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Voice in Rhetorical Units of Results and Discussion Chapter of Master's Theses: Across Science Study

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Abstract
In order to gain insights into the voice profile in academic discourse, the present study investigated the realizations of voice in obligatory moves and steps in integrated Results and Discussion chapter of 40 master's theses from hard and soft sciences written by ESL students from 2002 to 2012. To conduct the study, a mixed-method approach was adopted. The quantitative analysis was conducted to locate the voices in the identified obligatory rhetorical units of the corpus. The shifts in the use of the voices and possible reasons for voice selection were investigated in the form of contextual analysis. It was found that the use of active voice outnumbered passive voice in the overall corpus. The disciplinary variations were observed mostly in *Structure of the Section, Describing Aims and Purposes*, *Listing Procedures or Methodological Techniques*, and *Referring to Previous Research*. The influencing factors in voice choice were the function of the step, the associated verb and tense, and the writers' stance in the text.

Key words
Academic discourse; active voice; passive voice; obligatory; optional; rhetorical moves and steps; disciplinary variation

1. Introduction

Thesis is a type of academic genre that is substantially produced in academic contexts. A thesis may comprise different chapters. One significant and challenging chapter of a thesis is its integrated Results and Discussion chapter (Nguyen and Pramoolsook 2015; Brett 1994). According to Ebrahimi and Chan (2012), Results and Discussion chapter or section has considerable potential for conducting research in applied linguistics.

Genre analysis, as a method of text analysis, has been already employed in examining the linguistic features and/or rhetorical functions of Results and Discussion across different sciences (Fallahi and Erzi 2003). Similarly, by examining the linguistic features of the integrated Results and Discussion chapter of theses in a variety of disciplines, it is possible to shed a better light on the organization of

this significant chapter of theses. The findings of this study will also help writers to understand how content and context affect the choice of grammatical forms (that is the voice in the case of the present study) which in turn make meaning for the audience. In addition, a thorough understanding of the full range of possible meanings and uses of the voices and how they can be applied to rhetorical units in academic writing will provide the writers with the greatest flexibility in the use of voice to express nuances in meanings (Taylor 2001). Accordingly, the results of the study also show how voices can be embedded in the moves and steps of integrated Results and Discussion chapters of ESL master students who may need to differentiate the skills of writing according to sciences. Therefore, the study attempts to answer the following research question:

> What are the patterns of voice selection in the obligatory rhetorical moves and steps in the integrated Results and Discussion chapter in hard and soft sciences?

The active and passive voices are verb forms in the English language. In the active voice, the person or thing represented by the grammatical subject performs the action represented by the verb. However, in the passive voice, the grammatical subject of a verb is subjected to or affected by the action represented by that verb (*Merriam-Webster's collegiate dictionary* 2004).

According to Halliday (1985), the expression of voice is an extension of that of tense. The active has no explicit marker; the passive is expressed by *be* or *get* plus *V-en* (past/passive participle), appearing as an additional modifying element at the end (Halliday 1985). The passive voice has been widely used in the scientific discourse (Baratta 2009; Dong 1998). The passive voice allows for the subject of a sentence to be deleted, and thereby de-emphasized in terms of its semantic role (Baratta 2009). The basic form of constructed passive voice is well documented in most grammar books (for example, Carter and McCarthy 2006). In most definitions of the passive voice, 'be' auxiliary is a concomitant of the passive voice. However, the use of the passive form is not restricted to 'be' auxiliary. Puckica (2009: 215) asserted:

> The label 'passive voice' cannot be reduced to that single construction. A passive construction may involve a verb other than BE with a past participle.

However, it seems that in the first decade of the 21st century, there is a lack of consensus among the research studies about the widespread use of the passive voice in academic writing (Alvin 2014; Baratta 2009). Thus, with regards to the studies on voice, it is necessary to provide a concise review of the available literature.

In his study of stylistic features of scientific English in Medical and Natural Science articles, Ahmad (2012) analyzed 10 scientific research articles drawn from scientific journals such as The Lancet, BMJ, and Down to Earth. These journals are based on research findings of medical and natural sciences. Data revealed that the passive voice was the dominant voice in the results and discussion

chapters. Ahmad (2012: 47) noted that the passive voice was used in this step in order to "get rid of personal whims and fancies, and thus obtain impersonality and universality of the research".

Many researchers within the last two decades have shed light on the realizations of voices in different academic genres (for example, Alvin 2014; Pho 2008; Saboori and Hashemi 2013; Seoane 2006). By using a corpus of 60 scientific articles from several disciplines, ranging from chemistry to archaeology, Alvin (2014) examined the frequency of the use of the passive voice. Alvin (2014) selected a clause as a minimum unit of investigation. The results of his study revealed that about 30% of the clauses were in the passive voice. The dominantly used types of the passive voice, according to Alvin (2014), were basic passives and bare passives.

