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Effects of using corpus-based instruction on students' critical thinking skills and perceptions in academic writing classes

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This study aimed at examining the effects of corpus-based instruction on students' critical skills in academic writing classes. It also endeavored to investigate the students' perceptions towards corpus-based instruction. To conduct the research, a pretest-posttest quasi-experimental research design was employed. A total of 77 mechanical engineering students who took technical report writing course were selected using multi-stage sampling techniques. The data gathering instruments were academic writing tests, textual analyses, questionnaire, and semi-structured interviews. Independent and paired sample t-tests and thematic analyses were employed to analyze the data. Hence, the results indicated that the students who were instructed their academic writing skills through corpus-based instruction improved their critical thinking skills better than their counterparts who were instructed through the conventional instructional approach. Particularly, students who were instructed through corpus-based instruction employed appropriate lexical bundles and metadiscourse devices to express their argument and persuade their readers than the comparison group. Additionally, the data confirmed that students' reacted positively towards the corpus-based instruction. Consequently, this research calls for EFL instructors to consider authentic linguistic features to enhance their students' critical thinking skills in academic writing skills classes.

Keywords: academic writing, critical thinking, corpus-based instruction, perception

Introduction

Critical thinking is a crucial issue in education in general as well as in language teaching and learning in particular. Stobaugh (2013) states that “developing

critical thinking skills in curriculum help strengthen educated citizens, promote future careers, and improve social life” (p. 4). It is an indispensable skill that should be considered at every level of education (Lloyd & Bahr, 2010). Aloysius and Puspita (2019) also asserted that critical thinking skills are a needed skill in the 21st century. Accordingly, educators consider students’ critical thinking skills while they design curricula, syllabi, and materials. Improving the critical thinking skills of learners is the central aim of higher education (Van Peppen, et al., 2021). They learn new concepts and ideas, and they are expected to evaluate, analyze, and interpret them before they accept the ideas as they are factual.

Critical thinking skill focuses on solving problems, discovering assumptions, and reasoning skills (Pithers & Sodens, 2000; Starkey, 2004). Hilsdon (2010) also mentioned that the skill includes the ability to ask and answer questions in the most fruitful ways and to reach on comprehensive understanding. Hence, it consists of various skills such as interpretation, analysis, evaluation, and self-regulation. It also encompasses a set of strategies to help learners develop reflective analysis, and explanation skills (Fisher, 2001). Moreover, the skill encourages learners’ rational thinking in the learning and teaching process. Nevertheless, these skills could not be shown or expressed without adequate linguistic knowledge. To reflect learners’ positions, thoughts, and ideas in effective ways, they need to have adequate language skills.

Language skills and critical thinking skills are interwoven issues. Language learning is a cognitive process (Escribano, 2004) that requires selecting, retrieving, analyzing, and interpreting linguistic elements to use in a particular communicative context. In order to address questions and ideas in the most productive ways, the role of linguistic elements and critical thinking skills are undeniable. According to Sharma (1995), language is the vehicle of critical thinking skills. The writers and speakers show their arguments and positions toward a proposition through linguistic features. Casan-Pitarch and Calvo-Ferrer (2015) also explicated that students engage in critical evaluation when they encounter different linguistic elements. These elements could be acquired through proper instruction and meaningful interaction.

Among these linguistic elements, lexical bundles and metadiscourse features are invaluable linguistic features in academic writing. Lexical bundles, which are strings of words (phraseology units) and which frequently occur in academic contexts are essential to show writers’ positions, help them address their ideas, indicate their stances, and support their arguments. The other linguistic feature is the metadiscourse device. These linguistic features also help writers to express their attitude, show engagement, indicate the relationship among ideas, show a sequence of ideas and refer to the information mentioned before (Birhan, 2021; Hyland, 2005).

Previously conducted studies reported that students’ critical thinking skill depends on various issues. For instance, Sharma (1995) and Wale and Bishaw (2020) mentioned students’ critical thinking skill depends on the learner’s vocabulary skills, confidence, and instructional approaches. Nevertheless, little attention has been paid so far to investigating the effects of authentic linguistic features (which are developed through corpus-based instruction). Therefore,

this research attempted to examine the effects of using corpus-based instruction on students' critical thinking skills in academic writing classes.

