Linguistic Variations across Disciplines: A Multidimensional Analysis of Pakistani Research Articles

Aniqa Rashid

Assistant Professor, National University of Modern Languages Faisalabad, Punjab, Pakistan. Email: anrashid@numl.edu.pk

Muhammad Asim Mahmood

Professor, Government College University Faisalabad, Punjab, Pakistan.

Abstract

The current research explores the linguistic identity of Pakistani Academic writing register of Research Articles. Previous quantitative works on Pakistani academic writing have been insufficient due to unrepresentative data and lack of internal and external comparison. This study discovers the language of Pakistani research articles as an academic writing register by investigating the statistically significant linguistic variation among the disciplines of Pakistani Research articles, using Biber's (1988) five textual dimensions. The results of the study exhibit Pakistani academic research articles language as highly impersonal, non-persuasive, explicit, non-narrative and informational.

Key Words

Pakistani English, Register Variation, Research Articles, Academic Writing, Multidimensional Analysis

Introduction

With distinct registers, Pakistani English is entitled a non-native English variety. In last two decades, many researchers worked on the linguistic features of Pakistani English (Talaat, 1988; Rashid, Arif, Mahmood, & Ghayoor, 2014) to highlight its unique characteristics but the focus of this research was isolated linguistic items. Register variation studies in Pakistan had pointed out the limitations of studies based on isolated linguistic items (Shakir, 2013; Azher & Mahmood, 2016).

Registers are based on situational characteristics and that is why they are known as situationally defined varieties. The academic language of research articles register has been the focus of previous studies (e.g. Conrad, 1996; Biber & Finegan, 2001; Gray, 2013; Egbert, 2015). These studies have utilized the multidimensional approach for analysing research article registers. Research articles on academic registers provide information on latest studies and discoveries. Many studies have been conducted on RA from genre perspectives on Swale's (1990) model. Hyland (2002) is of the view that Research Articles are the source of knowledge particularly for academic community. In the field of research writing, there is a great need of appropriate guideline to promote research writing culture in Pakistan. Through the investigation of Pakistani research articles, the awareness of communicative purpose and appropriate grammatical and lexical items may be provided to the researchers in the field of scientific writing in Pakistan.No attempt has been made to explore the features of Pakistani academic research articles in English. Therefore, the present research has attempted to explore the variation in the language of Pakistani academic research articles in English and try to explore the features of Pakistani academic English by analyzing the language of research articles. Biber (1988) has claimed that register variation studies based upon individual linguistic features & lacking internal and external comparisons instead of co-occurring features are less valuable on account of their subjectivity. The present study is based on multidimensional (MD) analysis of Research articles in Pakistani academic writing to explore the linguistic variation among Pakistani research articles disciplines as the sub-categories of Pakistani academic research articles. Based upon a representative corpus of Pakistani academic research articles, an old multidimensional analysis has been conducted. The findings of MD analyses revealed the statistically significant linguistic differences among research articles of Pakistani journals as well as among sub-categories (in the form of disciplines) of Pakistani academic research articles on Biber's 5 textual dimensions.

Literature Review

Pakistani English with its Distinct Registers

Different registers of Pakistani English have been studied by previous researchers to explore Pakistani English variety. These studies are about different Pakistani registers such as print advertisements, fiction,

newspaper reportage, newspaper editorials, book blurbs and written Pakistani English registers (Shakir 2013; Ahmed & Mahmood 2015; Mahmood & Hussain 2016; Qasim & Shakir 2016; Alvi, Mahmood & Rasool 2016).

All this research emphasized firstly the distinct characteristics of Pakistani English registers and secondly the need of analyzing the texts through a multidimensional approach, being the most appropriate one for register variations.

Multidimensional Analysis and Register Variation

The advancement in the field of computational linguistics which immensely influenced register analysis played a great role in analyzing, processing and gathering a large amount of data for researchers. Register based research (Biber & Finegan 1989; Biber & Conrad 2009; Biber 1995, Biber 2006) which dealt with the large quantity of data have been considered very prominent in this regard.

The analytical framework (multidimensional approach) proposed by Biber (2006) is quantitative and very comprehensive for register analysis.

