LINGUISTIC VARIATION ACROSS DISCIPLINES IN PAKISTANI ACADEMIC WRITING: A MULTIDIMENSIONAL ANALYSIS

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Abstract

Pakistani English being an indigenous variety has its distinctive registers, which exhibit variation at different levels of language. Pakistani academic writing as a register is an area that needs to be probed into for exploring its internal as well as external variation. Biber (1988) proposed multidimensional analysis as the most suitable approach for register variation studies and stressed the importance of co-occurring linguistic features. Based on the multidimensional analysis of Biber's 1988 study, the present research strives to identify co-occurring linguistic features that account for the cross disciplinary variation in Pakistani academic writing. For this purpose, the study relies on 235 research dissertations of M.Phil and PhD graduates representing three major disciplines (Humanities, Social Sciences and Sciences) as a sample of Pakistani academic writing. The data was analyzed through the process of tagging of linguistic features, frequency counts, standardization and calculation of dimension scores and ANOVA. The findings reveal no statistically significant differences among disciplines on Biber's five dimensions and that all the three disciplines are highly informational, non-narrative, explicit, non-persuasive and impersonal in the production of Pakistani academic discourse.

Key Words: Pakistani English, Disciplinary Variation, Academic Writing, Multidimensional Analysis

Introduction

With the concept of language variation, it has become utmost important to analyze linguistic patterns across register. A register is regarded a situationally defined variety of language and is characterized by particular situation, topic and purpose. Biber et al. (1999), Biber (2006), and Biber & Conrad (2009) consider academic prose "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" (Biber & Conrad 2009,32). Academic writing in the present context may refer to the written discourse of a community existing within a specific discipline. Academic writing like many other registers of Pakistani English needs to be fully described in terms of linguistic characteristics to develop appropriate teaching materials and methods. So far, no register-based study has been done on co-occurring linguistic features of Pakistani academic writing as a register. Therefore, the present research strives to explore linguistic variation across disciplines of Pakistani academic writing as a register.

The most important condition, which is indispensable for any register study, is the idea of co-occurrence of linguistic features. Co-occurrence of linguistic features refers to the clusters of associated features having a tendency to occur together in a particular register. Biber practically

operationalized the concept of sets of co-occurring features in his 1988 multidimensional analysis. The multidimensional analysis is based on the identification of the sets of co-occurring linguistic features through statistical factor analysis and then interpretation of these sets of co-occurring features as dimensions on the basis of their shared communicative functions. Biber (1988) proposes Multidimensional approach to be the most suitable one for register variation studies as it is corpus based, quantitative, empirical and comparative in nature.

This is quite important to explore the distinctive clusters of co-occurring Lexico-grammatical features of different disciplines and to explore Pakistani academic writing as a register. The present research is based on the corpus of 235 M. Phil and PhD dissertations from different universities all over Pakistan. The dissertations represent three major disciplines: Humanities, Social Sciences and Sciences, each discipline embodying a wide array of subjects. The use of Multidimensional analysis will increase our understanding of distinct patterns of co-occurring linguistic features of different disciplines, which are recognized as categories for the present research. The research is limited in scope and nature as it relies on research dissertations as a genre of academic writing.

 By employing Multidimensional, analysis the present study aims to describe linguistic patterns across academic disciplines and to further explain these patterns in their functional aspects and describe association between the linguistic patterns and situational features of disciplinary texts. The present research seeks to answer the following research question.

Q. How far is the language of Pakistani academic writing different across disciplines on five textual dimensions of Biber's 1988 study?

Literature Review

Register-Based Studies on Pakistani English

Pakistani English in the early phase of its recognition has been mainly studied with reference to individual lexical, grammatical and phonological features. (E.g. Baumgardner, 1993, 1998; Rahman, 1990b; Talaat, 1993; Rahman, 1991; Talaat, 2002; Y. Kachru and Nelson, 2006). These studies do not provide functional interpretation of linguistic variation, which is a distinct feature of register-based studies. Recently the focus has been shifted to register variation-based studies to further strengthen the independent identity of Pakistani English. So far, three register variation studies based on multidimensional analysis have been conducted on Pakistani English. These studies include: linguistic variation across advertisement in print media (Shakir, 2013); linguistic variation across press reportage of Pakistani print media (Ahmed & Mehmood, 2015); linguistic variation across research sections of Pakistani academic writing (Azher & Mahmood 2016); exploring New Discourses of Pakistani Academic Writing: A Multidimensional Analysis and (Azher & Mahmood 2016); Comparing Linguistic Features of Academic Discourse in Pakistani and British English (Azher & Mahmood 2018). All these studies employ multidimensional analysis to explore internal as well external variation in different registers of Pakistani English. They stress the need for further register-based studies on Pakistani English by disregarding the previous studies, which relied on the frequency of individual linguistic features.

The present study therefore aims to explore disciplinary variation across Pakistani academic writing as a register.

The Importance of Disciplinary Variation in Academic Writing

Many researchers and linguists recognize the importance of disciplinary variation in academic discourse. Therefore, many researchers have emphasized the need to explore academic writing across disciplines in terms of linguistic variation. McCarthy (1987) describes a student as feeling like 'a stranger in strange lands' as he moves from discipline, and that the students' success at the university rest considerably on his ability to determine implicit assumptions about what is appropriate writing for each class.

Approaches to Studies on Disciplinary Variation in Academic Writing

Studies on disciplinary variations in academic writing as a register have been mainly conducted from multiple approaches so far. Four of them are being discussed here. In the first approach, the researchers have focused on a single discipline and go for intra disciplinary linguistic variation within single academic register, and analyzing lexical, rhetorical and grammatical devices (e.g. Afros and Schryer, 2009; Hyland, 1996; and Warchal, 2010).

The second approach, which is most often adopted, has considered three, four, or more disciplines while comparing the frequencies and functions of linguistic features across disciplines within the parameters of a single register (e.g. Harwood, 2005b; Peacock, 2006; Hyland and Tse, 2007). The present research also conforms to the trends of this approach. Lovejoy (1991) studied linguistic variation across three major disciplines of biology, history, and psychology and investigated the use of cohesive devices in academic written discourse. He found that the biology text makes more use of repetition because science repeats technical terms and its spotlight is a narrower topic as compared to other disciplines. Macdonald (1992, 1994) worked on the types of grammatical subjects used in the research articles of three disciplines: psychology, history and literary criticism. Her studies endorse the claim that patterns of language vary across disciplines features and the variation is due to epistemological backgrounds of the disciplines. Gray, B (2011) in her PhD thesis on academic writing analysed linguistic variation across 270 research articles through multidimensional analysis. The articles were taken from six diverse disciplines: philosophy, history, political science, applied linguistics, physics and biology. The articles are also grouped as theoretical, quantitative and qualitative research reports. This corpus-based study reveals that variation occurs along multiple parameters along with differences in disciplinary writings.

