		Incorrect superlative form	The coefficient of friction on foam is most. (the most)	SY72
	8. Parallel Structure	Incorrect parallel structure	The experiment are done again in 4 times but changes (changed) the sand's weight to 2.0, 3.0, and 4.0 N.	SY81
Lexical Error	1. Distortion	Misspelling	It makes small water wafe (wave) on water's surface in a beaker.	LE11
	2. Misselections	The misuse of honomymn	the catapult may loss (lose) elasticity	LE21
Semantic Error	1. Confusion of sense relations	The misuse of a more general term	The coefficient of static friction is analyzed by a y-coordinate. (y-intercept)	SE11
		The misuse of too specific term.	The data would be generated a graph. (plotted)	SE12
		The misuse synonyms	The objective of this experiment was to study the relation terminal (final) velocity and the angle.	SE13
	2. Collocation	The misuse collocation	The horizontal distance is directly vary (directly proportional) to spring contraction.	SE21

Table A.1 The tagsets in LSA Corpus (Continued)

Major Errors	Type of Errors	Sub-Types of Errors	Examples	Tags
Mechanical Error	1. Use of Punctuations	Lack of periods	The velocity 0.875 m/s, 1.27 m/s, 1.49 m/s, 1.6 m/s, and 1.83 m/s respectively (.)	ME11
		Lack of commas	the weight is budged with inclined plane angle of 10.0 15.0 and 20.0 (10.0, 15.0, and) degree respectively.	ME12
		Lack of Hyphens	The spring is hooked by 30 g object. (a 30-g object)	ME13
		Lack of colons	This experiment has procedures as follows; (:)	ME14
		Lack of semicolon	The purple wavelength is 370 nm and the red wavelength is 840 nm Therefore (; therefore,) the red wavelength is more than the purple one.	ME15
		Lack of quotation mark	The hypothesis is stated that "If....., then..... . (")	ME16
	2. Capitalization	Uncapitalization of words at the beginning sentence	the error may occur from the friction. (The)	ME21
		Misplacement of capitalized word	The Sine (sine) of the incident angle is calculated	ME22
		Uncapitalization for a proper noun	The young's modulus of zinc is more than the young's modulus of lead. (Young)	ME23
	3. Acronyms	The use of the incorrect form of the acronyms	The LASER (laser) beam incidents to ethanol.	ME31
	4.Abbrivation	The use of the incorrect form of the abbreviation	the catapult is pulled with 10 cm. (cm) of elongation	ME32
	5. Numbers used as words	The misuse of number if such number occur close together	...changed to two (2), 3 and 4 sand bags, respectively.	ME33

APPENDEX B

Lesson Plans and Teaching Material

Lesson Plan1

Topic : To-infinitive
Grade : Grade 11
Time Length of Class : 50 minutes
Teacher's name : Mr.Anon Ua-umakul

Instructional Goal

The students can use English written language for giving the objectives in abstract writing.

Essential Content

1. New vocabularies : Verbs show the objective of scientific experiment

to plot	to compare
to measure	to analyze
to calculate	

2. Grammar : The to-infinitive for expressing the purposes

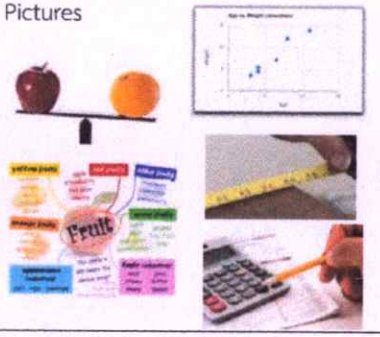
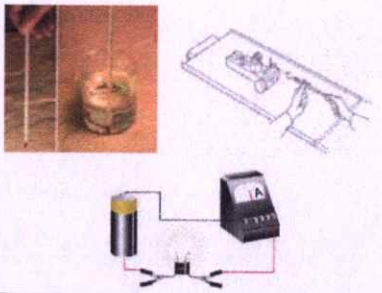
Instructional Objectives : The students can write sentences shown the purpose(s) in a scientific abstract writing.

Evaluation:

1. Students will be able to answer the exercise correctly no less than 70% of all items.

2. Students will be able to create sentences that show the purpose related to the picture correctly no less than 2 pictures.

Instructional Procedure

Phase	Teacher's Role	Teaching and Learning Activities		Instructional Material
		Teacher activities	Student activities	
Presentation (15 minutes)	Controller Questioner	1. A teacher introduces new vocabularies by using a picture and asking students about the meaning of new words. 2. A teacher introduces the usage of two structures of to-infinitive for showing a purpose by giving the example of sentences. Then, the teacher asks the students to give three example of sentence shown a purpose of experiment.	1. Students think, guess the meaning of a new words that shown in the picture. 2. Students give the teacher an example of using to-infinitive for showing a purpose.	Pictures 
Practice (15 minutes)	Organizer Counselor Observer Evaluator	3. A teacher gives students the exercise 1 and 2 and uses 15 minutes for doing the exercise and 5 minutes to check the answers.	3. Students do the exercise 1 and 2.	Worksheet (See in Next pages)
Production (20 minutes)	Organizer Observer Evaluator	4. A teacher divided the students into 10 groups (3 – 4 members) by counting number 1 2 3 4 1 2 3 4 ... 5. A teacher gives the students three pictures about scientific lab and asks the students for creating a sentence that shown the purposes of experiment within 5 minutes. 6. A teacher checks the answer.	4. Students are grouped by counting number 1 2 3 4 1 2 3 4... 5. Each group write down the purpose of experiment that shown in the pictures on the board.	Picture 

1 Abstract part 1: Introduction

Objectives

- to use and select the appropriate vocabularies for showing the aim of experiments
- to write the aim of experiment by using the to-infinitive.