It is inevitable to analyze the registers quantitatively in Biber's (1994) opinion. The reason is:

"register distinctions are based on differences in the relative distribution of linguistic features, which in turn reflect differences in their communicative purposes and situations" (ibid., p.35). So, register is "a cluster of associated features having a greater than-random [...] tendency to occur" (Halliday, 1988; p. 162). However, in order to determine linguistic dimensions, frequency counts are not enough. Rather, the analysis of a consistent pattern of linguistic features which co-occur in a text is necessary for identifying linguistic dimensions. The analytical framework of Biber (1994) has a different aspect as it deals with "register variation as *continuous* rather than discrete" (ibid., p.36). However, Linguistic features and their relative distribution is focused in this analysis.

A large number of data was quantitatively analyzed and initially sixty seven linguistic features (register markers) were identified by Biber (1988). (These linguistic features consist of syntactic constructions, grammatical categories and lexical classes). Later on, he had arranged these linguistic features in sixteen functional and grammatical categories (e.g., modals, lexical specificity, passives, pronouns and nominal forms). Then he had made factors by grouping these categories (with their co-occurring patterns) through factor analysis. At last, he had interpreted these factors in dimensions. These dimensions of variation were used for the comparison of different registers.

Register of Academic Writing and Related Studies

In past decades, academic writing language fascinated many linguists as academic writing is a source of knowledge transmission. Disciplinary cultures and practices may also be learned through investigation of language of academia. Gray (2015) said: "[…] academic writing is widely regarded as a register exhibiting inherent variation" (p. 1). Academic register is defined by Biber and Conrad (2009) in these words:

> […] academic prose is a very general register, characterized as written language that has been carefully produced and edited, addressed to a large number of readers who are separated in time and space from the author, and with the primary communicative purpose of presenting information about some topic (ibid., p. 32).

Many scholars worked on the language of academic writing. Groom (2005) analyzed the language of book reviews. Lewin (2005) worked on comment articles while analyzing sociology journals. Charles (2006) conducted a corpus-based research on the thesis. In another study of Conrad (1996) the textbooks' language was analyzed. Moore (2002) analyzed the textbooks and worked on three disciplines. Freddi (2005) collected and analyzed corpus of textbooks. Among these academic writing studies register of research articles is analyzed widely.

There are different multi-dimensional studies available for academic writing. Moran (2013) analyzed the language of student academic writing in the field of psychology and chemistry. Hardy and Romer (2013) analyzed papers written by students from 16 disciplines.

It is recognized widely that language of academic writing has disciplinary variation. In order to build knowledge and construct meaning, linguistic resources are utilized differently in different disciplines by different disciplinary communities. More comparative studies of various disciplines are required to provide information of disciplinary variations. Resultantly this research paper aims to highlight the pattern of variation across disciplines in Pakistani research articles.

Multidimensional Approach in Pakistani Academic Writing Researches

Multidimensional analysis was also adopted by different Pakistani researchers. Up till now these academic writing studies can be kept into account. These studies are about different Pakistani academic registers: academic dissertations and student essays (Abdulaziz, Mahmood & Azher (2016) Azher & Mahmood (2016).

In order to portray the comprehensive picture of Pakistani academic writing there is a need to study more academic writing registers. As research articles being very important register of academic writing have not yet been explored in Pakistani context. This research is an effort to bridge this gap. The focus of this research is on the narrower and more specific area of language use in academia i.e., research articles.

Methodology

The mixed methodology has been utilized for the current research. In this section, the process of corpus compilation and corpus analysis by utilizing MD approach has been described.

Pakistani Research Articles Corpus (PRAC) Compilation Process

Pakistani Research Articles Corpus (PRAC) has been compiled for the present research Thirteen hundred and twenty-nine research articles of different disciplines were selected from Pakistani journals.

Table 1. Numbers of Research Articles in Terms of Selected Disciplines for PRAC and the Assigned Codes

S. No	Sub-Categories of Pakistani Research Articles in terms of Disciplines	Codes	Research Articles
1	Humanities	H	405
2	Social Sciences	C	421
3	Sciences	S	503

The research articles were edited manually. The data was assigned code for the requirement of tagging process. After editing and coding of the research articles the word documents were transformed into notepad or text files. After the compilation of the corpus the data was sent to North Arizona University of America for multidimensional analysis.