The third approach has been to multiple text categories across multiple disciplines. Most of the research on disciplinary variation has been conducted from this perspective. Conrad (1996) investigated language variation in academic discourse across two diverse disciplines: biology and history (represented by ecology and American history). She developed a corpus both of the

professional texts, which students use to study during their academic career as well as students' writing (including original research papers and synthesis papers). The key areas of her study are variation across disciplines, variation across levels of textbooks, similarities between academic and non-academic registers of English, and differences between research articles and textbooks within each discipline. Some important patterns were revealed in disciplinary writing in the use of features of narration, over-argumentation, and impersonal style. The results show that there exists a complex relationship among the text categories. Katherine E Moran (2011) investigated the linguistic patterns of undergraduate students' writings in the subjects of chemistry and psychology. The multidimensional analysis of the corpus and interviews with the faculty and students revealed a mismatch between the expectations of instructors in each discipline and students' understanding of such writing expectations. The linguistic analysis of course readings and student writing demonstrated differences in language use both between registers and across disciplines. Jesse Egbert (2015) describes the linguistic variation across three publication types (journal articles, university textbooks, and popular academic books) in two disciplines (biology and history). The study is both quantitative and qualitative in nature based upon Multidimensional analysis, series of ANOVA and Post Hoc test as well as qualitative interpretations. Gardner et al. (2008) investigated linguistic variation in British higher education students' writing across disciplines and levels along with Biber 88 MD analysis particularly with reference to genre families. The corpus of British Academic Written English (BAWE) contained 2,761 students' assignments from 35 disciplines and 4 levels of study. The grouped disciplines include Arts and Humanities, Social sciences, Life Sciences, and physical sciences. The results show that 'the overwhelming majority of Arts and Humanities texts and slightly more than half the Social Sciences texts belong in the 'essay' genre family, while texts from the Life Sciences and particularly the Physical Sciences are more evenly spread across a wider range of genres.'

The fourth approach addresses historical perspective. Recent diachronic studies have shown that science writing has adopted this dense nominal style largely than social science or humanities writing over the past 100 years (Biber and Gray, 2013). This finding supports the premise that disciplinary variation in the use of core grammatical features exists, although this line of research has generally not been concerned with disciplinary variation.

All these studies indicate that interpretations are related to the differing nature of disciplines while considering academic writing extending to textbook, articles, students' writings etc. The studies in disciplinary variation have become increasingly relevant as more and more specificity is required in disciplinary writings. Students have to write in manners that conform to the nature and formalities of discipline. The table given below summarizes the different approaches to studies on academic writing as a register.

Table. 1. Summary of the Approaches to Academic Writing as a Register

Approach	Author/ year	Discipline	Major works	Register

Single discipline and single register	Afros and Schryer, 2009	Language	Rhetorical devices	research articles
	Hyland, 1998, 2004	Biology	Modals	Research articles
	Vassileva 2001	Linguistics	Hedging	Research articles
Multiple disciplines within a single register	Harwood, 2005b	Multiple Disciplines	Pronouns	Research articles
	Hyland 2002 c	Multiple Disciplines	Verbs	Research articles
	Hyland and Tse 2005	Multiple Disciplines	Evaluative that	Abstract
	Gray 2010	Education and sociology	Demonstrative	Research articles
	Gray 2013	Multiple Disciplines	MD analysis	Research articles
	Cortes 2004	History and Biology	Lexical bundles	Research articles
	Silver 2003	History and Economics	adverbials	Research articles
Multiple academic registers within multiple disciplines	Groom 2005	History, literary Criticism	Grammatical patterns	Research article, book review
	Bloch 2010	Biology and Engineering	Reporting verbs	Critical review , research proposals

	Conrad, 1996	Biology and History	MD Analysis	Text books, articles
	Diani, 2008	Linguistics, history, economics	MD Analysis	Research articles, book review article
	Hardy &. Römer 2013	Multiple Disiplines	MD analysis	response papers, reports and critiques
	Moran,K 2013	psychology and chemistry	Md analysis	Course readings and students, writings
	Jesse E, 2015	biology and history	Md analysis	Multiple registers
Historical approach	Biber gray 2013	Scientific Writing	MD Analysis	Historical changes in verbs across registers
	Biber et al	Personal letters, newspaper reportage, science articles	Variationist and Text analysis perspective	Historical changes in Nominal Modifiers

Multi-Dimensional Analysis and its Suitability for the Present Research

Biber (1988) presented Multidimensional analysis for register variation studies in his influential work '*Variation across Speech and Writing*' in which he compared 23 spoken and written registers based on the co-occurrence patterns of prominent linguistic features in an empirical way. Multidimensional analysis uses the methodological tools of corpus linguistics. By using computational techniques, it is possible to analyze the linguistic patterns found in a large corpus

of texts. Such analyses include a comprehensive linguistic characterization of each text, based on a wide range of linguistic features.

The primary goal of multidimensional analysis is to focus on the linguistic analysis of texts and text types and it undermines the analysis of individual linguistic features. It turns out, though, that the relative distribution of common linguistic features, considered individually, cannot reliably distinguish among registers. On the basis of this idea, MD approach focuses the fact that sets of co-occurring features work together towards getting a shared a communicative goal. These are marked in MD analysis as dimensions.

Moreover, the approach being explicitly multi-dimensional assumes that multiple parameters of variation will be operative in any discourse domain. Biber (1988) made it clear that no single dimension can differentiate between spoken and written form of texts. Biber (1988) also made clear that textual dimensions in multi-dimensional studies are investigated through the process of factor analysis. "Factor analysis enables quantitative identification of underlying dimensions within set of texts. Factor analysis provides primary analysis, but it is dependent on the theoretical foundation provided by an adequate data base of texts and inclusion of multiple linguistic features" (Biber 1988, p. 65). Dimensions are identified and labeled on the basis of the functional interpretation of sets of co-occurring linguistic features with significant frequencies in texts.

Multi-dimensional approach of register variation synthesizes quantitative and qualitative functional methodological techniques. Quantitative techniques are not sufficient in themselves for MD analyses of register variation. Quantitative analysis is concerned with the linguistic content of a dimension comprising a group of linguistic features to explain the quantitative linguistic patterns in functional terms, whereas qualitative analysis is required for the interpretation of functional bases underlying each group of linguistic features.