State the objective(s) of the experiment concisely, in paragraph form. The laboratory manual or instruction sheet will help here. The fact that experiments in laboratory courses are being used to educate students is a secondary objective, and should not be stated in the report. In other words, the objective written in your report should never be to "familiarize students with the use of equipment." Rather, the objective should state the problem that your procedure and data attempts to answer. The section should inform the reader precisely why the project was undertaken.

Vocabulary Focus

Some key verbs that you will use in the objective might include:

Vocabularies	Meaning
to plot	To mark the position
to measure	To be of a certain size or quantity
to compare	To examine the character or qualities of two things,
to analyze	To break down into components or essential features
to calculate	To make a mathematical computation

Adapted from: Writing Services, University of Guelph. (2014)

Exercise 1

Direction: After each sentence, select the word which best *fills in the blank* left in that sentence.

measure	plot	calculate	compare	analyze

1. The purpose of this experiment is to .....(measure)..... the speed of sound in air by using a speedometer.
2. The objectives of the experiment are to .....(plot)..... a straight line and to .....(analyze)..... data by a slope.
3. The aim of an experiment is to .....(compare)..... the effect of two different temperature on sound velocity.
4. The purpose of this experiment is to .....(calculate)..... the pH, temperature, and substrate concentration of solution in each minutes.

Grammar Focus : To-infinitive

The to-infinitive can be used for expressing the purposes.

Example

Affirmative sentence

I went to Australia { to / in order to / so as to } survey the koala population.

Negative sentence

I went to Australia { not to / in order not to / so as not to } survey the koala population.

The use of verb to be + to infinitive

The to-infinitive can be used as the complement of "verb to be"

Example

The purpose of the original study is to understand when the control of deferred gratification, the ability to wait to obtain something that one wants, develops in children.

The objective of using 32P in this *experiment* is to label the phage protein, the E. coli and the phage RNA.

Exercise 2

Direction: Use these to-infinitives to write the sentences showing an objective of experiment.

Example: calculate / the reflective index of light

The objective of the experiment is to calculate the reflective index of light in the water.

1. measure / the changing of temperature

.....

.....

The objective of the experiment is to measure the changing of temperature.

2. compare / the power of the two sound sources

.....

.....

The objective of the experiment is to compare the power of the two sound sources.

3. calculate / statics friction coefficient

.....

.....

The objective of the experiment is to calculate the statics friction coefficient.

4. measure / the diameter of can

.....

.....

The objective of the experiment is to measure the diameter of can.

5. calculate / the gravitational acceleration

.....

.....

The objective of the experiment is to calculate the gravitational acceleration.

6. plot / the graph of velocity and time

.....

.....

The objective of the experiment is to plot the graph of velocity and time.

7. analyze / heat transfer coefficient

.....

.....

The objective of the experiment is to analyze the heat transfer coefficient.

8. compare / the behavior of two material specimens

.....

.....

The objective of the experiment is to compare the behavior of two material specimens.

Lesson Plan 2

Topic : Passive voice
Time Length of Class : 50 minutes
Grade : Grade 11
Teacher's name : Mr.Anon Ua-umakul

Instructional Goal

The students can use English written language for making a procedure in abstract writing.

Essential Content

1. New vocabularies : Verbs show the procedure of scientific experiment

to place	to change
to switch on (off)	to fill
to record	

2. Grammar : Passive voice

Instructional Objectives : The students can write sentences shown the procedure by passive form in a scientific abstract writing.

Evaluation:

Students will be able to answer the exercise correctly no less than 70% of all items.

Instructional Procedure

Phase	Teacher's Role	Teaching and Learning Activities		Instructional Material
		Teacher activities	Student activities	
Presentation (15 minutes)	Controller Questioner	1. A teacher introduces new vocabularies by acting the body language and asking the students about the meaning 2. A teacher introduces the structures of passive voice and giving the example of sentences. Then, the teacher asks the students to give 3 examples of passive sentence	1. Students think, guess the meaning of new words. 2. Students give the teacher an example of passive sentence	Worksheet (See in Next pages)
Practice (15 minutes)	Organizer Counselor Observer Evaluator	3. A teacher divided the students into 10 groups (3 – 4 members) by selecting a slot. 4. A teacher gives groups the exercise 1 and takes 10 minutes for doing the exercise and 5 minutes to check the answers.	3. Students do the exercise 1. 4. Students are grouped by selecting a slot	Worksheet (See in Next pages)
Production (20 minutes)	Organizer Observer Evaluator	5. A teacher gives the students the exercise 2 and takes 10 minutes in person 6. A teacher random 2 - 3 students to present their work in class and check the answer.	5. Students do the exercise 2 and present writing work in class.	Worksheet (See in Next pages)

2 Abstract part 2: Procedures

Objectives

- to use and select the appropriate vocabularies for showing the procedure of experiments
- to write the procedure in scientific abstract by using passive form and appropriate vocabularies.