This percentage of occurrence (30%) of the use of the passive voice is considerably lower than another study that was performed by Seoane (2006). In scrutinizing a corpus of 120,000 words that were extracted from 15 different scientific English texts, Seoane (2006: 192) found that 41.9% of the clauses were communicated in the passive voice. The passives used were either basic or bare. The difference between the percentage of occurrence of the passive use in Alvin's (2014) study and Seoane's (2006) study (80% vs. 41.9%) may be explained in terms of eight years of time difference. It seems that there is a general acceptance by the discourse community towards the shift from the passive to the active voice in writing scientific research.

However, it seems that there is also a relationship between the use of the passive voice and the discipline of study. Pho (2008) conducted a study of rhetorical moves of 30 journal article abstracts in the disciplines of Applied Linguistics and Educational Technology. According to Pho (2008), there was a correlation between the choice of voice and the disciplines. More active verbs than passive verbs were employed in the discipline of Applied Linguistics. On the other hand, more passive verbs than active ones were employed in the discipline of Educational Technology. Pho (2008) concluded that generalization in Applied Linguistics was conveyed by the use of the active voice. However, in the Educational Technology discipline, the passive voice was the preferred voice.

Saboori and Hashemi (2013) analyzed 63 research article abstracts in three disciplines, namely Applied Linguistics, Applied Economics, and Mechanical Engineering. The analysis focused on the rhetorical movements as well as the embedded tenses and voices of the identified moves and steps. The results of the study indicated that disciplinary variation could influence the application of voice. According to Saboori and Hashemi (2013: 494), in comparison to the other two fields of study, the use of the passive verbs outnumbered the use of the active verbs in the Mechanical Engineering discipline. Saboori and Hashemi (2013) pointed out that the use of passive verbs in the Mechanical Engineering discipline was twice as many as those in Applied Linguistics and Applied Economics. It can be concluded that disciplinary variations influence the use of voice in abstracts in articles.

Fallahi and Erzi (2003) also have investigated the voices used in the rhetorical moves of the Discussion sections of 61 Language Teaching Research Articles. In their study, Information, Results, Findings, Unexpected Outcome, Reference to

Previous Research, Explanation, Claim, Limitation, Restatement of Hypotheses, and Procedure moves were all discussed and presented in the active voice, whereas the only move that made use of the passive voice was Recommendation. In the Recommendation Move, the passive voice was used in 65% of the sentences. This result implies that in the corpus of language teaching, when the argument was directed towards suggestions for future research, the authors preferred the use of passive verbs.

Furthermore, there may be a relationship between tense use and choice of voice in academic writing. For example, in another study conducted by Shaw (1992), the correlations between tense and voice of reporting verbs in introductory chapters of six Ph.D. theses in Agricultural Biology and Biochemistry were investigated. Shaw (1992) reported that there was a relationship between the use of tense and voice of the verbs. In other words, Shaw (1992) maintained that those verbs that were in the past tense were mostly presented in the active voice, whereas the perfect tenses were expressed in the passive voice.

Salager-Meyer (1992) also investigated how in terms of voice use, ideas may be communicated in the Abstracts of Medical Research Articles. To perform this task, Salager-Meyer (1992) investigated 84 Medical English Abstracts. Concerning the communicative function of the four rhetorical divisions of the abstracts, a number of the used verbs were examined. Salager-Meyer (1992) discussed that the Results Move was signaled by the active voice, whereas in the Methods Move, the dominant voice was passive. In Statement of the Problem and Purpose Moves, the most frequently used voice was active. This result puts forward the argument that the use of voice may be significantly different in different rhetorical divisions of a corpus.

Rhodes (1997) examined the occurrence of the passive voice verbs in empirical reports of some different disciplines such as Psychology, Botany, Chemistry, and Physics. Rhodes (1997) argued that in the most object-oriented fields like Chemistry and Physics, the frequency of the passive voice verbs was found to be higher than other fields of study. Rhodes also mentioned that in the less object-oriented fields like Psychology, the frequency of use of the passive voice was less compared to that of more object-oriented fields.

As it was related to rhetorical divisions of the articles, Rhodes (1997) discussed that the rhetorical movements that were more objective (Methods and Results) had a higher frequency of use of the passive voice verbs than those that were less objective (Introduction and Discussion). Rhodes (1997) concluded that the passive voice is generally used in scientific writing especially in order to refer to objective information. In other words, according to Rhodes (1997), the rhetorical moves that were more objective (Method and Results), the passive voice was highly employed. Whereas, Rhodes argued that in the more interpretive moves (Introduction and Discussion), the preferred voice was active. In brief, Rhodes asserted that the active voice is an appropriate grammatical structure for interpreting information and the passive voice is suitable for describing data and information.