Data Analysis

Data analysis consists of these steps: Firstly, the data has been tagged for linguistic features of Pakistani academic research articles, secondly, the linguistic features have been counted, and the counted frequencies have been normalized and standardized, dimension scores have been calculated and lastly, ANOVA has been applied to explore differences among categories of Pakistani research articles on old MD analysis. The data has been sent to Northern Arizona University, USA for complete tagging and MD analysis through Biber's Tagger.

Results

ANOVA for variation across Disciplines on Biber's 1988 Dimensions

In order to highlight the statistically significant linguistic variations among disciplines of Pakistani research articles along old multidimensions of Biber (ibid) an analysis of variance (AVONA) test has been applied in this research.

Univariate ANOVA on D1 across Disciplines

The following table exhibits the results of ANOVA on dimension-1.

ANOVA Test Result on D-1

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	112547.526[a]	204	551.704	15.768	.000	.273
Intercept	244914.518	1	244914.518	6999.970	.000	.449
Discipline	1.448	1	1.448	.041	.839	.000
Subject	28971.871	26	1114.303	31.848	.000	.088
Section	13182.279	7	1883.183	53.824	.000	.042
Discipline * Subject	.000	0	.	.	.	.000
Discipline * Section	.000	0	.	.	.	.000
Subject * Section	16431.139	150	109.541	3.131	.000	.052
Discipline * Subject * Section	.000	0	.	.	.	.000
Error	300126.550	8578	34.988			
Total	5471897.598	8783				
Corrected Total	412674.076	8782				

The following table exhibits the results of ANOVA on dimension-2.

ANOVA test Result on D-2

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	2797.914[a]	204	13.715	5.844	.000	.122
Intercept	3824.244	1	3824.244	1629.495	.000	.160
Discipline	.351	1	.351	.150	.699	.000
Subject	525.495	26	20.211	8.612	.000	.025
Section	131.172	7	18.739	7.985	.000	.006
Discipline * Subject	.000	0	.	.	.	.000
Discipline * Section	.000	0	.	.	.	.000
Subject * Section	680.360	150	4.536	1.933	.000	.033
Discipline * Subject * Section	.000	0	.	.	.	.000
Error	20131.611	8578	2.347			
Total	97762.010	8783				
Corrected Total	22929.525	8782				

The table below highlights the results of ANOVA on dimension-3.

ANOVA test Result on D-3

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	26277.154[a]	204	128.810	7.649	.000	.154
Intercept	32242.586	1	32242.586	1914.624	.000	.182
Discipline	10.204	1	10.204	.606	.436	.000
Subject	9126.801	26	351.031	20.845	.000	.059
Section	1971.880	7	281.697	16.728	.000	.013
Discipline * Subject	.000	0	.	.	.	.000
Discipline * Section	.000	0	.	.	.	.000
Subject * Section	4334.443	150	28.896	1.716	.000	.029
Discipline * Subject * Section	.000	0	.	.	.	.000
Error	144454.960	8578	16.840			
Total	776490.550	8783				
Corrected Total	170732.114	8782				

The upcoming table exhibits the results of ANOVA on dimension-4.

ANOVA test Result on D-4

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	9650.475[a]	204	47.306	6.217	.000	.129
Intercept	5739.701	1	5739.701	754.357	.000	.081
Discipline	.101	1	.101	.013	.908	.000
Subject	2110.361	26	81.168	10.668	.000	.031
Section	2796.435	7	399.491	52.504	.000	.041
Discipline * Subject	.000	0	.	.	.	.000
Discipline * Section	.000	0	.	.	.	.000
Subject * Section	1549.754	150	10.332	1.358	.003	.023
Discipline * Subject * Section	.000	0	.	.	.	.000
Error	65267.702	8578	7.609			
Total	199161.898	8783				
Corrected Total	74918.177	8782				

The table below shows the results of ANOVA on dimension-5.