Detail the procedure used to carry out the experiment step-by-step. Sufficient information should be provided to allow the reader to repeat the experiment in an identical manner. Special procedures used to ensure specific experimental conditions, or to maintain a desired accuracy in the information obtained should be described. Copying the procedure from a lab manual would be an inaccurate reflection of the work completed in the lab and is not acceptable

Vocabulary focus

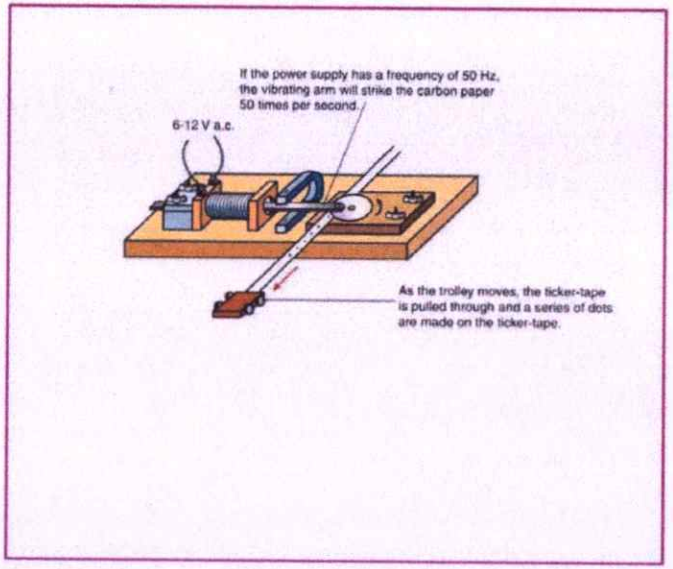
Some key verbs that you will use in the objective might include:

Vocabularies	Meaning
to place V_3 = placed	To put in a particular position
to change V_3 = changed	To make different
to switch on (off) V_2 = switched on (off)	To turn an electrical device off (or on)
to fill V_3 = filled	To become full or almost full
To record V_3 = recorded	To show a measurement or result

Adapted from: Jenifer Y. (2004)

Grammar Focus : Passive form

Using passive voice of the present simple tense in all procedures. This is a more formal style, since the steps of the same process can be written altogether in a paragraph form, using the passive voice in each verb. In addition to this, the sequence markers such as next, later, then, first, second, finally, etc are used in the paragraph to link the sentence and make the coherent in writing work.

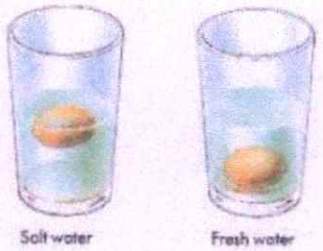


Exercise

Directions: Fill in the blank with appropriated words. Then, Write the procedure of experiment with passive form.

Experiment 1

fill put stir add rise



- Half 1)...fill..... a beaker with water.
- 2).....Put... an egg in water. It will sink to the bottom of the beaker.
- 3).....Add..... some salt in the water.
- 4)...Stir..... the water. The egg will slowly 5).....rise..... to the surface of the water

A beaker is half filled in a beaker with water. Then, an egg is put in water. It will sink to the bottom of the beaker. Next, some salt is added in the water. After that, the water is stirred. The egg will slowly rise to the surface of the water.

Experiment 2

place insert plot measure remove fill record

- 1).....Fill..... a boiling tube with naphthalene until it is about one-third full.
- 2)...Place... the boiling tube of naphthalene on a beaker of boiling water until all the naphthalene has melted.
- 3)...Remove... the boiling tube from the beaker and clamp it to a retort stand
- 4)...Insert..... a thermometer into the naphthalene.
- 5)...Measure... and ..record.. the temperature every minutes until it has dropped to 70°C.
- 6)...Plot... a graph of the temperature against time.

a boiling tube is filled with naphthalene until it is about one-third full. Next, the boiling tube of naphthalene is placed on a beaker of boiling water until all the naphthalene has melted. Then, the boiling tube is removed from the beaker and damps it to a retort stand. After that, a thermometer is inserted into the naphthalene. And then, the temperature is measured and recorded every minute until it has dropped to 70°C. Finally, a graph of the temperature against time is plotted.

Lesson Plan 3

Topic : Model Verb (May & Can)
Time Length of Class : 50 minutes
Grade : Grade 11
Teacher's name : Mr.Anon Ua-umakul

Instructional Goal

The students can use English written language for making result and discussion in abstract writing.

Essential Content

1. New vocabularies : Verbs show the result and discussion of scientific experiment

to find	to seem
to explain	to present
to appear	

2. Grammar : Model Verb (May & Can

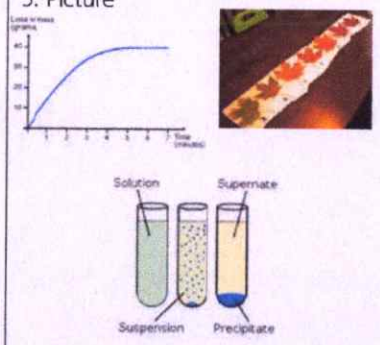
Instructional Objectives : The students can write sentences shown the result and discussion in a scientific abstract writing.