Literature review

Corpus-based instruction vs critical thinking

Corpus-based instruction is an instructional approach in which students learn language skills through authentic linguistic features that can be used frequently in particular communicative contexts. It is a method of using corpus data to assist, guide, and facilitate students' language learning in and outside the classroom. This instruction offers goal-oriented instruction and helps students to understand various realistic linguistic features that students can use in their social and academic communicative situations.

The corpus-informed enrichment activities help learners to use various authentic linguistic features that are frequently occurred in students' discipline and understand how to use them in a particular communicative context. O'Sullivan (2007, p.277) states that "corpus consultation increases the mental activity of learners such as predicting, reflecting, exploring, making inferences (inductively or deductively), focusing, guessing, comparing, differentiating, theorizing, hypothesizing and verifying."

Studies (e.g. Boettger, 2016; Kruger, 2012) reported that corpus-based instruction improved students' awareness of text production in a particular context. Other researchers (e.g. Jalilifar, Mehrabi & Mousavinia, 2014; Yoon, 2008; Birhan, Teka & Asrade, 2021) also testified that corpus-based instruction is a potential tool to enhance students' vocabulary, writing, and grammar skills. However, this study argued that to make language usage productive, especially in academic writing skill classes, considering learners' critical thinking skills seemed important. Moreover, researchers such as Boulton and Tyne (2014) and Botley and Hakim (2014) also pointed out that an instructional approach contributes to students' critical thinking. Therefore, this research aimed at examining the effects of corpus-based instruction on students' critical thinking skills in academic writing classes.

Critical thinking skills vs academic writing

Higher education students write various kinds of texts to fulfill their academic requirements. When they develop these texts, their critical thinking skill is necessary to communicate effectively and efficiently. Students are expected to show their positions and arguments on controversial issues. Academic writing and critical thinking skills are interrelated. For instance, one of the issues that are expected in students' essays is demonstrating their proposition. Alagozlu (2007, p. 119) mentioned that "a good academic writer should be able to present evidence and arguments that he/she can then defend and draw a conclusion." Thus, critical thinking is considered a crucial skill to construct academic writing texts.

However, in the conventional instructional approach of teaching academic writing skills which has been practiced for centuries, learners did not have a chance to use and practice real-life language activities, and they learned unauthentic linguistic features. Consequently, these have made students passive recipients. In Ethiopia, in which this research was conducted, learners have been taught through unfocused and general linguistic features; these contributed to the lack of students' critical thinking skills. According to Sinaga and Feranie (2017), the traditional approach of teaching writing skills does not help writers to communicate effectively. Alagozlu (2007) and Goodwin (2014) also mentioned that foreign language learners often face difficulty in comprehending, paraphrasing, and summarizing written texts. The students liked to engage in simple mental activities of recalling ideas than showing their positions and engaging in extended discourses. These proved that genuine and reliable linguistic features are vital to indicate their observation, understanding, and other issues effectively.

Researchers (e.g., Sharma, 1996) stated that learners' linguistic skill is a vehicle for critical thinking skills. As mentioned, authentic linguistic knowledge helps writers show their arguments and positions while constructing academic texts. It is fundamental to defend against biased ideas and to provide supporting evidence. In this research, integrating academic writing with corpus-based instruction is assumed to have an effect on students' critical thinking skills and perceptions in academic writing classes.

This instruction offers various authentic linguistic features which can be used to satisfy the communicative needs of foreign language learners, and it was assumed that while students learn genuine linguistic features that are used in academic writing genres, they improve their critical thinking skills. Zhang (2018) stated that students are exposed to different words that are used in specific communicative contexts, and they choose appropriate words critically while they construct texts. Among various linguistic elements, lexical bundles and metadiscourse help writers to engage in different phases of writing and help them to narrow, clarify and evaluate ideas from different perspectives. The researcher believed that through corpus analysis, it is possible to exploit appropriate lexical bundles and metadiscourse elements that writers could use to express their stances, attitudes, and positions, and to show engagement.

Recently, local and international researchers have been concerned about students' critical thinking skills to compose effective and persuasive academic writing texts. For instance, researchers such as Adege (2016), Wale and Bishaw (2020), Alidmat and Ayassrah (2017), and Hirvela and Du (2013) reported that foreign language students lack critical thinking skills and proposed various strategies to tackle the problem. However, these researchers focused on non-linguistic perspectives.