It must be mentioned here that there are two versions of MD analysis. The first kind of MD refers to Biber'1988 study based on the five textual dimensions explored on the basis of the co-occurring linguistic features of 23 written and spoken registers. New MD refers to a new statistical factor analysis on a particular corpus to identify new dimensions. Many studies have been conducted on both old and new MD analyses with reference to academic writing. The present study subscribes to old MD analysis.

The five textual dimensions explored in Biber (1988) study are discussed as under.

D1. Involved versus Informational Discourse

The first dimension represents a continuum along which registers may differ, is called Involved vs. Informational Production, by which high frequencies of occurrence of first- and second-person pronouns, Wh-questions, amplifiers are interpreted as an indication of inter-personal interaction, i.e., a higher involved text production. Contrastively, high frequencies of nouns, prepositional phrases, type/token ratio, and attributive adjectives indicate a more informational focus in the text production.

D2. Narrative versus Non-Narrative Concerns

The second dimension is labeled as Narrative vs Non-narrative Discourse. Linguistic features contributing to the positive characterization of narrative registers are past tense verbs, third-person pronouns, synthetic negation, and present participial clauses, among others. Non-narrative registers have lower frequency of occurrence of such linguistic features.

D3. Explicit versus Situation-Dependent Discourse

The third dimension is called 'Elaborated vs. Situation-dependent Reference. Linguistic features, contributing to a more elaborated discourse, are, for instance, nominalizations, Wh-relative clauses, which are highly frequent in, e.g., academic discourse. Time and place adverbials and adverbs with high frequency of occurrence indicate a more situation-dependent register.

D4. Overt Expression of Persuasion/Argumentation

Fourth dimension is named as Overt Expression of Persuasion / Argumentation. Features contributing to a higher expression of persuasion / argumentation are modals, suasive verbs and infinitives, among others. These occur highly in registers such as professional letters and editorials.

D5. Abstract versus Non-Abstract Information

The fifth dimension is Abstract vs. Non-abstract Style. Similarly, to dimensions 2 and 4, it has only positive loadings, e.g., conjuncts, passives, adverbial subordinators, etc. While academic discourse and social documents show a high frequency of these features, conversation and c-tion show practically the absence of them.

The present research on disciplinary variation across Pakistani academic writing subscribes to multidimensional approach as the most appropriate methodology for conducting register based study. Multidimensional analysis provides a framework for comprehensive description of register variation particularly by addressing the co-occurring linguistic features, which is the most important feature in doing register analysis.

Research Methodology

The Process of Corpus Compilation and Multi-Dimensional Analysis

The first step in building a representative Corpus of Pakistani Academic Writing was to select disciplines that may represent a wide range of academic areas. Three major disciplines, Humanities, Sciences and Social Sciences due to their importance in academics were then selected to study. The major factors in the selection were to include disciplines from a wide range of academic areas as to be representative of Pakistani Academic Writing, as well as relate findings with previous studies on disciplinary variation in academic writing. The following table describes the categories of Pakistani Academic writing to be studied in the present research.

Table.2 Disciplines as Sub-Categories of Pakistani academic writing

S/No	Disciplines as Sub-Categories of Pakistani Academic Writing	Array of Subjects Represented by Disciplines
1	Humanities	English Language and Literature, Mass Communication, History, Fine Arts, Gender Studies
2	Social Sciences	Education, Sociology, Psychology, Social work, Economics
3	Sciences	Botany, chemistry, Earth Sciences, Zoology, Pharmacy

The three disciplines are different in nature and oriented towards different goals. Pure sciences and Social sciences are oriented toward empirical research, whereas humanities are directed towards interpretative research. Sciences commonly rely on quantitative design, whereas, humanities and social sciences may rely on both quantitative and qualitative research design. Social sciences are considered to generate knowledge for scientific purposes to explain human behaviour. Humanities include cultural anthropology and ethnography, often history, languages and linguistics, literature, and philosophy, mass communication studies, etc. Humanities employ interpretative methodology focusing on text analysis, and reflective thinking that distinguish them from social sciences and sciences that employ empirical, rational, objective and quantitative methodology.

It may be clarified that disciplines in broader sense are "disciplinary groups' having multiple subjects. The three disciplines represent 15 different subjects to be widely representative of the situational characteristics of Pakistani academic writing. However, this study does not focus on the variation across different subjects in terms of the linguistic features and their functional interpretations. The same tradition of disciplinary grouping has been found in the compilation of BAWE (British Academic Written English), BASE (British Academic Spoken English) and MICASE (Michigan Corpus of Spoken English).

Collection of Data

Collection of data was the very first step in the process of corpus compilation. The information was collected about the universities, where the selected disciplines (Humanities, Social Sciences, and Sciences) were being offered. 235 research dissertations of M.Phil. and PhD graduates were collected from multiple universities of Pakistan. These 235 theses represented multiple subjects within three selected disciplines or 'disciplinary groups' in the words of Gardner, S (2007). Humanities and Social Sciences were represented by 80 theses each, whereas Sciences were

represented by 75 due to less availability of theses in the selected subjects and as per convenient sampling.

Transferring Data into Machine Readable Form and selecting Sample

After the collection of these, they had to be shaped as a corpus of Pakistani academic writing. All the theses were converted into text format to make them machine-readable and develop corpus of Pakistani Academic Writing. The subsequent step was to choose sample according to the proposed research objective. The major objective of the present research was to investigate linguistic variation across disciplines of Pakistani academic writing. All the text files were arranged discipline wise and were duly coded.

 Finally, the corpus of 8.38 million words was developed to

Table: Description of Corpus in Terms of words

Sr. #	Discipline	No of words
1	Humanities	3,852,622
2	Social Sciences	2,663,503
3	Sciences	1,868,875
4	**Total**	**8,385,000**

Data Analysis

The data analysis in the present research has gone through the following steps discussed in detail as under.

Tagging of the Corpus

The corpus of Pakistani academic writing was tagged by employing Biber's tagger. COPAW was tagged for all the linguistic features used in 88 MD Analysis on five textual dimensions. The list of linguistic features relevant in 1988 study is given in (Appendix I).

Computing Raw Counts of Linguistic Features and converting into Normalized Frequencies

Biber's tag count program was used for the raw counts of the frequencies of different linguistic features and normalized frequencies. The raw frequencies of linguistic features were obtained from all texts (235 and computed out of 1000 words. This normalization was highly essential for comparison of frequency counts across texts due to variation in the length of texts. This normalization was highly essential for comparison of frequency counts across texts due to variation in the length of texts. This standard was set by Biber in his 1988 study on the basis of the formula: actual frequency divided by total number of words, multiplied by 1000. After the frequencies are counted, they further undergo into the process of standardization.