Evaluation:

1. Students will be able to answer the exercise correctly no less than 70% of all items.

2. Students will be able to create sentences related to the picture correctly no less than 2 pictures.

Instructional Procedure

Phase	Teacher's Role	Teaching and Learning Activities		Instructional Material
		Teacher activities	Student activities	
Presentation (15 minutes)	Controller Questioner	1. A teacher introduces new vocabularies by giving the example of sentences 2. A teacher introduces the usage of two structures of model verb for showing a result by giving the example of sentences. Then, the teacher asks the students to give 2- 3 examples.	1. Students think, guess and discuss the meaning of a new words. 2. Students give the teacher an example of using model verb	Worksheet (See in Next pages)
Practice (15 minutes)	Organizer Counselor Observer Evaluator	3. A teacher gives students the exercise and uses 15 minutes for doing the exercise and 5 minutes to check the answers.	3. Students do the exercise 1 and 2.	Worksheet (See in Next pages)
Production (20 minutes)	Organizer Observer Evaluator	4. A teacher divided the students into 10 groups (3 – 4 members) by grouping students who have the same last ID number. 5. A teacher gives the students three pictures about scientific lab and asks the students for creating a sentence that shown the result of experiment in each picture. They have 5 minutes to do this mission. 6. A teacher checks the answer.	4. Students are grouped by their ID number. 5. Each group write down the result of experiment that shown in the pictures on the board by using new vocabularies and model verb.	3. Picture 

3 Abstract part 3: Result & Discussion

Objectives

- to use and select the appropriate vocabularies for showing the result of experiments.
- to write the result and discussion of experiment by using "can" and/or "may"

The Results section is often a good section to write-up after the method because it can provide clarity on the findings, before you embark on thinking about possible explanations for the findings in your discussion. The results provide the reader with information about what you found. Consequently, one of the key features of the results section is to ensure that you only mention the findings, and not what they mean in relation to the study.

Vocabulary Focus

Some key verbs that you will use in the result and discussion might include:

Vocabularies	Meaning
to find	To discover after a deliberate search
to explain	To make an idea clear to someone by describing it in more detail
to seem	To give the impression of being something
to appear	To come into sight
to present	To occur now

Adapted from: Zimmerman (1989)

Grammar Focus : Can & May

"Can" and "May" modal verbs are used when we want to make a guess or predict about something.

Can is used for something that is generally possible (90% – 100%), something we know happens.

May is used for something that is possible (70% – 80%), something we know sometimes happens.

Structure

Can / May + Verb infinitive

Example

It seems that our experimental results can be explained by the consistent irregularities in signal strength.

The value differences may originate from magnetic variability.

Exercise

Direction: After each sentence, select the word which best *fills in the blank* left in that sentence.

find	explain	seem	appear	present

1. Table A .....presents..... the relation between distance and time.
2. It .....seems..... that our experimental results can be ....explained.... by a slope of graph.
3. It ...appears... unlikely that chemical rates will fall.
4. It was ...found... that the current is directly proportional to the voltage.

Direction: Rewrite these sentences by using model verb can or may.

1. Light seems to travel in waves.
   .....Light can travel in waves. .....

2. The accumulation of carbon dioxide in the air is believed to be warming the earth to a dangerous level.
   ..... The accumulation of carbon dioxide in the air may be warming the earth to a dangerous level. .....

3. The universe appears to be expanding.
   ..... The universe may be expanding.....

4. The computers are able to design and create in ways that are undreamed of today.
   ..... The computers can design and create in ways that are undreamed of today. .....

5. The greenhouse effect is explained that one of warming our earth causes.
   ..... The greenhouse effect may be one of warming our earth causes. .....

Direction: Answer these questions by using verb can or may.

1. Are the pandas in China becoming extinct ?
   ..... The pandas in China may be becoming extinct. .....

2. Is the population of the world increasing at a dangerous rate?
   .... The population of the world may be increasing at a dangerous rate.

3. Is the radioactive fallout from nuclear test explosions harmful to the atmosphere?
   .... The radioactive fallout from nuclear test explosions can be harmful to the atmosphere. .....

4. Are the continents drifting on the surface of the earth?
   .... The continents can drift on the surface of the earth. .....

Lesson Plan 4

Topic : Simple Past tense
Time Length of Class : 50 minutes
Grade : Grade 11
Teacher's name : Mr.Anon Ua-umakul

Instructional Goal

The students can use English written language for making a conclusion in abstract writing.

Essential Content

1. New vocabularies : to relate, to indicate, proportional, error, trend

2. Grammar : Simple Past tense

Instructional Objectives : The students can write sentences shown the conclusion in a scientific abstract writing.

Evaluation:

1. Students will be able to answer the exercise correctly no less than 70% of all items.

2. Students will be able to create sentences that show the conclusion related to the lab report no less than 50% of all items.