Hence, this research argued that the lack of genuine linguistic features was a major challenge for EFL students to express their arguments and persuade readers. They did not engage in synthesizing, evaluating, and showing their positions. The lack of discipline-oriented lexical bundles and metadiscourse devices restricted EFL students to examine and indicate their position in their

projects and research reports. Sharma (1995, p. 1) mentioned that “the probability of misjudgment is rather high because of varying degrees of access to different registers of the language.” Learners need to understand the various rhetorical features and language structures to express their arguments and show their rational judgments. Thus, the purpose of this research was to examine the effects of corpus-based instruction on EFL students’ critical thinking skills in academic writing classes and to explore the students’ perceptions towards the instruction. Pertaining to this research objective, this research aimed to answer the following research questions.

- ▶ Does corpus-based instruction significantly improve students’ critical thinking skills more than conventional instruction?
- ▶ What are the perceptions of EFL students towards corpus-based instruction?

Methods and materials

Research design

The purpose of this research was to examine the effects of corpus-based instruction on EFL students’ critical thinking skills in academic writing classes. It also aimed at exploring students’ perception towards corpus-based instruction. Hence, to observe the effect of the instruction, the research followed a pretest and posttest quasi-experimental research design. The researcher used a pretest, intervention, and posttest (O1, X1, O2) for the experimental group and a pretest, conventional approach, and posttest (O1, Xo, and O2) for the comparison group.

Participants and sampling techniques

The participants of the study were 4th-year mechanical engineering students at Bahir Dar Institute of Technology, Bahir Dar University. Among five sections, the researcher selected two sections through the multistage sampling technique and assigned them into a comparison group (n=39) and an experimental group (n=38). It was understood that the two groups attended preparatory school and passed the national entrance examination. They all also took communicative English skills and basic writing skills courses as common courses. The two groups also took and passed pre-engineering courses.

Data collection instruments

The data were gathered via an academic writing test, textual analysis, questionnaire, and semi-structured interview. This instrument was used since students’ required critical reflection and analysis to address their ideas in productive ways. It also helped to measure learners’ critical thinking skills objectively. Additionally, this instrument was chosen because engineering texts are mostly constructed with argumentative and problem-solution frameworks (Grigg,

2012; Candelo, 2015). These students were expected to design a certain project for a problem/gap that they have identified.

Accordingly, a problem-solution essay test was used to observe the effects of learners' critical thinking skills as a result of corpus-based instruction. The students were instructed to write an essay before and after the intervention based on the topic they chose. The tests were marked with rubrics that Facione (2015) proposed, such as interpretation, analysis, evaluation, inference, and explanation to mark the students' essays.

The validity of the test was assured by experts who reviewed it with criteria such as item value, clarity of instructions, level of complexity, and time allowed to complete the tests. Besides, the tests were marked by two instructors, and the reliability was 0.87, which indicated it was appropriate to measure students' critical thinking skills in their academic writing classes (Taber, 2017).

Textual analysis was the other instrument that was designed to examine the students' critical thinking skills improvement as a result of corpus-based instruction. Besides, the instrument was used to triangulate the results which were found through academic writing tests and to provide further evidence regarding the effects of the instruction on students' critical thinking skills. Thus, the sample pre-test texts and post-test texts were analyzed qualitatively.

A questionnaire was the other instrument used to examine the students' perceptions regarding corpus-based instruction. It contained 18 items and was prepared on a five-point Likert scale ranging from 5 to 1 (5= strongly agree; 4= agree; 3= slightly agree; 2= disagree; 1= strongly disagree) and was administered twice to students who were instructed through corpus-based instruction in while-intervention and post-intervention.

The while-intervention and the post-intervention questionnaire items were similar. The post-intervention questionnaire examined the consistency of students' perceptions towards corpus-based instruction. The items were reviewed by five EFL instructors who have adequate experience in language teaching and assessment. The reliability was checked through Cronbach's alpha, and the value was 0.953, which indicated that it was reliable.

A semi-structured interview was employed to explore the students' perception of corpus-based instruction. The interview was conducted with five (Female = 2 and Male = 3) randomly selected participants, and they were interviewed through a face-to-face approach. The interview was aided by six open-ended interview items, and they focused on examining the students' previous experience regarding selected linguistic features, their views regarding the importance of lexical bundles and metadiscourse devices, the instruction process students had during the intervention (corpus-based instruction process), and the level of difficulty of using lexical bundles and metadiscourse devices, etc. The students' responses were recorded, transcribed, categorized, and analyzed.