Calculating Dimension Scores

The dimension score of each text of Pakistani academic writing was calculated by subtracting the standardized scores of negative features from the sum of standardized scores of positive features. The dimensions with no negative features include only sum of positive scores of linguistic features. In this way, dimension score of each text in 1988 MD analysis of Pakistani academic writing was calculated.

Analysis of Variance

ANOVA was applied between Dimension $\times$ disciplines to find out the statistically significant differences among different disciplines of Pakistani academic writing.

Results

Table 3: Analysis of variance table for variation among disciplines on five textual dimensions of 1988 MD analysis

| Dimension	Categories		
	Humanities	Social Sciences	Sciences
D1	-19.01±0.34E	-22.56±0.39E	-26.65±0.26E
D2	-2.76±0.09C	-2.81±0.08C	-3.59±0.07C
D3	8.17±0.18A	8.52±0.20A	6.34±0.15A
D4	-3.60±0.11D	-3.54±0.10D	-5.21±0.06D

| D5 | 3.29±0.17B | 3.21±0.15B | 4.34±0.21B |

Means sharing similar letter in a row or in a column are statistically non-significant (P>0.05). Small letters represent comparison among interaction means and capital letters are used for overall mean.

Discussion

Below is given the discussion on linguistic variation among Humanities, Social Sciences and Sciences of Pakistani academic writing on Biber's 1988 5 textual dimensions on the basis of the ANOVA results.
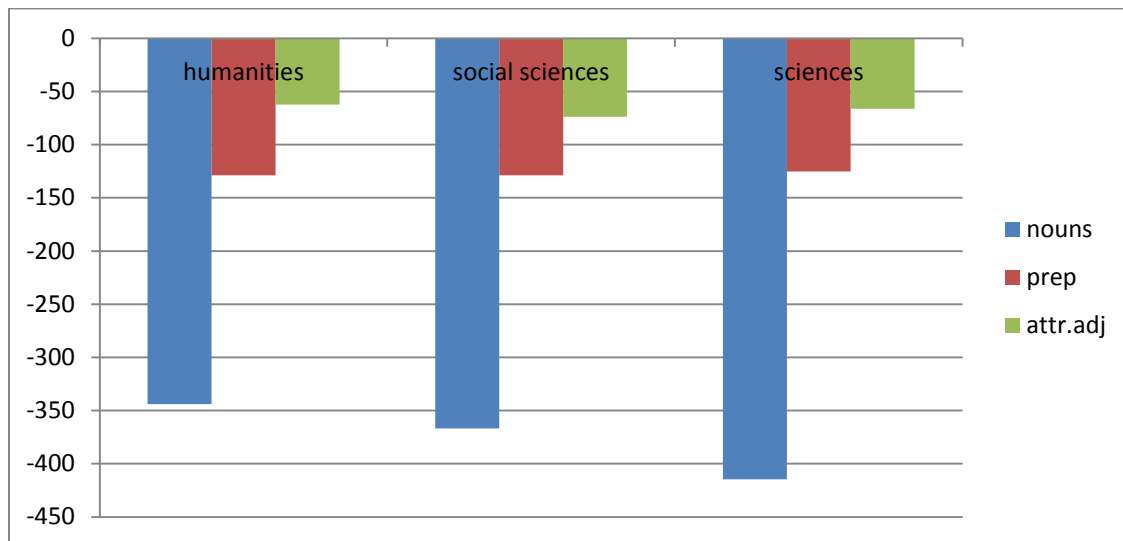
Variation among Disciplines on D1

Variation among disciplines on D1 reveals that all the disciplines in Pakistani academic writing have negative features along D1 and are highly informational and integrated. The ANOVA results on comparison of the mean dimension scores of three academic disciplines indicate that there lies no statistically significant variation among disciplines on D1. The figure given below compares Humanities, Social Sciences and Sciences as disciplines of Pakistani academic writing on Biber's D1 of 1988 study.
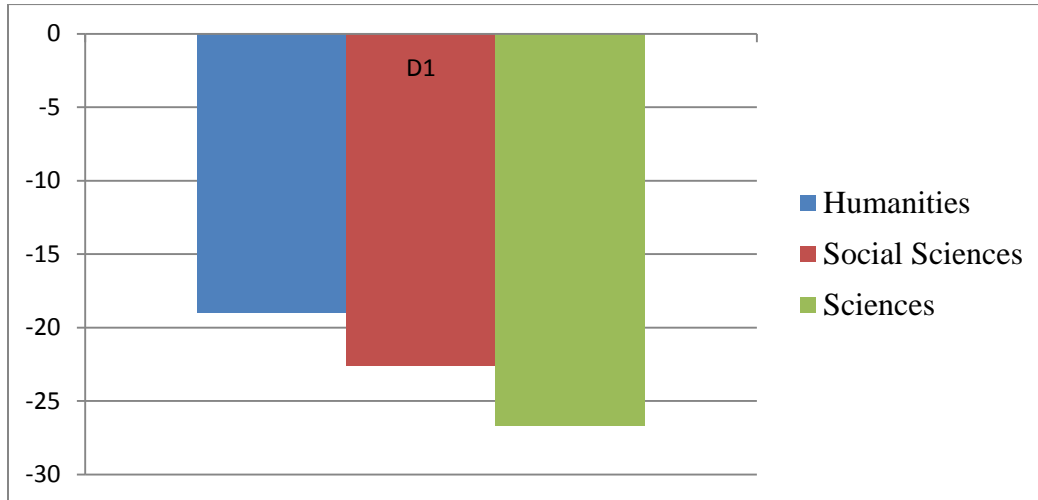
Figure 1a Comparison among Disciplines on D1

Figure 1a compares three disciplines on D1 and reveals that Sciences with the highest mean score of -26.65 have been found the most informational and least interactive among all disciplines. Humanities with the mean score of -19.01 have been found least informational when compared with Sciences and Social Sciences. Social Sciences stand in the middle with the mean score of -22.56. Alternatively, speaking Humanities contain more features of interactive and involved discourse as compared to sciences and social sciences and tend to be less informational.

The variation among disciplines can be further explored through the analysis of the linguistic features of informational discourse. The linguistic features on the negative pole contributing this dimension include nouns, prepositions and attributive adjectives. The density of these linguistic features across disciplines is exhibited in the figure 1b below.

Figure 1b Features of informational Discourse among Disciplines on Biber's D1

Figure 1b exhibits the density of informational linguistic features across three disciplines and reveals that nouns (-414.6147) are exceedingly frequent in Sciences which shows the reliance of Sciences on the description of objects and entities in giving highly informational discourse. Prepositions (-128.9913) are found at the highest frequency rate in Humanities, and add into clarity of informational stance of this discipline. Attributive Adjectives (-73.93875) provide elaboration in informational discourse in Social Sciences more than any other discipline.