Instructional Procedure

Phase	Teacher's Role	Teaching and Learning Activities		Instructional Material
		Teacher activities	Student activities	
Presentation (15 minutes)	Controller Questioner	1. A teacher introduces new vocabularies by giving the example of sentences that new vocabularies are used. 2. A teacher introduces the usage present simple in abstract writing by giving the example of sentences. Then, the teacher asks the students to give three example of sentence.	1. Students think, guess and discuss the meaning of a new words that shown in the sentences. 2. Students give the teacher an example of using past tense for showing a conclusion.	Worksheet (See in Next pages)
Practice (15 minutes)	Organizer Counselor Observer Evaluator	3. A teacher gives students the exercise and uses 15 minutes for doing the exercise and 5 minutes to check the answers.	3. Students do the exercise 1 and 2.	Worksheet (See in Next pages)
Production (20 minutes)	Organizer Observer Evaluator	4. A teacher give students a task in pairs work. They will read a lab report and write a conclusion of the experiment from data. 5. A teacher gives the students presents their works in class and checks the answer.	4. Students work a task in pairs 5. The student shows your work in board.	Worksheet (See in Next pages) Lab report

4 Abstract part 4: Conclusion

Objectives

- to use and select the appropriate vocabularies for showing the conclusion of experiments
- to write the conclusion of experiment by using the past simple tense.

The conclusion is a concise statement that answers the objective. The result of percent error and/or percent yield should be discussed and compared with known results. A portion of the conclusion should be dedicated to error analysis which discusses any possible sources of error that may have contributed to the percent error or yield. The conclusion should be written in the impersonal past tense. How to change the experiment for improved results, What did you learn? Explain what the results are telling you, Accept/Reject Hypothesis, Answer any Questions posed by the lab or teacher. A one-line sentence that supports the hypothesis or states that the hypothesis is incorrect.

Vocabulary Focus

Some key verbs that you will use in the conclusion might include:

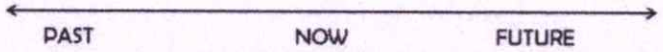
Vocabularies	Meaning
to relate	To show a connection between
to indicate	To point out or show
proportional	Corresponding in size or amount to something else
error	A condition of being wrong
trend	A general direction in which something is changing

Adapted from: Zimmerman (1989)

Grammar Focus: Past simple Tense

The past simple can be used to describe events, actions, or situations which occurred in the past and are now finished

Structure	Subject + V2 + complement
Example:	*It found that the gravity is 9.8 N/kg.*



These key words may appear in past simple sentences.

Key Words: last year, last month, yesterday, 2 days ago, in the past

Exercise 1

Directions: After each sentence, select the word which best *fills in the blank* left in that sentence.

relate	indicate	proportional	error	trend

1. The ...tend.... of fracture was ...related..... positively with the cooling time.
2. It was found that the mass is directly ...proportional... to the force.
3. The ...error... may occur from the unstable temperature.
4. It was ...indicated.... that the sulfur trioxide was the main causes of the acid rain in this city.

Direction: Use these verb to write the sentences showing conclusion of experiment.

1. The energizer (be) last the longest in all of the devices (test).
   The energizer was last the longest in all of the devices teste.

2. The coldest temperature water (have) the most oxygen in it – about 6.50 mg/L at 5°C.
   The coldest temperature water had the most oxygen in it – about 6.50 mg/L at 5°C.

3. While the experiment (be) in progress, the frame (move) at the same rate as Table.
   While the experiment was in progress, the frame moved at the same rate as Table.

4. The increased magnitude of table movement (cause) the greatest amplitude differences on the seismograph.
   The increased magnitude of table movement caused the greatest amplitude differences on the seismograph.

Direction: Read the passage and answer the question

Catalysts and the Control of Biochemical Reactions

Introduction

Catalysts are chemicals which promote chemical reactions in other chemicals but do not become a part of the product nor do they get used up. Catalysts can be simple as elements or complex compounds. Platinum and silver are two previous metals that act as catalysts in several inorganic reactions. Living cells use special catalysts that are complex proteins. These organic catalysts are called enzymes. Enzymes control cellular chemical reactions. Enzymes are "substrate specific" in that a given enzyme will work with the reactants of only one chemical reaction. In this investigation, you will experiment on both an enzyme and a simple inorganic catalyst.

You will test the relationship between temperature and reaction rates of both an enzyme and an inorganic catalyst. The enzyme is **catalase** which is naturally found in cells and is used to break down Hydrogen Peroxide which if too concentrated can be toxic to cells. The inorganic catalyst is **Manganese Dioxide (MnO_2)**. MnO_2 also catalyzes the breakdown of Hydrogen Peroxide (H_2O_2) into two harmless substances.

Experimental Design

Use three test tubes. Add one "measure" of MnO_2 to first test tube. To the second and third tubes add a small piece of potato and liver respectively. Place these three test tubes in a boiling water bath for eight minutes. Remove the tubes and add 10 ml of H_2O_2 (DO NOT BOIL THE H_2O_2!) and observe and record the reaction.

Result

Add a fresh piece of liver, potato, new MnO_2 to three clean tube and add the H_2O_2 without boiling anything. Again observe and record the reaction. These observations will serve as a control.

Conclusions

1. What can you conclude about catalytic reactions and temperature?
   The catalytic reactions quickly occurred when the temperature increased.

2. What can you conclude about the reaction rate and the amount of enzyme used?
   The reaction rate was increased when the enzyme was used.

Lesson Plan 5

Topic : Linking words
Grade : Grade 11

Time Length of Class : 50 minutes
Teacher's name : Mr.Anon Ua-umakul

Instructional Goal

The students can use English written language using linking words in abstract writing.

Essential Content

New vocabularies : Linking words

Moreover	In addition
However	First
Second	Then
Next	Last
because	

Instructional Objectives : The students can write the scientific abstract and use the linking words to connect the sentences.