In this study, the researchers considered self-designed corpora for the material preparation and classroom intervention. This was because the existing materials did not address the specific academic writing needs of the selected group. Braun (2005) indicated that “the genuine materials in corpora which have been collected following pedagogical considerations do seem to create some problems of authentication” (p. 51). Accordingly, small corpora (563,612 words) were designed from published mechanical engineering articles that were selected through criteria that include representativeness, particular importance to the discipline, scope, coverage, and indexing.

Since other journals satisfied these criteria, the researcher selected randomly eight journals through a lottery method. Hence, journals that were chosen included *Advances in Mechanical Engineering*, *Mechanism and Machine Theory*, *Mechanical Systems and Signal Processing*, *International Journal of Mechanical Sciences*, *Archive of Mechanical Engineering*, *Journal of Mechanical Engineering*, *Periodica Polytechnica Mechanical Engineering*, and *Chinese Journal of Mechanical Engineering*. From these journals, 120 (15 articles in each journal) articles were selected.

The selected articles were most downloaded, read, and cited articles according to the journal's website. AntConc corpus analysis software was also used to clean and analyze the frequency of metadiscourse devices and lexical bundles in the selected articles. Manual analysis was also employed to identify the specific function of the selected linguistic elements. The metadiscourse and lexical bundles were selected based on the taxonomies of Hyland (2005), Biber *et al.* (1999), and Biber *et al.* (2003). Also, the frequency cut-off points of the lexical bundles and metadiscourse had to occur in at least two research articles in each sub-corpus to avoid the peculiarities of individual writers.

The corpus-based instruction was implemented for twenty-four hours in the technical report writing and research methods course. In order to observe the effects of the intervention, the students were instructed with corpus-informed material, whereas the comparison group was instructed with conventional instructional material. The intervention was modeled through a genre-based cycle approach (Correa & Echeverri, 2017; Charles & Pecorari, 2016). The students engaged in the four stages of instruction, which include: preparation, modeling, joint construction, and independent construction.

Students were provided pedagogically relevant, teachable, and frequently occurred linguistic features (lexical bundles and metadiscourse) embedded with texts taken from previously published articles, and they were involved in examining the function and structures of selected lexical bundles and metadiscourse devices which were presented. They also engaged in text revision, data interpretation, and essay writing activities both individually and in groups. The students were also dedicated to revising sample paragraphs and essay texts. Finally, the students became independent learners, and they engaged in drafting, revising, and editing various academic writing genres independently, and they also got feedback from colleagues. Consequently, the experimental group constructed various academic writing genres by themselves.

The comparison group was taught through the conventional approach in which the theoretical aspects of report and research writing and the accompanying activities presented in the course materials were treated. This group also engaged in different academic writing activities (abstract writing, introduction, and data interpretation activities). However, they did not have exposure in the classroom to the activities on the selected metadiscourse devices and lexical bundles.

Data analysis

The data gathered through academic writing tests were analyzed through an independent t-test to compare the students' critical thinking skills between the pre-tests and the post-tests. A paired sample t-test was also employed to analyze the data which was gathered through the questionnaire. Additionally, the qualitative data gathered through semi-structured interviews and textual analyses were analyzed qualitatively.

Results

Students' critical thinking skills in corpus-based instruction

The data which were obtained through tests and textual analysis were analyzed below. As mentioned, the students were given essay-type pretests and posttests for both groups. The tests were administered before and after the intervention to observe if there were effects on students' critical thinking as a result of corpus-based instruction.

Accordingly, an assumption test was performed before the academic writing test results were analyzed through an independent t-test. Considering the remaining assumptions, which cannot be observed through SPSS, the normality of tests and homogeneity were checked. Table 1 shows that in the pre-test, group A scored (M = 10.51 and SD = 1.629) and group B scored (M = 11.07 and SD = 1.38) which indicated that both groups had almost similar levels of critical thinking skills before corpus-based instruction was made.

Table 1. Students' pre-test critical thinking skills performance

		t-test for Equality of Means						
	Test type	Participants	Participants	Mean	SD	t	df	Sig. (2-tailed)
Equal variances assumed	Pretest	Group A	38	10.51	1.62	.164	75	.106
		Group B	39	11.07	1.38			

In the same way, inferential statistics were also run to observe if there was a significant statistical difference between the two groups' critical thinking skills before they were assigned to the experimental and the comparison groups.