The reviewed literature clearly indicates that the analysis of voices in academic genres could provide novice academic writers with a good model to follow while developing academic genres. One of the challenging academic genres that post-

graduate students encounter is thesis writings. It could be noticed that in the reviewed literature, this genre is totally neglected. Thus, this study intends to focus on the challenging and demanding chapter of this genre, Results and Discussion chapter, to study voices used in moves and steps aiming to fill the gap in the literature and guide writers overcome the challenge of using appropriate voices in different moves and steps of the chapter.

2. Methodology

Since Becher and Trowler (1989) maintained that Physics and Chemistry are in the taxonomy of hard science and English Language and Economics are in the taxonomy of soft science, in tandem with the study's objectives, twenty theses were selected from hard science (ten from Physics Department, Faculty of Science and ten from Chemistry Department, Faculty of Science) and twenty were selected from soft science (ten from Department of English, Faculty of Modern Languages and Communication and ten from Department of Economics, Faculty of Economics and Management). The investigated integrated Results and Discussion chapters were mostly the fourth chapter of master's theses from the years 2002 to 2012.

The classification of the moves and steps was based on the adapted framework proposed by Kanoksilapatham (2005). For more information on the rhetorical moves and steps of the corpus, see Shirian Dastjerdi et al. (2017a, 2017b). Kanoksilaphatham's (2005) analytical framework was found to be more suitable for this study due to the following reasons: Firstly, in comparison to the other frameworks (Brett 1994; Swales 1990), it is more up-to-date. Secondly, it is more comprehensive than other frameworks in the literature (Basturkmen 2012; Atai and Falah 2005). In other words, Kanoksilaphatham's (2005) analytical framework covers almost all the moves and steps that are presented in the other frameworks. Moreover, the taxonomy of obligatory moves and steps was based on Kanoksilapatham's (2005) argument who maintained that if a rhetorical unit (move or step) was found in 60% or in more than 60% of the total number of all the examined text(s) (in case of this study equals to 12 or more than 12 out of 20 theses), it can be an evaluated as an obligatory rhetorical unit. As such, firstly obligatory rhetorical units of the Results and Discussion chapters of the master's theses were investigated. Secondly, the frequency of occurrence and percentage of occurrence of the used voices in the obligatory rhetorical units were identified (see Shirian Dastjerdi et al 2017a and 2017b). Thirdly, the textual analysis was conducted in order to find out the possible reasons for the voice preferences and shifts in the rhetorical moves and steps.

2.1 Research Design

In the present study, quantitative data was employed to compute and demonstrate the frequency of the voices used in moves and steps of the investigated texts. On the other hand, qualitative data was found to be useful in order to

classify and describe avtive and passive voices in the rhetorical movements of the examined texts.

In order to select the corpus of the study, out of the 114 theses, ten theses with integrated Results and Discussion chapters from each field of the study were randomly selected as the final corpus of the study (a table of the random number was used). Table 1 shows the distribution of the corpus per discipline and field of the study. The total number of 40 selected theses is justifiable in terms of the total word number of the corpus.

Hard Science: Faculty of Science		Soft Science: Faculties of Modern Languages and Communication and Economics and Management	
Physics	10	English Language	10
Chemistry	10	Economics	10
Total	20	Total	20

Table 1. Distribution of Theses per Science of Study

The corpus includes Results and Discussion chapters of MA thesis submitted to a university in an L2 context. The rationales are as follows: First, the researcher, as a student at the same university, was familiar with the site and staff, and therefore, this familiarity could facilitate the data collection procedure. Second, Paltridge (2002: 17) argued that since the beginning decades of the 21st century, public university students have become diverse in terms of "race, gender, nationality and economic background". In line with this argument, Duderstadt (2000: 22) emphasized that in the 21st century, since students of public universities "come from different backgrounds", they have the capabilities of performing research with "different intellectual objectives". Duderstadt (2000: p. 22) concluded that a single public university may provide a diverse population for data gathering purposes. Third, it may be referred to Bhatia (2000) who believes that in an academic setting such as a public university, a wide range of genres including theses are available, and thus a researcher may consider a single public university as an adequately suitable source of data collection. Finally, this adequacy of selecting a single academic institution for data collection is verified by other researchers (for example, Cheng 2014; Aitchison 2003; Strauss et al. 2003; Aitchison 2003; Thompson 2001; Kennedy 1998).

The total word number of the corpus of the present study is 200,000 which is identified as a reasonable corpus worthy of investigation. In his discussion in relation to small and large corpora, Ooi (2001) and Kennedy (1998) opined that the size of a corpus is relative and there is no right or wrong choice in terms of the number of words. In a computer-based discourse analysis study, Sinclair et al. (2004) used a corpus of 166,000 words and referred to it as a small corpus. In another computer-based corpus study, Taylor and Knowles (1988) used a corpus of 53,000 words and referred to it as a large corpus.

According to Kennedy (1998), the type of corpus, analysis, and the objective(s) of the study are important factors that should be taken into consideration when deciding on the word number of a corpus. For example, for the study of prosody,

a corpus of 100,000 words is big enough (Kennedy 1998). In addition, in a more recent study of move analysis by Kanoksilapatham (2007), the corpus size was 320,000 words. Since data analysis of this study was performed manually, a corpus size of approximately 200,000 words can be evaluated as reasonably accepted.