The following example from sciences exhibits the density of informational linguistic features in sciences.

Example: 1

'In Pakistan, the public sector food handling agencies facing grain storage management problems due to the lack of covered space in go down. As per government policy to procure every offered grain, the surplus wheat was supposed to procure by food handling agencies without the consideration of available storage space. The public sector procured about 9 million tons of wheat against the rated storage capacity of 4.2 million tons. (Text 230, S)

The example reveals the highly informational stance of Pakistani academic writing packed with the density of nouns, attributive adjectives and prepositions. The situational analysis reveals that the differences among disciplines on D1 can be related to the nature of subjects these disciplines

deal with and different types of readers for each discipline. Sciences deal with more technical and informational discourse and need not to be elaborative in nature as compared to Humanities and Social Sciences. Humanities, on the other hand have been found least informational and more involved and interactive with the reader as compared to other two disciplines because they deal with subjects like history, mass communication, gender studies and literature, which focus on human behaviour and events. Social Sciences include subjects like economics, psychology, education etc. They deal with social issues in scientific way; therefore tend to be more informational and less involved as compared to Humanities.

Academic writing in Sciences is generally produced for those equipped with technical vocabulary and scientific knowledge, whereas, Humanities and Social Sciences are comparatively associated with general readers. The results on D1 are quite similar to Gardner, Nesi & Biber (2015) on the study of disciplinary variations in British Academic Written English (BAWE) corpus. In both studies, Sciences have been found most informational, whereas, Humanities as the least informational and most interactive discipline in nature.

Variation among Disciplines on D2

On D2, all the disciplines representing Pakistani academic writing have been found highly non-narrative in the presentation of informational discourse. The ANOVA results indicate that there lies no statistically significant variation among disciplines on D2. The figure given below compares Humanities, Social Sciences and Sciences on Biber is D2 of 1988 study and indicate that all disciplines have negative features and have been found highly non-narrative in style. The figure 2a compares the mean dimension score of Humanities, Social Sciences and Sciences on D2.
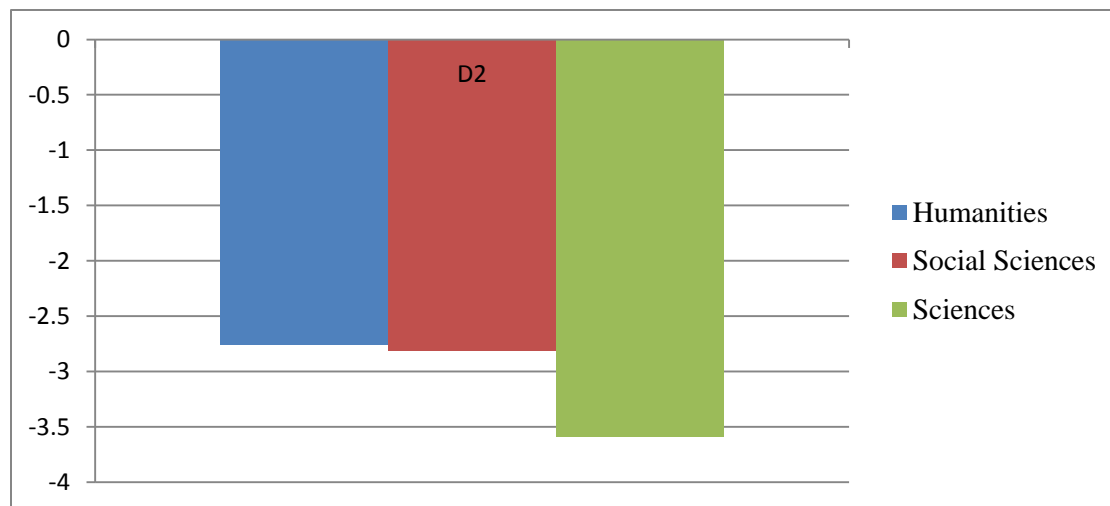
Figure 2a Comparison among Disciplines on D2

Figure 2a draws a comparison among disciplines of Pakistani academic writing on D2 and reveals that all the three disciplines of Pakistani academic writing have been characterized by highly non- narrative and expository discourse. Sciences with a sharp difference of mean score (-

3.59) have been found the most non-narrative in nature and appear to be more expository in style as compared to other two disciplines. Social Sciences with the mean score of -2.81 have been found less non-narrative in comparison with Sciences. Humanities with the mean score of -2.76 have been manifested least non-narrative and can be categorized as the most narrative discipline among all. The results on this dimension reveal Pakistani academic writing again similar to the findings of Gardner et al. (2015) on variation across disciplines as in both studies the discipline of Humanities has been found least non-narrative in comparison with the disciplines of Social Sciences and Sciences.

The linguistic features, which mark the text as non-narrative mainly, include present verbs on the negative side of this dimension. The density of non-narrative linguistic features in Pakistani academic writing is exhibited in the example below.

Example: 2

*'The main objective of **this system is to achieve** the steady state of concentration of therapeutic agents by modifying the pharmacokinetic behavior of the drug either in conventional tablets or capsules. Conventional dosage **forms are** "dump systems" which **releases** drug by first order fashion means higher release initially and by the passage of time decline in release. Use of sustained release **system provides** an excellent tool to achieve precise control of rate standpoint, but also at particular site.' (Text 200, S)*

The differences among disciplines can be related with the varying nature of subjects associated with the three disciplines. Humanities tend to be narrative in academic discourse as compared to Social Sciences and Sciences as they are to great extent concerned with historical and behavioral issues. That shows their inclination towards historical and event oriented discourse. The trends of three disciplines on non-narrative discourse are true of their nature. Sciences have been revealed most non-narrative as they deal with the description of objects and materials more than other disciplines and include subjects like chemistry, pharmacy, biology that demand a descriptive and expository style of the informational discourse.
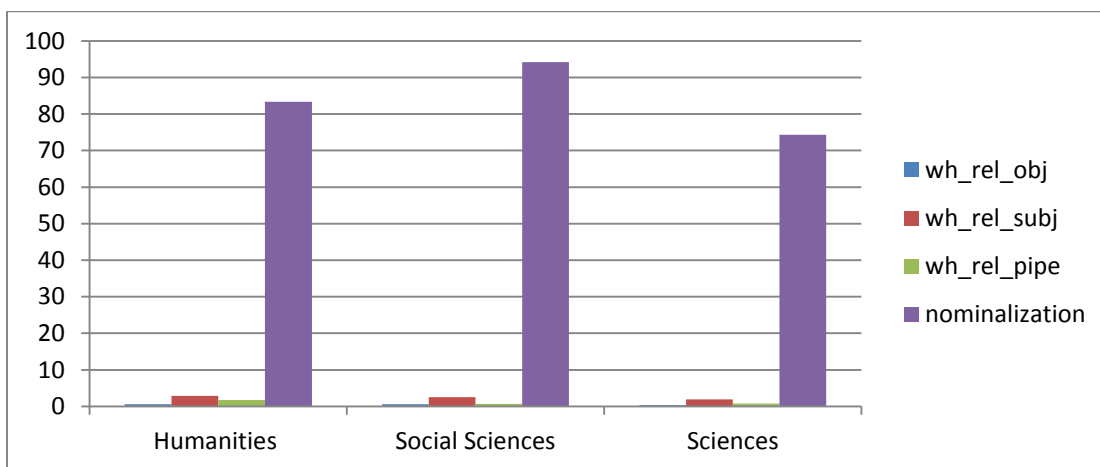
Variation among Disciplines on D3