Accordingly, the data in Table 1 revealed that there was no significant statistical difference ($t = 1.64$, $df = 75$, $p > .05$) between the two groups in their critical thinking skills. Therefore, according to the pre-tests result, students had almost similar levels of critical thinking skills in their academic writing skills classes, and the two groups were homogeneous. Hence, it was possible to assign them to the experimental and comparison group randomly.

Considering the results of the assumptions made so far, the experimental group and the comparison group were compared in their post-intervention critical thinking skills by running the same statistical test, the independent t-test. As portrayed in Table 2, the mean and the standard deviation of the experimental group and the comparison group were ($M=16.48$, $SD=1.267$) and ($M=15.0$, $SD=1.42$) respectively. The descriptive statistics revealed that though the two groups showed improvements, the experimental group outperformed in their critical thinking skills. Students who were instructed their academic writing skills through corpus-based instruction showed their positions and engaged in text evaluation, explanation, inference, and analysis better than the comparison group.

Table 2. Students' post-test critical thinking skills performance

		t-test for Equality of Means						
	Test type	Participants	Participants	Mean	SD	t	df	Sig. (2-tailed)
Equal variances assumed	Posttest	Experimental	38	16.48	1.267	-4.75	75	.000
		Comparison	39	15.0	1.42			

Additionally, as indicated in Table 2, an independent sample t-test was run again to investigate if there was a significant statistical difference between the two groups in their critical thinking skills performance after corpus-based instruction was carried out. In this regard, the result confirmed that there was a significant statistical difference ($t = -4.75$, $df = 75$, $p < .05$) between the experimental and the comparison groups' critical thinking performance.

According to these results, students who received instruction in academic writing skills through corpus-based instruction were able to indicate positions and provide evidence. They also explained and interpreted ideas using various lexical bundles and metadiscourse features. These contributed to improving the students' critical thinking skills, which involved explanation, interpretation, analysis, inference, and evaluation skills. The results also confirmed that an instructional approach that constitutes genuine linguistic features and discipline-related activities helped students to improve their critical thinking skills.

The other instrument was textual analysis analyses. Two sample pre-test texts and two post-test texts were taken and analyzed textually. The pre-test textual analysis indicated that both groups had critical gaps before corpus-based instruction. For instance, the first writer started his/her essay "since the 19th century technology has changed our world and our lifestyle in many ways".

This sentence did not address the background information. Though the writer was expected to explain his/her positions supported by evidence and empirical data, he/she did not indicate all those issues vividly. The sample proved that the writer did not take his position. It was also mentioned that technology helped to decrease the mortality rate. However, he/she stated a contradicted idea with the statement mentioned before "...they hardly find time for face-to-face communication or go out enjoy nature's beauty." He/she also states "nuclear technology can cause modern battle with accessibility of many kinds of dangerous guns, deadly weapons." Based on these statements, it is possible to infer that the writer's position towards the proposition was not addressed, and the writer did not clearly show his/her explanation, interpretation, and analysis skills.

Besides, the writer did not identify the intended and actual inferential relationship between statements. The credibility of the ideas mentioned was also not indicated through supportive evidence. In addition, the concluding statement, which says, "modern technology had become an evil in our lives unless we use it in a proper way" contradicted the statement the writer mentioned, "technology bring higher education, material wealth, etc." and it was not made based on relevant judgments, beliefs, and reasons mentioned. In short, the essay confirmed that the writer lacked critical thinking skills in terms of explanation, interpretation, inference, and analysis skills besides various grammatical and pragmatic issues.

The other student assigned to the comparison group also had similar critical thinking skills problems before corpus-based instruction was made. The writer wrote his essay on "technology and its effect..." In the sample, it is understood that the writer did not clearly show his critical thinking skills. The introductory paragraph began with a sentence that said, "I live in the age of technology." In this paragraph, the thesis statement and communicative purpose of the text were not indicated. More importantly, the writer's position towards the proposition was not provided through evidence and empirical data. Though the writer explained what technology consisted of (airplane, automobiles, and emails) these were not supported by sufficient data. Hence, the sample indicated that the writer provided extremely limited data. The data confirmed that the writer had lack of interpretation and explanation skills.