Attempts were made to select the corpus of the study based on the following criteria. Firstly, all the selected theses were written as the requirement for the fulfillment of a master's degree by ESL students. Secondly, the chosen theses contained an integrated Results and Discussion chapter.

Furthermore, by utilizing the non-parametric Chi-Square Test, attempts were made to highlight how the distribution of voice of each rhetorical unit was significantly different. The choice of the Chi-Square Test was based on the reasoning that the data of the corpus was not distributed normally. As such, according to Samah (2010: 70), the non-parametric test of Chi-Square was found to be more appropriate to conduct this type of investigation.

2.2 *Ethical Issues*

According to Baker (2006), in discourse analysis, one ethical issue is to obtain permission from copyright holders or authors of the texts. In the present study, a permission letter was obtained from the university which holds the copyright of the theses. Another ethical issue in text analysis was the confidentiality of the university in which the data was collected and the anonymity of the thesis writers.

3. Results and Discussion

An overall picture of the voice distribution in the investigated texts is presented.

Voice	Frequency of Occurrence	Percentage of Occurrence
Active	2627	65.94%
Passive	1357	34.06%
Total	3984	100%

Table 2. Overall Distribution of Voice in the Corpus

The overall picture of the whole corpus' voice distribution shows that the active voice outnumbered the passive voice (Table 2).

	Hard Science		Soft Science	
	Active *F** (%)	Passive *F** (%)	Active *F** (%)	Passive *F** (%)
Structure of Section	11 (47.83%)	12 (57.17%)	40 (61.54%)	25 (38.46%)
Describing Aims and Purposes	5 (22.73%)	17 (77.27%)	26 (70.27%)	11 (29.73%)
Listing Procedures or Methodological Techniques	28 (17.83%)	129 (82.17%)	96 (55.81%)	76 (44.19%)

	Hard Science		Soft Science	
	Active *F** (%)	Passive *F** (%)	Active *F** (%)	Passive *F** (%)
Citing Established Knowledge of Procedure	45 (59.21%)	31 (40.79%)	53 (73.61%)	19 (26.39%)
Pointer	186 (56.36%)	144 (43.64%)	114 (52.29%)	104 (47.71%)
Substantiating Results	368 (71.32%)	148 (28.68%)	332 (78.67%)	90 (21.33%)
Explaining the Results	126 (69.23%)	56 (30.77%)	73 (68.87%)	33 (31.13%)
Making Generalizations or Interpretations of Results	142 (71.36%)	57 (28.64%)	155 (72.77%)	58 (27.23%)
Evaluating Current Findings with Those from Previous Studies or Hypotheses	62 (74.70%)	21 (25.30%)	128 (83.12%)	26 (16.88%)
Describing Established Knowledge	121 (72.02%)	47 (27.98%)	85 (76.58%)	26 (23.42%)
Referring to Previous Literature	47 (69.12%)	21 (30.88%)	36 (75%)	12 (25%)

*F indicates the frequency of occurrence

** (%) indicates the percentage of occurrence

Table 3. Distribution of Voice in Obligatory Rhetorical Units

Following is a discussion concerning the identified voices in the obligatory rhetorical units (moves and steps) of the corpus.

Structure of Section

In this rhetorical move, the authors communicated the order and content of the texts. In the hard science, the preferred voice with a frequency of 12 (57.17%) was the passive voice. But in the soft science, the dominant voice was found to be the active voice with a frequency of 40 (61.54%). Hence, it seems that the hard science writers had more tendencies to present the structure of sections by using the passive voice rather than the active ones. The results of the Chi-Square Test also denoted that in communicating this move, the use of the active and the passive voices was significantly different (χ^2= 5.463; df =1; $\rho < 0.05$). The probability associated with the Chi-Square statistic of 5.463 was less than 0.05 indicating the pattern of the used voices in presenting this move was different between the hard and soft sciences.

The impact of the sciences on the choice of voice has already been attested by different research studies (for example, Saboori and Hashemi 2013; Pho 2008; Hanania and Akhtar 1985), although their research studies have not discussed the voice within the rhetorical units of texts.

The contextual analysis revealed that the choice of tense together with the choice of verbs played a role in the student writers' choice of voice in this move. For example, when a verb was in the simple future tense, the associated voice was mostly found to be passive. The location in which the verb appeared was also found to have an impact on the choice of voice. The following extract that is an example of this move, appeared at the beginning of the chapter and shows how the simple future tense is communicated in the passive voice.