ANOVA test Result on D-5

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	24109.999[a]	204	118.186	5.711	.000	.120
Intercept	10909.058	1	10909.058	527.181	.000	.058
Discipline	3.148	1	3.148	.152	.697	.000
Subject	4403.652	26	169.371	8.185	.000	.024
Section	4647.764	7	663.966	32.086	.000	.026
Discipline * Subject	.000	0	.	.	.	.000
Discipline * Section	.000	0	.	.	.	.000
Subject * Section	4836.446	150	32.243	1.558	.000	.027
Discipline * Subject * Section	.000	0	.	.	.	.000
Error	177506.050	8578	20.693			
Total	423904.380	8783				
Corrected Total	201616.049	8782				

Discussion on Disciplinary variation in Pakistani Research articles on five Dimensions of Biber's 1988 study

This section describes how the disciplines of Sciences, humanities and social sciences of Pakistani Academic Research articles vary linguistically along textual dimensions introduced by Biber (ibid. 1988).

Disciplinary variation in Pakistani Research articles on 1st Dimension

On 1st dimension the analysis reveals Pakistani research articles as well integrated and very informational. Sciences are the most informational discipline. Humanities have been found more involved and interactive.
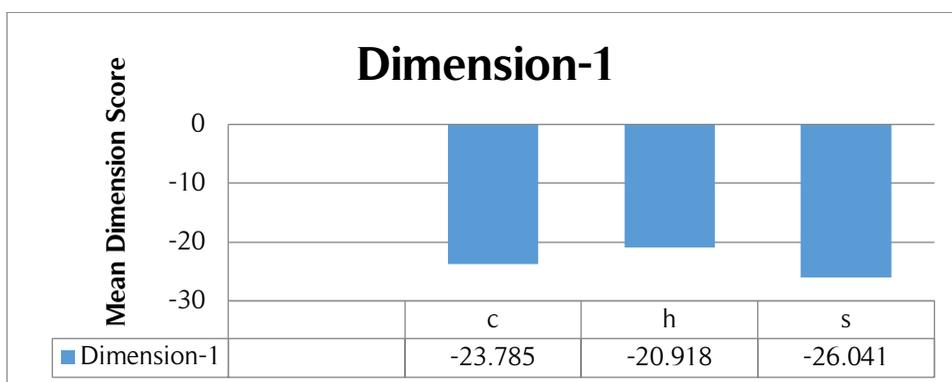
Figure 1: Comparison of Disciplines of Pakistani Research Articles on 1st Dimension

These variations among disciplines are due to the nature of various subjects in all these three disciplines. Science disciplines focus on more informational and technical discourse. Social sciences scientifically focus on social issues and so have been found less involved and more informational than Humanities. While the focus of Humanities is on human behaviours, it tends to be more involved than other disciplines. Further, variations are found as these three disciplines address various kinds of readers. Sciences address the particular readers who have scientific knowledge and technical vocabulary related to scientific field. Social sciences and Humanities address the needs of general readers in comparison with Sciences. The results have been found similar to the study of BAWE corpus by Gardener, Nesi & Biber (2015) on first dimension. Following figure exhibits comparison of informational features in disciplines in terms of linguistic features on first dimension found in Pakistani research articles. The features like attributive adjectives, prepositions and nouns are the markers of informational stance.
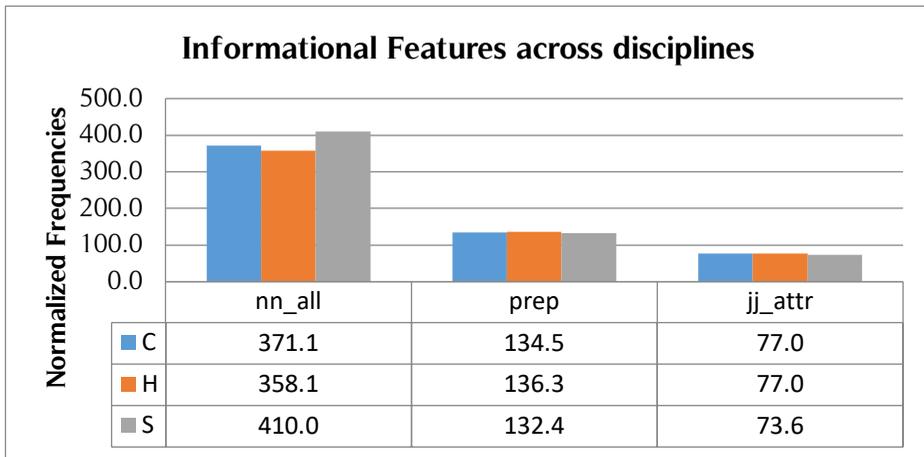
Figure 2. Comparison of Informational Features across Disciplines of Pakistani Research Articles

The resulting mean scores indicate that *prepositions* have highest frequency in Humanities disciplines. The ratio of *nouns* is higher in Sciences disciplines. On the other hand, *attributive adjectives* have been found with similar package in Humanities and Social Sciences disciplines. All these linguistic features contribute to make Pakistani research articles as informational.