Moreover, in this sample, the writer was expected to take a position regarding the influence of technology in our day-to-day life though it was not addressed successfully. In one way, the writer mentioned as he agreed that modern technology could improve users' life "...I believe that automation technologies not only save human labor but also increase productivity, which helps people create more materials wealth". However, the writer opposed his first mentioned position "... technology makes people life boring." This indicated the writer did not vividly explain the controversial ideas regarding the issue by categorizing, exemplifying, or classifying techniques. Evidential and supportive details were not provided to assert the claims.

However, in the post-textual analysis, the experimental group outperformed their academic writing skills. The post-test textual analysis proved that students who were instructed their academic writing skills through corpus-based

instruction showed improvement in their critical thinking skills. The students outperformed their counterparts in terms of explanation, interpretation, evaluation, analysis, and inference. Additionally, students who engaged in corpus-based instruction indicated their stance towards the proposition. The writers explained their ideas clearly and supported them via practical and research-based evidence. The writers' claims and evaluations about the selected ideas were facilitated using linguistic features such as lexical bundles and metadiscourse devices. In contrast, students in the comparison group did not clearly show their positions and arguments. They showed little evaluation, analysis, inference, explanation, and interpretation skills.

In short, the inferential statistics and the textual analyses results proved that students who were instructed through corpus-based instruction showed better critical skills improvement than students who were assigned into the comparison group. The data indicated that real-life examples, authentic activities, and explicit linguistic features instruction enhanced students' critical thinking skills in academic writing classes.

Students' perceptions of using corpus-based instruction

The other objective of this research was to examine the students' perceptions regarding corpus-based instruction to enhance their critical thinking skills. The inferential and descriptive statistics data confirmed that students hold positive perceptions regarding the instruction in technical report writing courses and, that the instruction helped them improve their critical thinking skills. Particularly, the descriptive statistics of students' perception, in Table 3 revealed that the students had ($M = 3.94$, $SD = .23672$) in the while-intervention and ($M = 4.327$, $SD = .31705$) in post-intervention.

Based on these data, the students had positive perceptions in both the while-intervention and the post-intervention, which were greater than 3. These proved that the students reacted positively when they started learning their academic writing skills through corpus-based instruction.

Table 3. Descriptive result of students' perception

Paired samples statistics					
		M	N	SD	Std. error mean
Pair 1	During intervention	3.9461	33	.23672	.04121
	Post-intervention	4.3278	33	.31705	.05519

The students perceived that the activities considered in corpus-based instruction helped them to improve their critical thinking skills in academic writing classes and allowed them to use lexical bundles and metadiscourse devices in their research and project writing.

Comparing the students' perceptions between the while-intervention and post-intervention responses, However, as it is seen that the post-intervention

mean score (4.327) was greater than the while-intervention mean score (3.94). These indicated that continuous exposure to authentic and discipline-related linguistic features and real-life activities modified students' views towards the instruction.

Since the above data did not tell whether the post-intervention mean score was significantly higher than the while intervention mean, the inferential statistics were run to measure if there were significant statistical differences between the while-intervention and the post-intervention. Table 4 showed that there were significant statistical differences ($t = -5.836$, $df, 32$, $p < .05$), between the while-intervention and the post-intervention responses.

Table 4. Inferential statistics of students' perceptions regarding corpus-based instruction

		Paired differences			T	df	Sig. (2-tailed)
		Mean	SD	Std. error mean			
Pair 1	During intervention – Post-intervention	–.38171	.37573	.06541	–5.836	32	.000

The data also affirmed that the instruction helped them identify their academic writing gaps, lexical bundles, and genre-based linguistic usage. Based on these results, it is understood that students positively perceived using corpus-based instruction in their academic writing classes. They viewed that the instruction assisted them in showing their voices in problem-solution texts and constructing coherent and organized academic texts.

In addition to the questionnaire data, the semi-structured interview results also attested similar results. Look at some items and a sample of students' responses below. The first item focused on students' previous experience using lexical bundles and metadiscourse devices while writing different academic texts. The students' responses are presented as follows.

The first student: Before I learn this course, I did not know how to use them and the functions of metadiscourse and lexical bundles but at this time I understand the type and their functions. *The other student mentioned:* primarily, I was not that much familiar with these linguistic elements before this course was delivered..... However, now, I have gained so much information with an optimum exercise---them in writing different articles given in the assignment.

