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Material Development and English for Academic Purposes Word Lists; a Reductionist Approach *

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Abstract

Nagy (1988) states that vocabulary is a prerequisite factor in comprehension. Drawing upon a reductionist approach and having in mind the prospects for material development, this study aimed at creating an English for Academic Purposes Word List (EAPWL). The corpus of this study was compiled from a corpus containing 6479 pages of texts, 2,081,678 million tokens (running words) and 63825 types (individual words), and 2615 word families from online resources. The created EAPWL included 636 word families, which accounted for 12% of the tokens in the EAPWL under study. The high word frequency and the wide text coverage of this word list confirm that this word list plays an important role in English for Academic Purpose texts and hence can be a justified resource for material development in the field. From these findings, it can be concluded that the EAPWL created in this study can serve as a guide for material developers and syllabus designers especially in designing course-books, in addition learning these words by learners can help them in better understanding of their texts, and development in their writing and reading comprehension.

Keywords: English Word List for Academic Purpose, Corpus, Token, Text Coverage, Material Development

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Introduction

Vocabulary acquisition has long been considered an important component of learning a language (Coady, Magoto, Hubbard, Graney, & Mokhtari, 1993; Nation, 2001) because the descriptiveness, accuracy and quality of students' writing is directly related to his or her vocabularies knowledge (Read, 1998). Based on Nagy (1988) vocabulary is a prerequisite factor in comprehension. Research with second language learner by Hsueh and Nation (2000) and first language learners by Carver (1994) indicated that for unassisted reading at least 98 percent coverage of the running words is needed. Consequently, in order to be able to read the texts one must have vocabulary knowledge.

It is clear that in different stages of learning all words are not equally important and are not in the same frequency. Long and Doughty (2009) distinguished among four vocabulary levels: high-frequency, academic, technical, and low-frequency words. The high-frequency words are consisted of 2000 words of English cover between 80% and 90% of the running words in a text. This is Michael West's General Service List (GSL) of English words. According to Nation and Waring (1997), it is generally agreed that the beginners of English learning should focus on this list. Coxhead's (2000) Academic Word List, created for learners who wish to do academic study, consists of 570 word families that covers around 10% of the running words in academic list, around 4% of the running newspapers, and less than 2% of the running words in novels. Technical words are developed for learners who have very specific purposes. Technical vocabulary can come from high-frequency, academic, and low-frequency words. Low-frequency words are also need to be learned to reach an unassisted language use.

Literature review

A close look at the previous studies revealed that there are number of studies conducted on the academic vocabulary within or across different fields of study (e.g. Laufer, 1988; Sutarsyah, et al., 1994; Laufer and Nation, 1999; Ming-Tzu and Nation, 2004; Coxhead, 2000; Nation, 2001a, 2001b; Wang et al., 2008; Martinez et al., 2009). A General Service List (GSL) was published by West (1953). This list consisted of words that covered 90% to 95% of the colloquial conversations and 80% to 85% of the English common texts. Nation (2001b) mentioned that the main fallacy of this word list was its inadequacy in covering the

unknown words in the texts. If we just focus on the GSL then every 5 words in the texts will have 1 unknown word Nation (2001b) argued.

A word list containing 500 most common words and 3200 frequently used words was developed by Champion and Elley (1971). The words in their list contained the words that students were likely to encounter in their university studies. Praninskas (1972), using a corpus of 272466 words from 10 university-level textbooks covering 10 academic disciplines, compiled the American University Word list. Another word list that was developed by Lynn's (1973) and Ghadessy's (1979) contains the words that the students had found difficult during their reading. Xue and Nation (1984) combined the four earlier word lists (Champion and Elley's, Praninskas's, Lynn's, and Ghadessy's) into the University Word List (UWL). Xue and Nation's purpose of setting up the UWL was to create a list of high frequency words for learners with academic purposes, so that these words can be taught and directly studied in the same way as the words from the GSL.

Academic word list (AWL), was developed by Coxhead (2000). The corpus of this study was 3.5 million running words that the texts of her corpus were selected from different academic journals and university textbooks in four main areas: arts, commerce, law and natural science. The AWL consists of 570 words families that accounted for almost 10% of the total words in her selected academic texts. In comparison with UWL, AWL included fewer word families but provides more text coverage and more consistent word selection criteria.