The example below highlights the informational production in Sciences disciplines.

Example

At the end of the experiment, randomly the liver of three rabbits from each treatment (irrespective of gender) was removed and rinsed with normal saline and dried using lint free paper towel. (ANI.002.0.S)

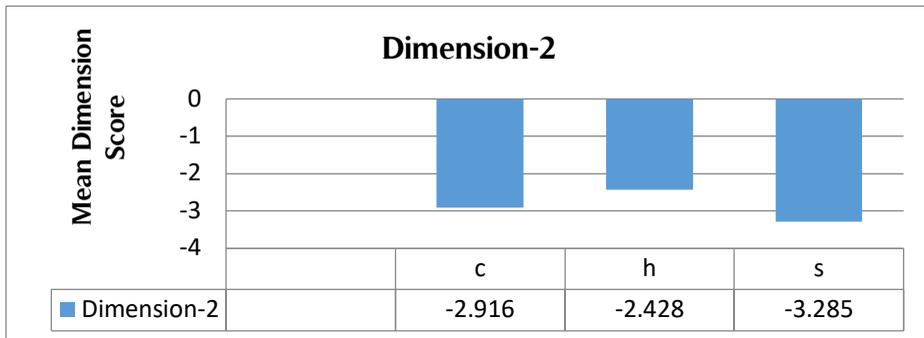**Disciplinary variation in Pakistani Research articles on 2nd Dimension**

Figure 3. Comparison of Disciplines of Pakistani Research Articles on 2nd Dimension

The figure 5.1.1.2 compares the mean values of disciplines of Pakistani research articles on dimension-2 of Biber's 1988 work. The result of mean dimension score declares the disciplines of Pakistani research articles as highly non-narrative. The disciplines of Sciences have been found the most non-narrative among all. Social Sciences disciplines have more non-narrative features than humanities while less non-narrative features than Sciences. The least non-narrative disciplines among all are that of humanities. On the other hand, Humanities is more narrative as compared with other disciplines. Sciences tend to be less narrative but more as compared with Social sciences and Humanities. This research in this regard is similar to the research of BAWE corpus of Gardner et al. (2015).

The present verb is non-narrative marker which has been found in abundance in scientific research articles. The following paragraph shows non-narrative production in Pakistani research articles corpus.

Example

Curcumin is a lipophilic molecule and does not appear to be toxic even at high doses. It has been used extensively in ancient medicinal system. Curcumin possesses biological actions. Curcumin also provides protection. (BIO.001.0.S).

There lie situational differences due to different nature of disciplines of Pakistani research articles corpus. Sciences have been found least narrative as the Sciences disciplines are more concerned with depiction of materials and objects. The inclination of Sciences is towards expository and descriptive discourse. Humanities deal with behavioural as well as historical issues and tend to focus on event-oriented discourse so, have been found a bit narrative as compared to other disciplines.

Disciplinary variation in Pakistani Research articles on 3rd Dimension

The mean score shows Pakistani research articles disciplines are highly elaborated and explicit in nature.

Dimension-3	c	h	s
Dimension-3	8.427	9.407	7.129
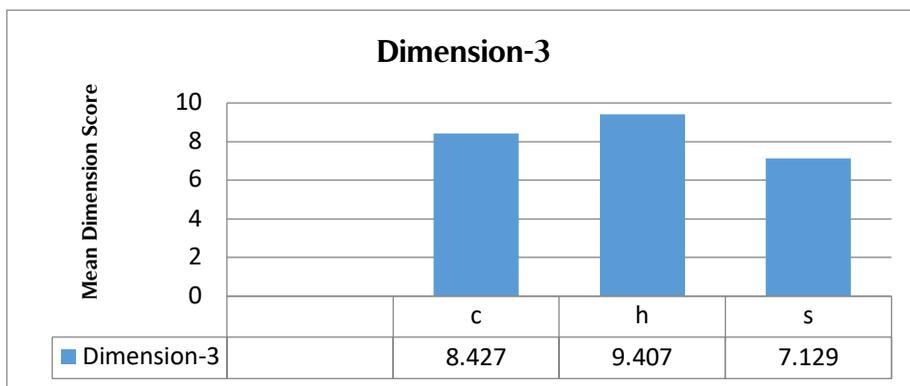
Figure 4. Comparison of Disciplines of Pakistani Research Articles on 3rd Dimension