The students indicated in their responses that they had little or no previous experience with lexical bundles and metadiscourse devices. They also clearly reflected that the corpus-based instruction assisted them in using these linguistic features while writing abstracts, introduction, and discussion sections, and sub-genres such as problem-solution and argumentative essays.

The other issue was concerning what they thought regarding corpus-based instruction and the use of lexical bundles and metadiscourse that they discussed in their technical report writing and research methods classes. The

students' validated the questionnaire data, and they indicated that they had a positive view toward the instruction. They perceived that linguistics features considered in corpus-based instruction were important to construct different academic writing genres. The respondents added that using lexical bundles and metadiscourse devices helped them improve their critical thinking skills in their academic writing skills classes.

The other point was to examine the process they had in the technical report writing and research methods course, and they responded that they enjoyed using linguistic feature in every part of their writing and they strongly appreciated that they learned these linguistic features. For instance, one student mentions "corpus-informed instruction gave me a great experience how to use lexical bundles and metadiscourse while I write academic writing. I enjoyed very much in academic writing activities. The instruction also helped us to identify our academic writing mistakes."

Accordingly, the students liked the instruction, which aimed to improve their critical thinking skills and create awareness about the importance of using lexical bundles and metadiscourse. The students underscored that they enjoyed the instruction and engaged actively in the teaching and learning process. The instruction helped them to identify and indicate errors by their own. Moreover, they also indicated that the instruction contributed to raising their awareness regarding the structure and function of lexical bundles and metadiscourse devices.

The next item was aimed at examining the students' intention regarding using lexical bundles and metadiscourse devices in their future academic writing situations. The student responded confidently and stated that linguistic features are highly necessary for expressing ideas in writing and taking the attention of the readers. Hence it is understood that students would use lexical bundles and metadiscourse devices in their future academic writing communicative situations. When the students are persuaded by the roles of these linguistic features, they are more likely to use them in their communicative situations. Yoon and Hirvela (2004) indicated that students use particular linguistic features if they have positive attitudes regarding their usage and understand how to use them. Hence, the students' positive perception towards the instruction contributed to having significant roles in the future use of lexical bundles and metadiscourse devices.

Based on the questionnaire and the semi-structured interview results, it is possible to conclude that mechanical engineering students were not familiar with the recurrent metadiscourse and lexical bundles before corpus-based instruction was made. However, the students hold positive perceptions regarding the instruction process and the contents covered after the instruction was delivered. The data also portrayed that the students' perceptions were modified through continuous exposure to authentic linguistic features. Generally, the students' views on corpus-based activities and the instructional process were positive. The majority of participants believed that corpus-based instruction was useful to aid them in writing different academic writing texts.

Discussion and implications

The purpose of this research was to examine the effects of corpus-based instruction on students' critical thinking skills in academic writing classes. It also aimed at examining the students' perception towards corpus-based instruction. Accordingly, the academic writing tests and the textual analyses results mentioned above indicated that students who were instructed their academic writing skills through corpus-based instruction enhanced their critical thinking skills better than their counterparts. They made arguments and showed their position using appropriate lexical bundles and metadiscourse devices better than their counterparts. Students who engaged in the instruction employed various lexical resources to show their position, acknowledge the presence of a reader, infer, evaluate, and analyze ideas.

The findings of this research are conceded with previous findings (e.g., Jalali, 2017; Smirnova, 2017). These researchers reported that corpus-based instruction contributed to showing students' positions, arguments, and counterarguments, and defining the scenarios given. Similarly, previous corpus-informed studies (e.g., Zhu, 2011) also reported that corpus-based instruction enhanced students' critical thinking skills.

This study also showed that students who engaged in corpus-based instruction held positive perceptions towards the instruction. The questionnaire and the semi-structured interview data indicated that students modified their perceptions while instructed their academic writing skills through corpus-based instruction. The data proved that the students' perceptions towards the instruction were modified continuously as a result of continuous exposure to authentic and linguistic features and real-life examples.

The instruction assisted students to experience authentic linguistic features and helped them improve their critical thinking skills. The students accepted the instruction that assisted them construct their future and current academic writing texts. Students thought that the activities and examples would help them improve their evaluation, analysis, interpretation, explanation, and inference skills which were considered during the instruction. The results also revealed that lexical bundles and metadiscourse devices helped students to indicate the controversial issues, show their position, and provide reasons which helped them to persuade their imagined readers.