> *Four research questions were proposed in this study that* ***will be addressed*** *in the following.* (Passive voice in English language, excerpt 1)

However, as shown in the following examples, only in one thesis in the soft science, all the future tenses in this move were in the active voice with the use of the pronoun 'we' which according to the guidelines by Paltridge and Starfield (2007) and Hyland (2002) is inappropriate:

> *In this chapter,* ***we will reveal*** *the result from the estimation procedures as explained in the previous chapter on country basis for better perceptive. Firstly,* ***we will briefly explain*** *the result of stationarity test; ADF unit root test and Phillip-Perron unit root test.*
> *In this section,* ***we will report*** *the estimation results for Indonesia.*
> *In this section,* ***we will discuss*** *the results obtained for Malaysia.*
> *In this section,* ***we will analyze*** *the results for Thailand.* (Active voice in Economics, excerpt 2)

Regarding the association between the verb and voice, the data revealed that in presenting this move, verbs like *discuss*, *explain*, *give*, *divide*, *follow*, and *report* were mostly found in the passive voice. The following excerpt shows an example of the choice of the voice in the mentioned verbs in this move:

> *Relationship between dielectric constant and loss factor with m.c at specified frequencies are* ***also discussed****...* This ***is followed*** *by a discussion on the relationship between conductance, susceptance, moisture content and frequency in Section 5.3. Equations to predict moisture content from conductance and susceptance values* ***are also given*** *for some selected frequencies.* (Passive voice in Physics, excerpt 3)

Generally, it can be concluded that the student writers had more tendency towards using the active voice in this move. This tendency is explicable in terms of the nature of this move in which student writers attempted to make a direct connection between themselves as writers to the readers. In other words, by using this rhetorical unit, the writers directed the readers to follow what was presented in the chapters/sections and consequently tried to get them involved with the texts. The necessity of this connection between writers and readers was also echoed by Baratta (2009) and Hyland (2005). Hyland (2005: 363) mentioned that "the importance of including readers in written academic texts and engaging them in the unfolding discourse is now well established".

Describing Aims and Purposes

This step explains the aims and purposes of the study. A notable difference was observed in the voice usage of this step. Mostly, the passive voice was used in the hard science (77.27%). But in the soft science, the active voice (70.27%) outnumbered the passive voice. The results of the Chi-Square Test also verified the significant difference between the choice of voice in the two sciences ($\chi^2 = 44.398$; df = 1; $\rho < 0.05$). The probability associated with the Chi-Square statistic of 44.398 was less than 0.05 indicating that the pattern of the used voices in presenting this step was different between the hard and soft sciences.

The use of active voice in presenting the purpose of study in soft science theses is not surprising as the writers treat this step as an informative step that requires using verbs in the active voice. This is in line with findings reported in Fallahi and Erzi's (2003) study. As to the use of passive voice in presenting this step in the hard science theses, it can be discussed that the rules and conventions of disciplines are imposing such a use. This is stressed by studies carried out by Salager-Meyer (1992) and Rhodes (1997). As in these two studies, even the data were not from soft science, but the step was presented in active voice that stress the disciplinary impact on the selection of voice. The following examples present the voice used in this step:

> *The second objective of this study* ***is*** *to discover the differences between MI of the students and their reading proficiency and gender respectively.* (Active voice in English language, excerpt 4)

> *The grafting reactions* ***were studied*** *from 50°C to 70°C.* (Passive voice in Chemistry, excerpt 5)

Listing Procedures or Methodological Techniques

The procedures or methodological techniques employed in the production of data are presented in this step. In the hard science, this step was highly presented in the passive voice. In the hard science, 82.17% of verbs were passive. However, in the soft science, the active voice (55.81%) was the dominant voice. Fallahi and Erzi (2003) underlined that 'Procedure' was mostly presented in the active voice.

The results of the Chi-Square Test also denoted a significant difference between the choice of voice in the two sciences in this step ($\chi^2 = 30.974$; df = 1; $\rho < 0.05$). The probability associated with the Chi-Square statistic of 30.974 was less than 0.05 indicating that the pattern of the used voices in presenting this step was different between the hard and soft sciences.

As it was already discussed, in the active voice the focus is on actors, but when the focus is on action rather than the actor, the passive voice is used. Moreover, the passive voice is used when authors tend to draw readers' attention to the person or thing acted upon or when the actor in the situation is not important. This may imply that in the hard science, the focus of methodology is more on the procedure or tools than in the soft science. On the other hand, in the soft science,

the focus is more on the researcher and/or the researcher's choice of procedure in conducting research. In harmony with this discussion, in his study of stylistic features of scientific English in Medical and Natural Science articles, Ahmad's (2012) data revealed that 70% of the voices in the method sections were passive. Ahmad (2012: 47) noted that the passive voice was used in this step in order to "get rid of personal whims and fancies, and thus obtain impersonality and universality of the research". Thus it can be suggested that in the soft science, writers practice the subjectivity by using active voice, and in hard science, writers are sure about the procedure as they are more standard-based and laboratory-generated, so they prefer to stress the action than the actor. The examples below present the voice used in this step:

> *Experimentally, beyond 15 mol % ZnO, the addition of composition ZnO* ***decreased*** *the values of σ.* (Active voice in Physics, excerpt 6)

> *An analysis using SPSS* ***was conducted*** *and the results were outlined.* (Passive voice in English language, excerpt 7)

Citing Established Knowledge of the Procedure

This step provides the established findings that had impacts on the choice of procedures. In both sciences, the prominent voice in presenting this step was the active voice. In the hard science, 59.21% of the verbs were in the active voice and 40.79% of them were presented in the passive voice. But in the soft science, the active voice with a high frequency of 53 and a percentage of occurrence of 73.61% outnumbered the frequency of the passive voice (F=19 with a percentage of occurrence of 26.39%). The results of the Chi-Square Test denoted that in this step, the use of voice in the two sciences was significantly different ($\chi^2 = 5.050$; df =1; $\rho < 0.05$). The probability associated with the Chi-Square statistic of 5.050 was less than 0.05 indicating the pattern of the used voices in presenting this step was different between the hard and soft sciences.

The voice pattern in this step may be explained in terms of the nature of this step. Since in this step, the writers' choice of procedure is justified, the active voice was used. This could help the writers to highlight their role in their study. The following examples could highlight the stated claim.

> *Langmuir equation* ***can be used*** *to calculate theoretical maximum sorption capacity* q_{max} *(mg* g^{-1}*) and the energy parameter of sorption* K_L *(l* mg^{-1}*).* (Passive voice in Chemistry, excerpt 8)

> *The first section* ***presents*** *the basics of English pronunciation focusing on the segments, and the second section* ***focuses*** *on suprasegments of speech.* (Active voice in English language, excerpt 9)

Pointer

This step indicated which data were going to be discussed. This rhetorical unit has been presented mostly in the active voice in both the hard and soft sciences. Table 3 shows that there was not a considerable difference between the choices of voice in this step. In agreement with this observation, the results of the Chi-Square Test ($\chi^2 = 0.322$; df =1; $\rho > 0.05$) indicated that there was no significant difference between the choice of voice in the two sciences. The probability associated with the Chi-Square statistic of 0.322 was more than 0.05 indicating the pattern of the used voices in presenting this step was similar between the hard and soft sciences.

One noticeable factor that influenced the choice of the voice of this step was the associated verbs used. In other words, it was found that an association between the choice of the verb and the choice of the voice existed. For example, some verbs including *display*, *report*, *present*, *observe*, *summarize*, *list*, *depict*, and *tabulate* were found in the passive voice mostly. Following are some examples from the corpus depicting some of the mentioned verbs used in the passive form in this step:

> *The average scores for sequenced EST materials of both groups* ***are presented*** *in Table 4.5.* (Passive voice in English language, excerpt 10)

> *The relationship between m.c, conductance and susceptance for several selected frequencies* ***are listed*** *in Table 5.4.* (Passive voice in Physics, excerpt 11)

The verb *show* was equally expressed in the active and passive voices:

> *Figure 5.1* ***shows*** *the normalised powder x-ray diffraction (XRD) spectra for LDySMnO system*. (Active voice in Chemistry, excerpt 12)

Based on the above observations, it can be concluded that some particular verbs require being presented in the passive voice and some particular verbs are mostly presented in the active voice. In other words, whenever an idea (as a rhetorical unit) can be expressed either in the active or the passive voices, the associated verb has effects on the voice selection.

Substantiating Results

This step communicated the results of the study and pointed to the validity of the findings. From the presented information in Table 3, it is clear that in both sciences, the active voice was the dominant voice.

In the hard science, the active voice (71.32%) was used more than the passive voice (28.68%). Similarly, in the soft science, the percentage of occurrence of the active voice was 78.67%, which was considerably more than the percentage of occurrence of the passive voice (21.33%). Consequently, a disciplinary variation of choice of the voice between the two sciences was not observed.

Besides, the results of the Chi-Square Test ($\chi^2 = 1.707$; df = 1; $\rho > 0.05$) congruent with observation, stated that there was no significant difference between the choice of the voice in the two sciences. The probability associated with the Chi-Square statistic of 1.707 was more than 0.05 indicating the pattern of the used voices in presenting 'Substantiating Results' was similar between the hard and soft sciences.

The prevailing use of the active voice in this step was found to be in line with the studies conducted by Fallahi and Erzi (2003) on a Social Science corpus and Salager-Meyer (1992) on Medical Abstract's texts. It seems that in this step, writers are required to present the results in the active voice as the results are treated as the contribution of their study to the existing knowledge. This is also stressed by Biber et al. (1998) in their book of Corpus Linguistics and Tarone et al. (1998). Therefore, strong governance of the active voice in this step is justifiable in terms of the manifestation of the writers' voices in constructing the argument. The examples below present the voice used in 'Substantiating Results':

> *In the early stages of practice, the effect of L1 on L2* ***occurred*** *repeatedly. Learners* ***produced*** */v/ in place of /w/.* (Active voice in English language, excerpt 13)

> *Therefore, using calculated* MC_{fL}*, the actual volume fraction of water in fresh leaves mixture,* V_{wfL} ***is estimated*** *as 0.369.* (Passive voice in Physics, excerpt 14)

Explaining the Results

In this step, the writer suggests reasons for findings or alternatively explained the results of the study. The prominently used voice in presenting this step was active in both hard and soft sciences. In the hard and soft sciences, 69.23% and 68.87% of the verbs of this step were in the active voice respectively. Thus, no disciplinary variation in the choice of voice was found in this rhetorical unit.