All three disciplines show different trends on this dimension due to the differences found in the subjects related to all disciplines. The humanities have been found the most interpretive, detailed and explicit in all. Humanities and Social Sciences discipline have been found more elaborated due to the focus of both on issues related to human behavior and society. Whereas, Sciences are least elaborated and explicit among all disciplines due to their tendency towards providing exact information of materials and objects.

	wh_rel_subj	nn_nom
C	2.9	95.2
H	3.8	90.0
S	2.2	80.7
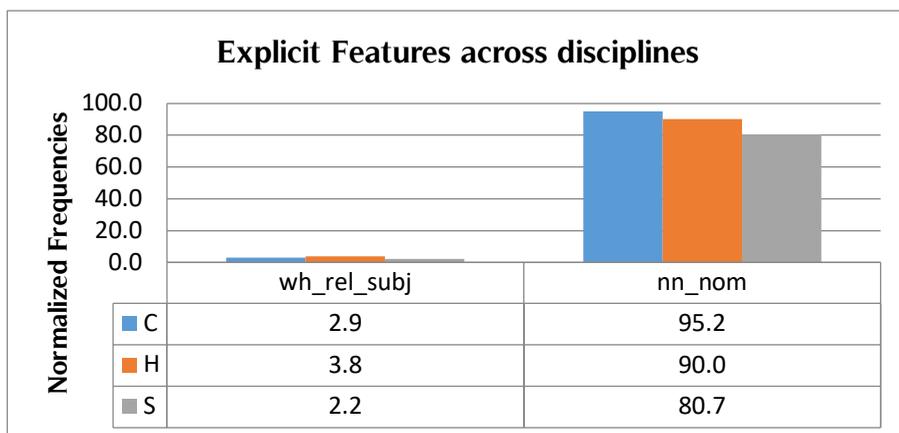
Figure 5. Comparison of Explicit features across different disciplines of Pakistani Research Articles

The existence of *Wh relative* clauses and *nominalizations* in different disciplines of Pakistani research articles exhibit the explicit nature of this register. There is more usage of *nominalizations* as compared to *WH clauses* in Pakistani research articles. The following example shows the production of elaborated and explicit discourse in Humanities discipline in Pakistani research articles corpus.

Example

The writers instead of giving suggestion rely on the request mode. One category leaves the decisions to super natural powers which can be considered as arguments. Move 6 which include his name and address. This move identifies who has written the letter and where from it has been sent. (ENG.001.0.H)

The results on this dimension are similar to Gardner et al. as both studies depict Science disciplines as least explicit and elaborated in all disciplines, but a slight difference may be observed with regard to other two disciplines. In Gardner et al. (2015), study of BAWE corpus Social Sciences are the most elaborated disciplines while in this research of PRAC corpus the most elaborated disciplines are that of Humanities.

Disciplinary variation in Pakistani Research articles on 4ᵗʰ Dimension

The mean dimension scores describe all disciplines of Pakistani research articles as non-persuasive along dimension-4. All three disciplines vary in terms of the degree of persuasiveness. The results depict Sciences disciplines as the most non-persuasive in all and humanities as least non-persuasive in contrast to Gardner et al. (2015) research