Hence, the quantitative and qualitative data results revealed that students were positive towards using corpus-based instruction in academic writing classes. These results concur with other researchers who examined the students' perceptions. Corpus-informed studies (e.g., Sun, 2007; Yoon, 2008) indicated that students improved their perception towards using corpus data in academic writing skills.

In conjunction with this, additional researchers, such as Eak-in (2015), reported that students had positive perceptions. This finding was also similar to Yoon (2008)'s findings which reported that corpus was used not only to solve immediate writing/language problems but also to promote their perceptions. Yoon and Hirvela (2004) also found out that students were positive towards the corpus-based instruction in L2 instruction, in particular 'acquiring usage

patterns of words and enhancing their skills". Yoon and Hirvela added that comparing intermediate students with advanced learners, intermediate students hold more positive perceptions than advanced learners.

In addition, other researchers (e.g., O'Sullivan & Chambers, 2006) also reported similar findings. These researchers reported that undergraduate and post-graduate students agreed to consult corpora in their future writing activities. Students consulted corpus data while having positive perceptions of the instruction and activities incorporated into the instruction. Researchers Kazemi, Katiraei, and Rasekh (2014) also reported that the majority of students had positive perceptions towards explicit instruction of lexical bundles to enhance the students' writing skills.

The findings implied that genuine linguistic features facilitated students' voices while they constructed academic writing texts. Accordingly, academic writing teachers, syllabus designers, and material writers should focus on authentic linguistic features to enhance EFL students' critical thinking skills in academic writing classes.

It is also seen in this research that students analyzed, evaluated, and rewrote academic writing texts (abstract, introduction, and data analysis), and these made them familiar with moves and genre-based linguistic features. They also became familiar with the target linguistic features, which occurred more frequently in their field of study. Thus, incorporating authentic linguistic elements is commendable in contexts where writing is practiced for academic purposes, and it is suggested that similar pedagogical procedures should be practiced while teaching academic writing skills in engineering and other disciplines to improve critical thinking skills.

Students evaluated, inferred, analyzed, explained, and interpreted academic writing texts while the teacher instructed them through corpus-based instruction. Accordingly, this research recommends incorporating discipline-oriented lexical bundles and metadiscourse devices in academic writing classrooms to enhance students' critical thinking skills.

In addition, the research proved that the students accepted the instruction as it was relevant to improve their critical thinking skills. Thus, the researcher suggests that academic writing teachers and material writers should consider students' critical thinking gaps and incorporate genuine linguistic features when they design materials and instruct academic writing skills.

The limitation of this study was generalizability. The findings that were mentioned above may not be generalizable and applicable to other psychological aspects (variables) and English language skills other than critical thinking and perception. Despite this limitation, the study reported important implications for further implementation of corpus-based instruction in academic writing classes. The researcher believed that these results would initiate a further study to examine the effects of the instruction on other English language skills in the EFL contexts.

Conclusion

This research focused on examining the effects of corpus-based instruction on students' critical thinking skills and their perceptions towards the instruction. Accordingly, the pre-test results and the textual analyses of students' critical thinking skills confirmed that both groups did not have significant statistical differences before corpus instruction was carried out. Both groups lacked analysis, evaluation, inference, explanation, and interpretation skills in their academic writing texts.

However, the post-test academic writing tests and the textual analyses proved that corpus-based instruction in academic writing classes contributed to the development of critical thinking skills more than the conventional instructional approach. These were demonstrated by the statistically significant improvement from the students' initial critical thinking skills measured by the pre-test academic writing test and textual analyses. Accordingly, significant statistical differences were observed between students who were instructed through the conventional approach and students who were instructed through corpus-based instruction.

Concerning students' perception, the quantitative data results proved that the majority of students had positive reactions corroborating the effects of corpus-based instruction to enhance the students' academic writing skills. The qualitative results were also concurrent with the quantitative result which revealed that students had positive perceptions towards the instruction.

To sum up, this research highlighted the strong relationship between corpus-based instructions on students' critical thinking skills in academic writing classes. The instruction which encompassed authentic linguistic features, examples, and appropriate pedagogical intervention showed contributions to students' critical thinking skills and their perceptions. It initiated students to engage in different authentic and real-life activities. Accordingly, students became aware of how to use authentic linguistic features (lexical bundles and metadiscourse devices) while constructing different academic writing texts.

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