Besides, the results of Chi-Square Test ($\chi^2 = 0.000$; df =1; $\rho > 0.05$) supported the lack of disciplinary variation of voice use in this step. The probability associated with the Chi-Square statistic of 0.000 was more than 0.05 indicating the pattern of the used voices in presenting this step was similar between the hard and soft sciences. In tandem with this finding, in the study by Fallahi and Erzi (2003), the active voice was found to be the dominant voice used in explaining the results of the study.

It is suggested that the function of this step (which is explaining the results) helps to explain the reason for the extensive use of the active voice. Accordingly, through this step, the writers express themselves and provide evidence and proof to justify the results of their study. Therefore, a strong voice which is the active voice is needed to achieve this purpose. Additionally, the use of the active voice helps the reader to understand better the explanations provided by the writer (Yannuar et al. 2014). The following excerpts from the corpus illustrate the use of voice in this step:

> *The recurrence of these verb phrases* ***may be related*** *to the market trend at that point of time.* (Passive voice in English language, excerpt 15)

*This **might be** due to the incorporation of ibuprofen.* (Active voice in Chemistry, excerpt 16)

Making Generalizations or Interpretations of the Results

By using this step, the writers make generalizations based on the results of the study. Also, they interpreted the results obtained from the study. Accordingly, reactions of the writers towards the results obtained are expressed in this step. It seems that to achieve this goal, writers prefer using the active voice. Accordingly, the active voice was found to be the dominantly used voice in this step.

According to Table 3, in the hard science and soft science, the respective percentage of occurrences of the active voice were 71.36% and 72.77%. Therefore, no disciplinary variation was observed in the choice of the voice of this step. The prevailing use of the active voice in the generalization of results is also attested by Fallahi and Erzi's (2003) study.

The results of the Chi-Square Test ($\chi^2 = 0.099$; df =1; $\rho > 0.05$) supported the lack of disciplinary variation of the voice use in this step. The probability associated with the Chi-Square statistic of 0.099 was more than 0.05 indicating the pattern of the used voices in presenting this step was similar between the hard and soft sciences. The following examples from the corpus illustrate the voice used in this step:

*This **seems** to suggest that visuals in sequenced EST materials **have** a material impact on students' learning.* (Active voice in English language, excerpt 17)

*... the frequency of the peaks of both conductance and susceptance **are shifted** to the lower frequencies.* (Passive voice in Physics, excerpt 18)

Evaluating the Current Findings with Those from Previous Studies or with Regard to the Hypotheses

In this step, the finding(s) of the study is evaluated with those from previous studies or with regard to the hypotheses proposed by the study. As Table 3 shows, the percentage of occurrences of the active voices of this step in the hard science and soft science were respectively computed as 74.70% and 83.12%. Therefore, no disciplinary variation was observed in the voice selection in this step, which was also attested by the results of the Chi-Square Test ($\chi^2 = 1.929$; df =1; $\rho > 0.05$). The probability associated with the Chi-Square statistic of 1.929 was more than 0.05 indicating the pattern of the used voices in presenting this step was similar between the hard and soft sciences.

The findings of this study could suggest that the use of the passive voice should be limited when referring to the previous studies. It is believed that sentences in the passive voice are harder to understand. In this regards, Acheson and Bond (2011) also mentioned that supervisors suggest the use of the active voice because it provides a clearer writing style. The following extracts demonstrate the voice used in this step:

According to Wong (2004), the average cost for the surveillance visit per company ***is*** *around RM3,000 per mill.* (Active voice in Economics, excerpt 19)

Such behaviours ***are associated*** *with domain rotations caused by applied magnetic field (Blasco et al., 1996).* (Passive voice in Physics, excerpt 20)

Describing Established Knowledge

By using this rhetorical unit, the author situated the study being reported in the interest of the discourse community. As can be observed from Table 3, this step was mostly presented in the active voice.

The frequency of the use of the active voice in this step in the hard science was 72.02%. Similarly, in the soft science, the active voice with a percentage of occurrence of 76.58% constituted the dominant choice of voice. Consequently, in line with the results of the Chi-Square Test ($\chi^2 = 0.\ 658$; df =1; $\rho > 0.05$), no significant disciplinary variation was found in the use of voices in this step. The probability associated with the Chi-Square statistic of 0. 658 was more than 0.05 indicating the pattern of the used voices in presenting this step was similar between the hard and soft sciences.