On D3, comparison among disciplines reveals Pakistani academic writing as highly explicit and elaborated. The ANOVA results indicate that there lies no statistically significant variation among disciplines on D3. The figure given below compares Humanities, Social Sciences and Sciences indicate that all disciplines have positive mean scores along D3 and have been shown highly explicit and elaborated in nature. Figure given below compares the three disciplines on D3.
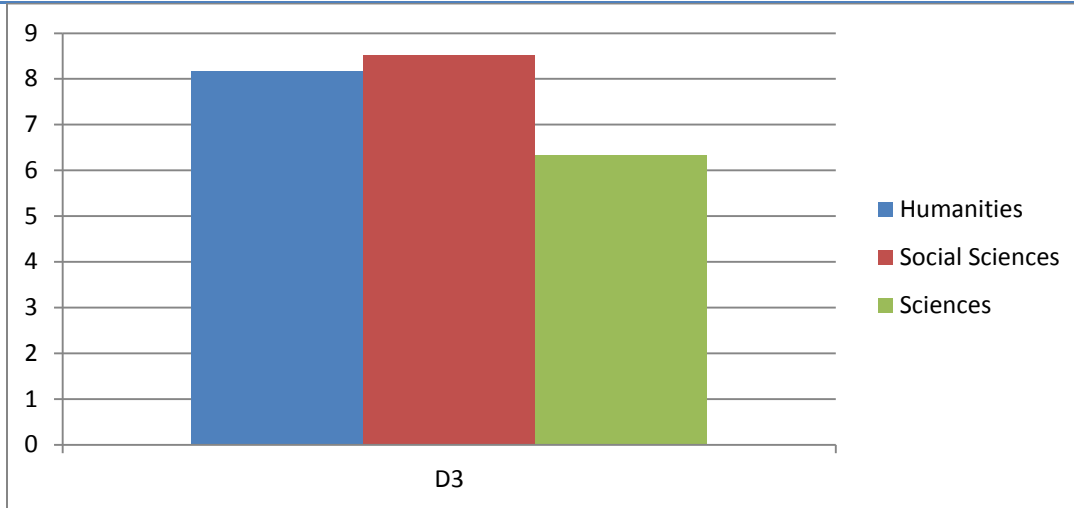
Figure 3a Comparison among Disciplines on D3

The comparison exhibited in Figure 3a reveals Social Sciences with the highest mean score of 8.52 as the most explicit and elaborated discipline in nature. That shows that Social Sciences are characterized by the most open, detailed and interpretative discourse that is due to the demand of the subjects related to Social Sciences. Humanities, with the mean score of 8.17, stand next to Social Sciences in being explicitly detailed and interpretive in nature. Sciences with the mean score 6.34 have been found least explicit as compared to Social Sciences and Humanities.

The comparison among disciplines can further be viewed in terms of the linguistic features associated with this dimension. The figure 3b given below exhibits the normalized frequency of the features of explicitness across three disciplines for further investigation into the variation among disciplines on D3.

Figure 3b Features of Explicitness across Disciplines on D3

Figure 3b illustrates the comparison among the features of explicit discourse across three disciplines on D3 of Biber's 1988 study. The figure indicates that nominalization is exceedingly frequent among all disciplines; whereas, the other features are found to have very low frequency rate in all disciplines. Nominalizations with highest mean score (94.21625) are mainly associated with the most explicit stance of Social Sciences. Nominalizations provide plenty of information in few words and further add into the explicitness of the discourse. The following example from the discipline of Sciences exhibits the frequency of nominalizations and relative clauses.

Example: 3

*'Moreover, in recessionary phases, **when economy is in a liquidity trap** (e.g.*

*Japan), **where private investment demand becomes inelastic**, fiscal policy can provide the necessary **stimulus** to the **economy** for coming out of that trap. , Further, in developing **economies**, **government expenditures** also play a complimentary role for private **investment.'** (Text 86, SS)*

The differences in the nature of subjects across disciplines seem to be important for the trends shown in the results. This trend is mainly due to the exactness that scientific subjects demand in the production of academic discourse. Social sciences and Humanities deal with the issues related to society and human behaviour and focus on elaborated presentation of information. Sciences deal with objects and materials and are inclined towards exact and less explicit type of discourse.

The findings on this dimension are again similar to Gardner et al (2015) study of variation among Humanities, Social Sciences and Sciences based on BAWE. In both studies, Social Sciences have been found most elaborated and explicit in the production of academic discourse; whereas, Sciences with the minimum mean score on this dimension have been found least explicit.