In addition to these discipline-crossing academic word lists, some researchers have focused on the academic vocabulary used in a single discipline. The assumption behind this is that there must be some unique features in the academic vocabulary across sub-disciplines of one discipline. A study was conducted by Lam (2001) in order to find the vocabulary problems that the students of computer science have in reading academic texts. She mentioned that the appearance of the academic vocabulary is semantically different when they appeared in general texts. She suggested that these lexical terms with information of frequency should be presented as a glossary of academic vocabulary. Khani and Tazik (2013) conducted a research that the focus of their research was developing an academic word list for the field of Applied Linguistics. The corpus of their study consisted of 240 research articles

(RAs) with 1553450 running words that the articles of their study derived from 12 journals published between 2000 and 2009 in the field of Applied Linguistics. They obtained 773 words. The criteria of their study included both frequency and range. The findings of their study indicated that about 74.12% of the academic words found in the corpus overlapped with the word types in AWL. Mudraya (2006) created the Student Engineering English Corpus (SEEC), including 2000000 running words. Different engineering textbooks from different discipline were selected. The result was an academic word list of 1200 word families for engineering students. These word families are frequently appeared in engineering textbooks regardless of the fields of specialization. In another study conducted by Wang et al (2008) using a written specialized corpus containing 1093011 running words from 288 written texts of a single genre to create a Medical Academic Word List (MAWL). The result of their study was a 623 word families that formed the Medical Academic Word List.

Martinez et al., (2009) pointed out that the coverage of AWL (Coxhead, 2000) and GSL (West, 1953) is essential in academic settings, also new findings (Hyland, 2002) emphasizes the importance of establishing new word lists for the texts of ESP and EAP. Consequently, this study tried to establish an English for Academic Purposes Word List (EAPWL)

2. Methodology

2.1. Corpus establishment

The establishment of the corpus involved gathering each text in electronic form, removing its bibliography, diagrams, references, and counting its words. The resulting corpus contained 6479 pages of texts containing 2,081,678 tokens (running words) and 63825 types (individual words), and 2615 word families. Although there are different divisions of sciences, in this study the corpus was divided into four science areas including: social science, natural science, formal science, and applied science. Each science area consisted of 4 subject-areas and each subject-area approximately consisted of 40 articles. The total articles of this study were 640. Table 1 shows the included information of this study.

Table 1. Composition of the study corpus

sciences	Social science	Natural science	Formal science	Applied science	Total	
Running Words	518,155	523,375	519,922	520,226	2,081,678	
Pages of text	1,773	1,545	1,683	1,478	6,479	
Number of articles	162	158	161	159	640	
Subject areas	literature history psychology English	biology physics chemistry physiology	mathematics logic accounting statistics	medicine agriculture automobile engineering computer engineering		

2.2. Data collection and word selection criteria

All the written research articles (RAs) that was used in this study, after consulting with the experienced specialist of each subject-area, were gathered from the journals and downloaded from internet. Both range and frequency were used as the criteria for the vocabulary selection. The frequency criterion is the word forms have to occur at least 60 times in the entire corpus; the range criterion is that the word forms have to occur at least 8 times in 16 subject-areas. The rationale of this selection was based on Coxhead's (2000) selection of AWL words. The corpus of the Coxhead consisted of 3.5 million words. The frequency of each word form in her study was the occurrence at least 100 times in the entire corpus. The range in Coxhead study was occurrence of the words in at least half of the 28 subject areas in her corpus. Using a simple mathematical computation, the frequency and the range of this study were 60 and 8 respectively. All of the words that met the criteria were selected. Then among these words the GSL of English words were deleted and finally 636 words remained and formed the EAPWL.

Results and discussion

This study focused on creating a specialized English word list for academic purposes. The rationale behind this purpose was that this kind of word list helps learners to learn the most frequent words in different academic texts. Toward this aim, 640 articles containing more than 2

million running words from 16 different field of study were selected. The results are discussed below in detail.

Table 2 indicates the coverage of lexical items in the corpus. As shown in table 2, there were 2,081,678 running words, 63,825 word types, and 2,615 word families in the corpus. In total 1,476,914 of the running words were in the first and second 1000 words of GSL 2000 words that almost consisted of 70% of the total corpus, 14% of the total tokens that is 280,952 of the words were in Coxhead's (2000) AWL, and finally 16% of the total tokens that is 323,812 of the words were not in any list.