A plausible explanation for the high frequency of usage of the active voice was that in this step, the writers connect their results to the established body of knowledge. Hence, by using the active voice, the writers may express the related established knowledge of the field. The voice used in this step is exemplified in the following excerpts:

Temperature ***is*** *one of the important reaction parameters for grafting reaction.* (Active voice in Chemistry, excerpt 21)

The concerns of the Ricardian equivalence hypotheses existence ***are based*** *on fiscal balance and debt insignificancy to affect the private consumption.* (Passive voice in Economics, excerpt 22)

Referring to Previous Literature

In this step, the author referred to the previous research. 69.12% of the voices in the hard science and 75% of the voices in the soft science were the active voice. The results of the Chi-Square Test ($\chi^2 = 0.\ 893$; df = 1; $\rho > 0.05$) also indicated that the patterns of voice used in the hard and soft sciences in this step were not significantly different. The probability associated with the Chi-Square statistic of 0. 893 was more than 0.05 indicating the pattern of the used voices in presenting this step was similar between the hard and soft sciences.

This finding is not surprising as referring to previous studies are mostly through the use of active voice. In this regards, findings reported in the studies carried out by Fallahi and Erzi (2003) and Yannuar et al. (2014) are also stressing the use of active voice while referring to earlier studies. In the active voice, the agent or doer in the sentence takes the responsibility of the claim made. In the case of this

step, the heavy use of the active voice may be interpreted that the student writers use the active voice in addressing other bodies of a discourse community that their studies are in line with them. In addition, referring to the literature through the use of the active voice and relating research to previously conducted research may add validity to the integrated Results and Discussion chapter and give the student writers the opportunity to relate their results to the established body of knowledge accepted in the discourse community. The following extract from the corpus show the voice used in this step:

> *Cortazzi, Rafik Galea, and Jin (1998)* ***suggest*** *visual frameworks* ***connect*** *language skills, content knowledge, discourse knowledge, and thinking skills.* (Active voice in English language, excerpt 23)

4. Conclusion

The results of the investigation indicated that generally in the corpus, the active voice outnumbered the passive voice. The findings of the study indicated that the function of the rhetorical units was influential in selecting the voice of the texts. It is suggested that to present scientific findings, the active voice is a better choice in academic writing. This conclusion is also suggested in earlier studies, e.g. Ahmad's (2012). Thus, the dominant choice of the active voice in rhetorical units of the integrated Results and Discussion chapters of the ESL student writers seems to be imposed by the nature of the genre.

On the other hand, it can be argued that the passive voice is used in academic writing in order to create an impersonal academic context. Thus, it can be concluded that the passive voice is a superior choice for presenting objective discussion. In other words, whenever the passive voice is used, it is not important who did something, but what has been done is the focus of attention.

Furthermore, it was observed that there was a relationship between the choices of verbs and the selection of voice. The examination of data revealed that certain verbs like *discuss*, *explain*, *give*, *divide*, *follow*, and *report* were mostly found in the passive voice.

As another influential factor in the choice of voice, it was realized that the context also contributed to the choice of voice in the examined texts. For example, in presenting an argument such as explaining results, claiming generalizations, and validity of the results, a strong voice of the writer was needed. As a result, the active voice was the appropriate choice. On the other hand, when the writers intended to de-emphasize their role, they use the passive voice. For example, when presenting the limitations of the study, writers used the passive voice to save themselves from the possible blames which may arise from limitations of the study.

The results obtained from the study are useful for students studying in different disciplines and instructors who teach grammar, ESP (English for Specific Purposes) courses, and theses writing. For example, writing instructors in ESL

contexts can design materials and tasks that emphasize grammar and rhetorical trends of integrated Results and Discussion chapters of theses. Students can be given different tasks to practice how to use voices to write and organize this chapter successfully.

Disciplinary variations on these issues can be taken into consideration. Teachers can design different tasks and practices for two groups of students (those who study in hard sciences and those who study in soft sciences) in the class. This helps to make students sensitized to the conventions of rhetorical segments in their writings. Pointing to macro-and micro-features of the text ranging from rhetorical moves, tense, and voice variation in different sciences may help to develop an understanding of the written text.

Besides, the results of the study may give a pedagogic utility to ESP teachers who teach reading comprehension to develop reading materials since knowledge of the genre conventions is of relevance for assisting them. Based on the results of this study, in instructional guides on academic writing, the meanings, functions, and uses of various voices can be explained in detail. A thorough understanding of the full range of possible meanings and uses of the voices and how they can be applied to rhetorical uses in academic writing will allow the writer the greatest flexibility in the use of voice to express nuances in meanings (Taylor 2001).

Finally, the results gained from this study can help supervisors and colleagues to understand the rhetorical trends of the writers of theses and allows them to comprehend both the text and the writers' stance in the text.

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