Variation among Disciplines on D4

On D4, all the disciplines representing Pakistani academic writing have been found highly non-persuasive and least argumentative in style. The ANOVA results indicate that there lies no statistically significant variation among disciplines on D4. The figure given below compares Humanities, Social Sciences and Sciences and indicates that all disciplines have negative features along D4 and are characterized by non-persuasive discourse. Figure 4a given below compares the three disciplines on D4 to mark the degree of persuasiveness among three disciplines.
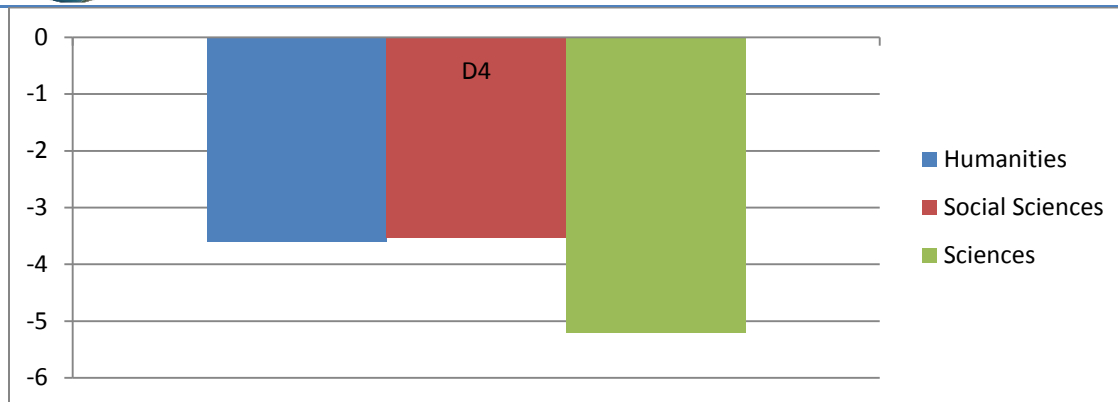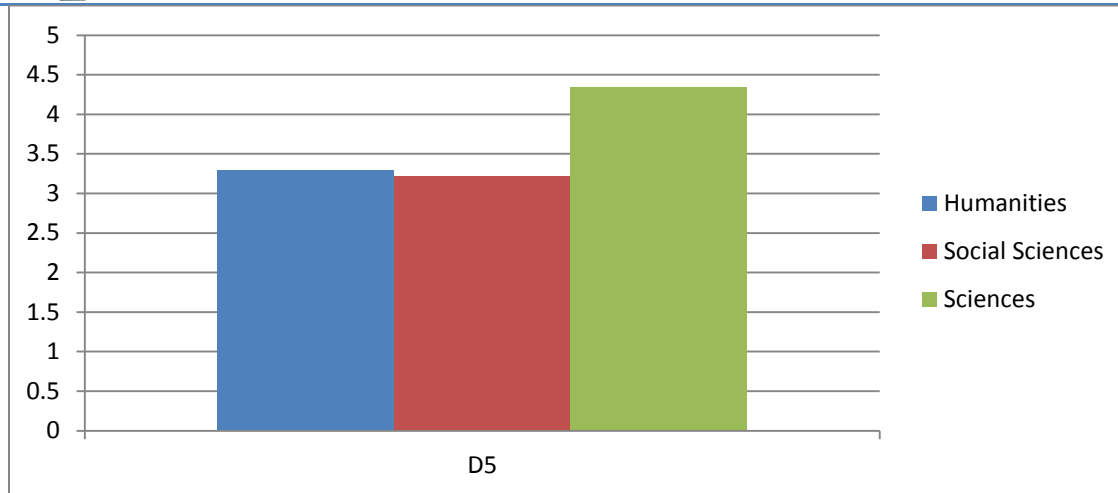
Figure 4a Comparison among Disciplines on D4

Figure 4a compares the mean dimension score of academic disciplines on D4 of Biber's 1988 study and reveals that Sciences with the highest mean score -5.21are characterized by the most non-persuasive discourse as compared to Social sciences and Sciences. This clearly indicates that scientific academic discourse has been found non-argumentative in persuading the reader with writer's own point of view. Social Sciences with the minimum mean score -3.54 have been revealed least non-persuasive and have shown an inclination towards persuasive and argumentative discourse. Humanities with mean score of -3.60 have been found close to social sciences in being less non-persuasive.

 Features of overt argumentation are generally employed to indicate logic behind the procedures, describing how and why the procedures work. Moreover, overt expression of argumentation is also used to explain procedures to the novices. In Pakistani academic writing, Social Sciences being the most elaborated discipline have also been revealed most persuasive and argumentative in style. This clearly speaks that Social Sciences present greater justifications for the procedures and findings of their research as compared with other two disciplines.

The findings on D4 of Pakistani academic writing are different from Gardner, Nesi and Biber's study (2015) of disciplinary variation on 1988 textual dimensions. In their study, Humanities have been found as the most and Social Sciences as the least non-persuasive disciplines in the production of academic discourse.

 Variation among Disciplines on D5

Variation among disciplines on D5 reveals Pakistani academic writing as highly impersonal in the presentation of academic discourse. The ANOVA results indicate that there lies no statistically significant variation among disciplines on D5. The figure given below compares the mean scores of Humanities, Social sciences and Sciences and exhibits all the disciplines as highly impersonal with the positive mean score ranging from3.21 to 4.34.
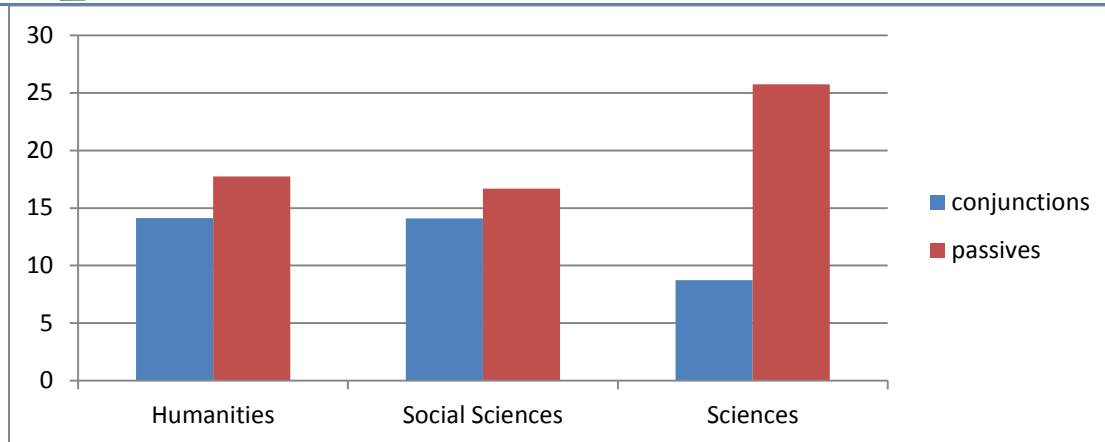
Figure 5a Comparison among Disciplines on D5

Figure 5a displays the comparison among Humanities, Social Sciences and Sciences and indicates that Sciences with the highest mean dimension score of 4.3 have been found the most impersonal discipline in the production of academic discourse. In other two disciplines, Social Sciences have been revealed least impersonal with the mean dimension score of 3.21; whereas, Humanities have been found slightly more impersonal than Social Sciences with the mean score of 3.29.

The differences across disciplines may be attributed to the nature of subject matter the three disciplines deal with. Sciences deal with objects and materials and have been found more concerned with the presentation of precise information. The exactness in the presentation of information may be related to the use of more impersonal linguistic features. As compared to Sciences, Social Sciences and Humanities are concerned with social issues and human events and are more detailed, elaborated, interactive and involved. Therefore, these two disciplines have been found less impersonal and more inclined towards the use of non-impersonal linguistic features.