Evaluation:

1. Students will be able to answer the exercise correctly no less than 70% of all items.

2. The students can write the scientific abstract in controlled situation in group and present it.

Instructional Procedure

Phase	Teacher's Role	Teaching and Learning Activities		Instructional Material
		Teacher activities	Student activities	
Presentation (15 minutes)	Controller Questioner	1. A teacher introduces new vocabularies and how to use these words in sentences by giving the example of sentences 2. The teacher asks the students to give examples of sentence.	1. Students think, guess and discuss the meaning of a new words that shown in the sentences 2. Students give the teacher an example of using the linking words	Worksheet (See in Next pages)
Practice (15 minutes)	Organizer Counselor Observer Evaluator	3. A teacher gives students the exercise in groups (3 – 4 members) and uses 15 minutes to do the exercise.	3. Students work a task in group.	Worksheet (See in Next pages)
Production (20 minutes)	Organizer Observer Evaluator	4. A teacher gives the students presents their works in class.	4. The groups present their work and give a feedback to other group.	Worksheet (See in Next pages) Lab report

5 Abstract part 5: Linking Part

Objectives

- to use and select the appropriate vocabularies for linking the sentences in the abstract

The connectors are commonly used to continue or add to ideas that were written in the sentences. We will use the same sentences in order to illustrate how the words are used and to show their different positions in the sentences. The positions of the words that we show you are the most common but not necessarily the only positions.

Example

1. Linking word for adding idea

Sentence 1 : The weight is directly proportional to the force.
Sentence 2: The gravitational acceleration was 9.03 m/s^2.
Link idea: The weight is directly proportional to the force. Moreover, the gravitational acceleration was 9.03 m/s^2.
Link idea: The weight is directly proportional to the force. In addition, the gravitational acceleration was 9.03 m/s^2.

2. Linking word for adding contrast idea

Sentence 1 : The gravitational acceleration was 8.93 m/s^2.
Sentence 2: It has 9.52% of errors
Link idea: The gravitational acceleration was 8.93 m/s^2. However, it has 9.52% of errors

2. Linking words to show the experimental procedure

Sentence 1 : The ticker-tape timer is placed at one end of the laboratory bench.
Sentence2 : It is placed under the trolley that is held with your hand.
Sentence3 : The ticker-tape timer is switched on.
Link idea: First, the ticker-tape timer is placed at one end of the laboratory bench. Second / Next / Then, it is placed under the trolley that is held with your hand. Last, the ticker-tape timer is switched on.

3. Linking words to show the cause

Sentence 1 : The velocity of hydrogen atom is more than the velocity of helium atom.
Sentence2 : The diameter of hydrogen atom is smaller.
Link idea: The velocity of hydrogen atom is more than the velocity of helium atom, because the diameter of hydrogen atom is smaller.

Exercise 1

Directions: Rewrite the following sentences with the connectors

1. Sentence 1 : The experiment aims to study the stress and strain.
   Sentence 2 : The experiment aims to analyze the Young's Modulus.
   Linking idea : The experiment aims to study the stress and strain. Moreover / In addition, it aims to analyze the Young's Modulus.

2. Sentence 1 : The result was found that the static coefficient of friction is 0.23.
Sentence 2 : It was some errors in this lab.
Linking idea : The result was found that the static coefficient of friction is 0.23. However, it was some errors in this lab.

3. Sentence 1 : The light velocity in the air is more than the Light velocity in the water.
Sentence 2 : The water is more refractive index.
Linking idea : The light velocity in the air is more than the Light velocity in the water, because the water is more refractive index.

4. Sentence 1 : The spring scale is attached to the sandbag.
Sentence 2 : The spring scale is used to measure the pulling force.
Sentence 3 : The pulling force is recorded in Table.
Link idea : First, the spring scale is attached to the sandbag. Second / Then / Next, the spring scale is used to measure the pulling force. Last, the pulling force is recorded in Table.

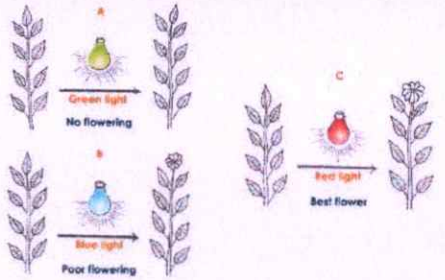
5. Sentence 1 : The resistors are connected to the source.
Sentence 2 : The electric current is measured in three times.
Sentence 3 : The data are recorded in Table.
Link idea : First, the resistors are connected to the source. Second / Then / Next, the electric current is measured in three times. Last, the data are recorded in Table.

Task

Direction: Use this data and the linking words to write down the scientific abstract. Then, the writing work is presented in class.

Green colour of the visible spectrum is ineffective in inducing flowering whereas blue colour induces poor flowering. The wavelength 580 nm to 680 nm in the red portion of the spectrum has been found to be most effective for inducing flowering.

Flowering is a phytochrome mediated process. It occurs in 2 possible forms. The form which absorbs red light (660 nm) is PR and the form which absorbs far red light is termed PFR. PR stimulates flowering while PFR inhibits it. The two forms are easily interconvertible.



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Adapted from: Pearson (2014)

APPENDEX C

A Guided Interview Form

A Guided Interview Form

Guided Questions

- Have you ever learnt or study ..... in class before?
- Why did you use ..... in this sentence?
- Are you clear in concept ..... in class? Why? Please you give me some examples.