Table 2. Coverage of Lexical Items in the Corpus

WORD LIST	TOKENS/%	TYPES/%	FAMILIES
one	1284038/66.46	4010/ 5.98	1030
two	192876/ 5.21	3058/ 4.47	982
three	280952/10.16	2937/ 4.28	603
not in the lists	323812/18.1	53820/85.27	not known*
Total	2081678	63825	2615

*The number was so high that it could not be counted by the program.

Based on Table 2 the coverage of GSL and AWL are 84% of the tokens in the corpus. This high coverage makes it clear that these two word lists play an important role in the English Word List for the Academic Purposes.

The coverage of the three word lists that is AWL, MWL, and AWL for applied linguistics in the present word list are indicated in table 3. As table 3 indicates, this word list covers 50% of words in AWL, 45% of words in MWL, and 55% of words in AWL for applied linguistics. The coverage mean of this word list for these three word lists is 50%. This high frequency reiterates 'the need for applied linguistics researchers to know these words when they read or write academic works in this field' (Vongpumivitch et al., 2009: 36). Learning these words and the most frequent words in each field can help learners in their reading and writing for the academic purposes.

Table 3. Coverage of other word lists in this study

Word lists	percent
AWL	50%
MWL	45%
AWL for Applied Linguistics	55%

Note: these numbers consist of both exact word and the family of the words

The first 20 words in each of the AWL, MWL, and AWL for applied linguistics were checked and the words that were shared with EAPWL with the range and frequency of each word are shown in Table 4. It is worth mentioning that these words are ranged based on their frequencies. As this table shows, almost half of the 60 words that is 28 words are existed in EAPWL word list and this is in agreement with previous findings in table 3.

Table 4. The first 20 words in in each of the AWL, MWL, and AWL for applied linguistics that shared with EAPWL

Type	R	FRQ	Type	R	FRQ	Type	R	FRQ
Data	16	2525	Factor	16	401	Affect	16	220
Process	16	1413	Context	16	391	Task	16	219
Research	16	1368	Previous	16	375	Accurate	16	215
Method	16	1164	Interaction	16	371	Achieve	16	180
Significant	16	1036	Focus	16	346	Demonstrate	16	153
Function	16	818	Abstract	16	336	Analyze	14	83
Similar	16	736	Features	16	332	Concentrate	16	78
Structure	16	640	Normal	16	300	Adequate	15	68
Text	16	433	Items	12	295			
Cell	12	416	Access	16	278			

To check the usage of the EAPWL in academic texts the following excerpt was accidentally taken from a research article in this corpus. The underlined words can give us a picture of the words that was determined as the EAPWL.

The IEP may also play a role in high use of social strategies by participants, many of whom showed a strong preference for learning with others by asking questions and cooperating with peers. This

particular IEP has a very student-oriented philosophy underpinning its curriculum. In terms of the participants' high social strategy use, which is a departure in some ways from culturally driven learning practices that are more independent, the environment (e.g., high availability of native-English speakers around the students) of and instruction in the IEP strongly encourage and support more interactive learning for the sake of developing greater linguistic fluency. These findings are in line with those of Phillips' (1991) study of Asian ESL students also enrolled in college IEPs who used social strategies more than affective and memory strategies. The least favored strategies by participants in this study were affective strategies and memory strategies. In terms of affect, these learners reported that despite efforts to relax when they were uncertain about speaking English, their fears of making a mistake often kept them from trying.

Among the 176 words in the text above, 21 words belong to EAPWL. The coverage of EAPWL in this text is almost 12 %. This high coverage shows that this word list is worth paying attention to.

Pedagogical Implications

The EAPWL is the result of a corpus-based study. This word list can serve as a reference for EFL/ESL learners to understand the academic texts that they need to read. Other implications are listed below:

- Developing an EAPWL can be used for explicit teaching of vocabularies in EFL/ESL classes. It helps teachers and students to know which word should be focused on.
- Concerning vocabulary in curriculum, the EAPWL can provide some guidelines especially in preparing course-books.
- Containing both academic vocabularies and others, the EAPWL can help both novice and expertise in their reading and writing of academic texts.
- Knowing just words is not enough for learners. They need to practice these words in the actual contexts. 'Academic success requires learning how to use academic vocabulary in writing as well as recognize it in reading' (Coxhead and Byrd, 2007: 143).