 The positive features on this dimension include all passives, conjunctions and adverbial subordinators. The figure 5b given below presents the comparison among three disciplines on the distribution of these linguistic features.

Figure 5b Features of Impersonal Discourse across Disciplines on D5

Figure 5b exhibits the comparison among the features of impersonal discourse across disciplines. Passives which are considered as norms in the presentation of detached information have been found most frequently occurring (25.732) in Sciences. However, passives have been found least frequent in Social Sciences with the minimum mean score of 16.6825. The minimum mean score of passives clearly indicates the least impersonal stance of Social Sciences as compared to the other two disciplines. On the other hand, conjunctions are generally employed to add cohesion. Conjunctions, with the highest mean score (14.12875), are most frequently occurring in Humanities and are least frequent (8.729) in Sciences.

The example given below exhibits the extensively frequent use of passives in scientific writing.

Example: 4

'The detector was bloused in lead shield of 5 cm thickness. The lower pint of the detector was connected to liquid nitrogen through a rod, which was immersed in the liquid nitrogen for detector cooling. The detector assembly was comprised of following three parts.' (Text 213, S)

 Conclusion

The comparison among disciplines has exhibited multiple relationships on five textual dimensions of Biber's 1988 study. On all the five dimensions, all the three disciplines exhibit similar trends, and have been found highly informational, non-narrative, explicit, non-persuasive and impersonal in the presentation of academic discourse. The consistency in these trends suggests further research across other disciplines and sub registers.

However, there are important differences among disciplines on individual dimensions. On D1 Sciences are exposed to be the most informational due to dense presence of nouns; whereas, Humanities have been found least informational and tend to be more interactive and persuading the readers. On D 2, Sciences have been shown as the most expository in discourse; whereas, Humanities are found least descriptive and have shown an inclination towards narrative discourse as they deal with human behaviour and events. On D3, Social Sciences are

distinguished from the other two disciplines in being the most explicit and elaborated in more relying on nominalizations than other two disciplines. Sciences are the least elaborated and more precise due to their concern with objects and entities; whereas, Humanities have been found close to Social Sciences in being elaborated and explicit. On D4, Sciences have been found least persuasive in the production of academic discourse. On the other hand, Social Sciences have been found more inclined towards persuasive discourse as compared to Humanities and Sciences. On D 5, Sciences are shown as the most impersonal in style, whereas, Social Sciences and Humanities are found comparatively less impersonal and more personal in discourse.

The results are justified as per nature of the subjects these disciplines deal with. Sciences have been found the most informational, non-narrative and impersonal on the one hand, least explicit and personal on the other due to their concern with the presentation of information about objects and entities. Humanities have been found the most interactive, narrative being concerned with human events and behaviour. Social Sciences have been revealed slightly more informative and less interactive than Humanities, less non-narrative than Sciences, most elaborated and explicit, most persuasive and most personal as compared with the other two disciplines.

The foregoing discussion on variation across disciplines indicates that Pakistani academic writing is highly informational, non-narrative, explicit, non-persuasive and impersonal in style. All these features formulate Pakistani academic writing as a composition of expository, open, objective and clear information.

The findings of the present research may prove to be a useful source to researchers working on Pakistani English as a distinct variety. The results of the present study may be taken as norms of Pakistani academic writing and may be compared with other registers of Pakistani English. The results of MD analysis of the Pakistani academic writing can also be compared with the prospective researches on the linguistic features of other genres of academic writing like the language of text books, journals etc. Moreover, some other disciplines may be taken and compared with the results of the present study. This comparison will be a valuable study to evaluate the linguistic variation across sub-genres of academic writing.

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(Appendix I)

Linguistic Features Relevant to the 88 MD analysis of Academic Writing

Private verb(e.g, believe, feel, think)
'That' deletion (e.g; I think[that] he did it)
Present tense verb(uninflected present, imperative and third person)

Pro-verb 'do'
Demonstrative pronoun(that, this, those, these)
Adverb/ Qualifier-Emphatic (e.g, just, really, so)
First person pronoun (e.g, we, our)
Pronoun it/its
Verb 'Be' (Uninflected present tense, verb and auxiliary
Subordinating Conjunction- Causative (e.g, because)
Discourse particles (sentence initial, *well, now*)
Nominal pronoun(e.g, someone, everything)
Adverbial-Hedge(e.g, almost, may be)
Adverb/ Qualifier, Amplifier(e.g, absolutely, entirely)
Wh-question
Modals of possibility(can, may, could, might)
Coordinating conjunction-clausal connector
Wh-clause(e.g, he believed what I told him)
Stranded Preposition(appearing at sentence end)
Noun(excluding nominalization and gerund)
Preposition
Attributive adjective (e.g, national interest, annual return)
Past tense verbs
Third person pronoun (except 'it')
Verb-perfect aspect
Public verb (e.g, assert, complain)
Wh-pronoun- relative clause-object position(the person who he likes)
Wh-relative clause-subject position (e.g, the participants who like to join…)
Wh-relative clause-object position with prepositional fronting(' pied piping')
Co-ordinating conjunction-phrasal connector
Nominalization(e.g, organization, development)
Adverb-Time(e.g, instantly, soon)
Adverb-place (e.g, above, beside)
Adverb other(excluding adverb/Qualifier, Hedge, Emphatic, Time, place, Amplifier
Infinitive Verb
Modals of prediction (will, would.)
Suasive Verb(e.g, ask, command)
Subordinating Conjunction- conditional (if, unless)
Modal of necessity(Ought, should, must)
Adverb within auxiliary (splitting aux-verb)(e.g, the product is specifically meant)
Adverbial-conjuncts(however, therefore, thus)
Agentless passive verb(e.g, however, therefore, thus)
Agentless passive verb(e.g, the scheme was introduced)
Passive verb+ by (e.g, the plan was introduced by principal)
Passive post nominal modifier(e.g, the message conveyed by)
Subordinating conjunction-Other (e.g, as, excepts, until)

Present Tense Verbs(Uninflected present, imperative and third person)
2nd person Pronoun
Ist Person Pronoun
Verb "Be"
Noun (excluding nominalization and Gerund)
Preposition
Verb Perfect Aspect
Predictive adjectives
Passives all
That-complement clause controlled by stance verb
To-complement clause controlled by stance verb
To-complement clause controlled by stance adjective
Process nouns, (isolation et.)
Other abstract nouns (e.g, idea)
Activity Verb (e.g, give, take)
Mental verb (e.g, believe, enjoy)
Seem
Contractions
Split infinitives
NOT neg.
P-AND
O_AND
FINAL PREP.