The data are checked in a recording form as below:

Student Name.....Class Number.....

The number of errors in student's writing work	L1 Interference	Missconcept in language rules	A teacher or textbook	Lack of available linguistic forms	Other
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					
10.					
11.					
12.					
13.					
14.					
15.					
16.					
17.					
18.					
19.					
20.					

Other Comments : .....

.....

APPENDEX D
Example of LSA Corpus

The example of LSA Corpus made by the experimental group

Concordance | Concordance Plot | File View | Clusters | Collocates | Word List | Keyword List

Hits 0 File: 0021.txt

The experiment purposes to study a relation between force (F) and weight of object (W), and analyzes coefficient of static friction.

A hypothesis is "If the weight effects on the force, then the more the weight is, the more the force is."

The procedures of this experiment are as following ; First, An object which weigh 10.0 N puts on a floor until it starts to move.

Second,The force is measured and recorded.

Third, The force is meassured repeatly, but changed to 20.0, 30.0, 40.0 and 50.0 N respectively.

Lastly Data are used to plot a graph that shows the relation between force and weight, and analyzed the coefficient of static friction by a slope.

The result are found that the force is directly proprotional to the weight, and coeffection of static friction 0.045 with 1.125% of errors.

The errors may occur from a measurement resolution is too small.

Concordance | Concordance Plot | File View | Clusters | Collocates | Word List | Keyword List

Hits 0 File: 0028.txt

The experiment aims to find a relation between force and weight of object and to analyze a value of static friction coefficient.

The hypothesis is "if the weight of object effect on the force, the more the value of weight, the more the value of force is."

The procedures of this experiment are as following; First, the object which has a weight 10.0 N put dowm on plain, the pulling the object parallely to the floor until the object starts to move.

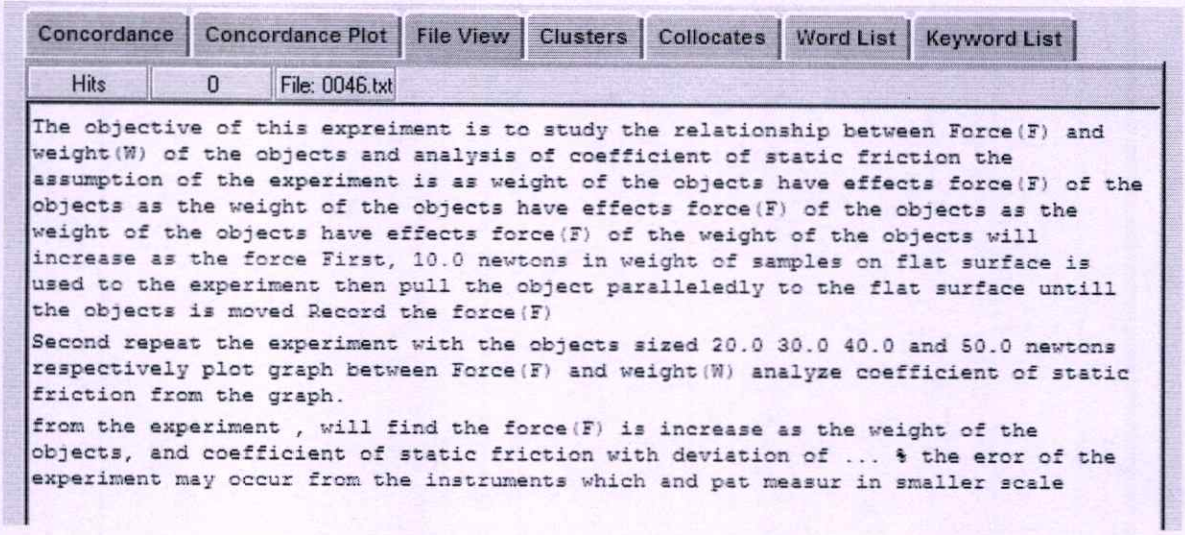
The force is measured and recorded.

Repeating the experiment, but changing the weight to 20.0 30.0 40.0 and 50.0 N, respectively.

Finally, Plotting the graph to show the relation between foce (F) and weight (W) of object and to analyze the value of static friction coefficient from a slope of graph.

The result shows that the force is directly proportiinal to the weight and the static friction coefficient is 0.390 with 2.5% of errors.