	c	h	s
Dimension-4	-3.642	-3.213	-4.242
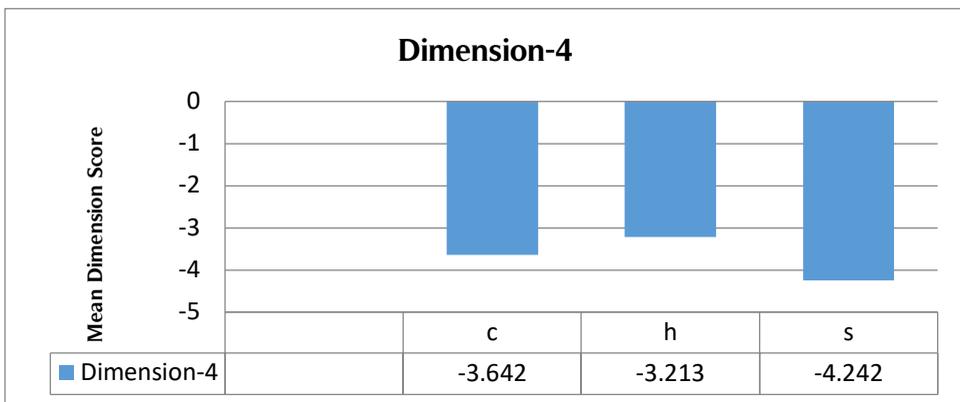
Figure 6. Comparison of Disciplines of Pakistani Research Articles on 4ᵗʰ Dimension Disciplinary variation in Pakistani Research articles on 5ᵗʰ Dimension

The mean dimension score shows Pakistani research articles as very impersonal in terms of disciplines on dimension-5 of Biber's 1988 research. Being associated with human events and social issues Humanities and Social Sciences are less impersonal while more interactive and detailed. Whereas, Sciences due to the inclination towards presenting the exact knowledge are more impersonal in all.


	c	h	s
Dimension-5	4.694	4.117	6.048
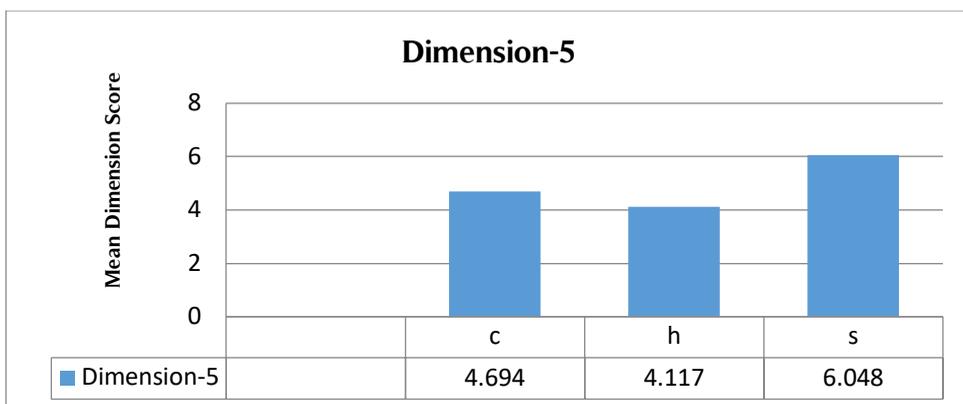
Figure 7. Comparison of Disciplines of Pakistani Research Articles on 5ᵗʰ Dimension

The following example highlights impersonal features like passives and conjunctions.

Example

This study was conducted at the department of Pathology and the blood bank. All blood donors with no health problems and without history of HBV or HCV infection were included in the study were also included. (MSC.002.0.S)

The figure below exhibits the mean values of detached linguistic features. The resulting scores indicate Pakistani research articles are highly impersonal.
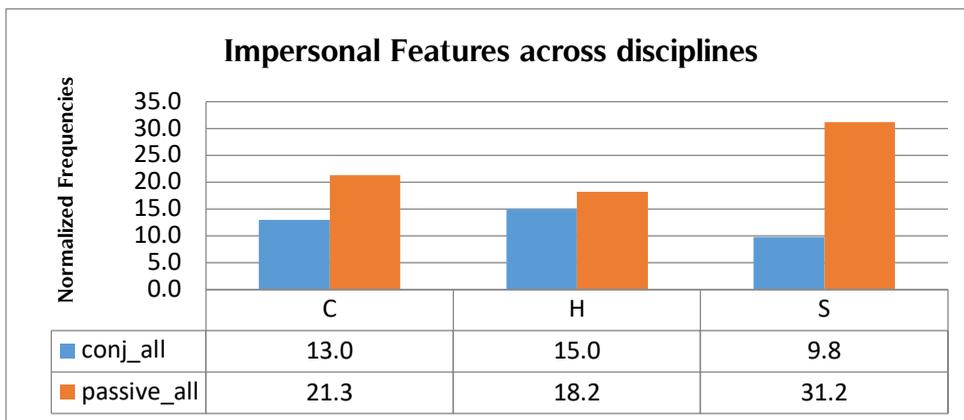