The example of LSA Corpus made by the control group



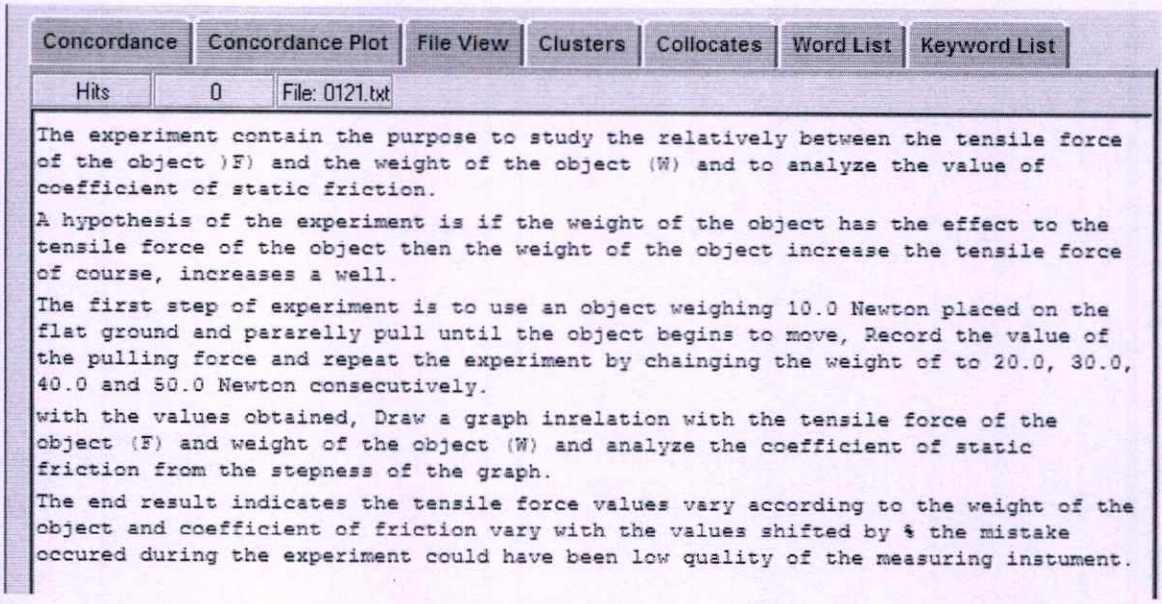
Concordance | Concordance Plot | File View | Clusters | Collocates | Word List | Keyword List

Hits 0 File: 0046.txt

The objective of this expreiment is to study the relationship between Force(F) and weight(W) of the objects and analysis of coefficient of static friction the assumption of the experiment is as weight of the objects have effects force(F) of the objects as the weight of the objects have effects force(F) of the objects as the weight of the objects have effects force(F) of the weight of the objects will increase as the force First, 10.0 newtons in weight of samples on flat surface is used to the experiment then pull the object paralleledly to the flat surface untill the objects is moved Record the force(F)

Second repeat the experiment with the objects sized 20.0 30.0 40.0 and 50.0 newtons respectively plot graph between Force(F) and weight(W) analyze coefficient of static friction from the graph.

from the experiment , will find the force(F) is increase as the weight of the objects, and coefficient of static friction with deviation of ... % the eror of the experiment may occur from the instruments which and pat measur in smaller scale



Concordance | Concordance Plot | File View | Clusters | Collocates | Word List | Keyword List

Hits 0 File: 0121.txt

The experiment contain the purpose to study the relatively between the tensile force of the object)F) and the weight of the object (W) and to analyze the value of coefficient of static friction.

A hypothesis of the experiment is if the weight of the object has the effect to the tensile force of the object then the weight of the object increase the tensile force of course, increases a well.

The first step of experiment is to use an object weighing 10.0 Newton placed on the flat ground and pararelly pull until the object begins to move, Record the value of the pulling force and repeat the experiment by chainging the weight of to 20.0, 30.0, 40.0 and 50.0 Newton consecutively.

with the values obtained, Draw a graph inrelation with the tensile force of the object (F) and weight of the object (W) and analyze the coefficient of static friction from the stepness of the graph.

The end result indicates the tensile force values vary according to the weight of the object and coefficient of friction vary with the values shifted by % the mistake occured during the experiment could have been low quality of the measuring instument.

APPENDEX E

Yamane Table

TABLE

Sample Size for Specified Confidence Limits and Precision When Sampling Attributes in Percent

A. 2σ Confidence Interval
($\pi = 0.5$)[a]

Size of Population (N)	Sample Size (n) for Precision (c) of ±1%	±2%	±3%	±4%	±5%	±10%
500	[b]	[b]	[b]	[b]	222	83
1,000	[b]	[b]	[b]	385	286	91
1,500	[b]	[b]	638	441	316	94
2,000	[b]	[b]	714	476	333	95
2,500	[b]	1,250	769	500	345	96
3,000	[b]	1,364	811	517	353	97
3,500	[b]	1,458	843	530	359	97
4,000	[b]	1,538	870	541	364	98
4,500	[b]	1,607	891	549	367	98
5,000	[b]	1,667	909	556	370	98
6,000	[b]	1,765	938	566	375	98
7,000	[b]	1,842	959	574	378	99
8,000	[b]	1,905	976	580	381	99
9,000	[b]	1,957	989	584	383	99
10,000	5,000	2,000	1,000	588	385	99
15,000	6,000	2,143	1,034	600	390	99
20,000	6,667	2,222	1,053	606	392	100
25,000	7,143	2,273	1,064	610	394	100
50,000	8,333	2,381	1,087	617	397	100
100,000	9,091	2,439	1,099	621	398	100
∞	10,000	2,500	1,111	625	400	100

[a] Formula for sample size when population proportion π is

$$n_o = \frac{z^2\pi(1-\pi)N}{z^2\pi(1-\pi) + Ne^2}$$

This table assumes $\pi = 0.5$, $z = 2$:

$$n = \frac{2^2(0.5)^2N}{2^2(0.5)^2 + Ne^2} = \frac{N}{1 + Ne^2}$$

$$n \geqq n_o$$

[b] In these cases the assumption of normal approximation is poor, and the formula does not apply.

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