Figure 8. Comparison of Impersonal features across different disciplines of Pakistani Research Articles

Passives have been found with highest score in sciences disciplines. Humanities have the lowest mean score of *passives* which indicate this discipline as the least impersonal in all. The frequency of *conjunctions* is more in humanities that indicates the presence of cohesion in Humanities.

Disciplinary Variation in Pakistani Research articles on 1988 Textual Dimensions; an Overview

Following figure shows multiple relationships among three disciplines; Humanities, Social Sciences and Sciences of Pakistani research articles on 1988 textual dimensions. The analysis exhibits Pakistani research articles disciplines on Biber's textual dimension as very informational, impersonal, non-persuasive, explicit and non-narrative.
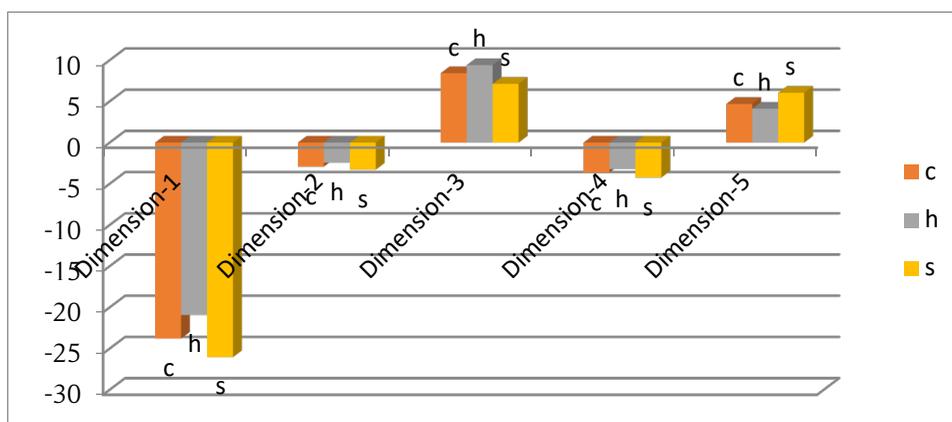
Figure 9. Comparison of three Disciplines of Pakistani Research Articles on 1988 Dimensions

Nevertheless, the comparison of Pakistani research articles disciplines reveals no statistical significant differences as collectively all show same trends but differences lie on each dimension individually. Thence, among all disciplines the Sciences disciplines in Pakistani research articles corpus are the most impersonal, non-persuasive, non-narrative and informational while least elaborated in nature. The disciplines of Social Sciences are more impersonal, non-persuasive, non-narrative and informational than Humanities but less than Sciences. On the other hand, Social Sciences have been

found more elaborated than Sciences but less than Humanities. The Humanities disciplines have been found least informational, impersonal, non-persuasive, and non-narrative while most elaborated in all disciplines.

Conclusion

Above discussion on different disciplines of Pakistani research articles show interesting results in degrees of variations depending on the nature of respective disciplines. Disciplines of Humanities are least informational, impersonal, non-persuasive, and non-narrative while most elaborated. Disciplines of Social Sciences are more impersonal, non-persuasive, non-narrative and informational than Humanities but less than Sciences. Disciplines of Sciences are highly impersonal, non-persuasive, non-narrative and informational while least elaborated. As a whole, study of disciplines of Pakistani research articles on Biber's 1988 textual dimensions reveals that Pakistani academic research articles are highly informational, abstract/impersonal, non-persuasive, non-narrative and explicit in nature. The results indicate that Pakistani research articles register is a combination of clear, objective and expository information.

The particular research is the pioneering research study for exploring the register variation in research articles as academic writing register. The results have indicated Pakistani academic research articles language as impersonal/abstract, non-persuasive, non-narrative, explicit and informational in nature. It is helpful for syllabus designers, teachers and researchers.

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