Conclusion

Learning and teaching vocabularies has long been one of the main concerns among researchers across different fields of study and contexts (Nation and Waring, 1997; Moir and Nation, 2002; Nation, 2006; Mudraya, 2006; Ward, 2009). Coxhead (2000) tried to gather and define an AWL that is generalizable to other field of study. Other researchers (Kani and Tazik, 2013; Lam, 2001; Wang et al, 2008; Mudraya, 2006) have focused on the academic vocabulary used in a single discipline. This study focused on creating an English for Academic Purposes Word List (EAPWL). The established word list consists of 636 word families with a good coverage of academic texts, almost 12%, regardless of the field of study. As results show, this word list almost includes half of the words in each AWL, MWL, and AWL for applied linguistics. Combining the findings of this study with other studies can help learners in reading and writing of academic texts. The findings of this study can also help in syllabus designing. Considering the findings of this study and incorporating these findings and the findings of other studies can help to save lots of time, energy, and money in terms of vocabulary selection.

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Appendix

English for Academic Purposes Word List (submitted by range and frequency of word families)

Note 1: Bolded words are the words or the family of the words that are in AWL by Coxhead (2000).

Note 2: Italic words are the words or the family of the words that are in AWL for Applied Linguistics by Khani and Tazik (2013).

Note 3: Underlined words are the words or the family of the words that are in MWL by Wang, Liang, Ge (2008).

Note 4: In this word list R and F represent range and frequency respectively.

Word Types	R	F	Word Types	R	F	Word Types	R	F
<u>DATA</u>	16	2525	<u>ROLE</u>	16	720	<u>SECTION</u>	16	526
DIFFERENT	16	2027	<u>SPECIFIC</u>	16	712	GOVERNMENT	13	523
HOWEVER	16	1731	RELATED	16	662	<u>PARAMETERS</u>	15	523
<u>ANALYSIS</u>	16	1470	<u>JOURNAL</u>	16	660	<u>VARIABLES</u>	15	520
<u>PROCESS</u>	16	1413	<u>EVIDENCE</u>	16	656	<u>MAJOR</u>	16	516
<u>RESEARCH</u>	16	1368	<u>PHASE</u>	16	655	<u>CULTURE</u>	14	514
<u>THEME</u>	16	1323	<u>CONCENTRATION</u>	16	650	<u>PROCESSES</u>	16	513
<u>FOUND</u>	16	1297	<u>DEVELOPMENT</u>	16	650	CASES	16	512
INFORMATION	16	1197	ASSOCIATED	16	649	<u>DESIGN</u>	16	503
<u>METHOD</u>	16	1164	<u>POSITIVE</u>	16	645	<u>ENVIRONMENTAL</u>	16	497
SOLUTION	16	1064	<u>STRUCTURE</u>	16	640	PRESSURE	16	497
<u>TASKS</u>	16	1038	<u>POTENTIAL</u>	16	637	ESSENTIAL	16	489
<u>SIGNIFICANT</u>	16	1036	<u>REFERENCE</u>	16	634	INTRODUCTION	16	487
<u>EQUATION</u>	12	1014	KNOWLEDGE	16	614	<u>IMPACT</u>	16	486
<u>THEORY</u>	16	918	ADDITION	16	608	<u>SOURCE</u>	16	485
TREATMENT	16	916	PERFORMANCE	16	599	<u>AVAILABLE</u>	16	483
<u>ENERGY</u>	15	897	NATIONAL	16	598	<u>DETECTED</u>	13	478
<u>PERIOD</u>	16	863	<u>PER</u>	16	598	RATES	16	474
<u>INDIVIDUAL</u>	16	819	<u>VOLUME</u>	16	592	<u>DEFINED</u>	16	473
<u>FUNCTION</u>	16	818	<u>NEGATIVE</u>	16	591	<u>SIGNIFICANTLY</u>	16	471
<u>OBTAINED</u>	16	800	<u>DISTRIBUTION</u>	15	585	NATURAL	16	470
ACCORDING	16	797	RELATIONSHIP	16	582	<u>UNDERSTANDING</u>	16	465
<u>APPROACH</u>	16	770	<u>AREA</u>	16	576	<u>DETECTION</u>	13	461
<u>RANGE</u>	16	758	<u>STRESS</u>	15	568	<u>RATIO</u>	14	457
<u>RESPECTIVELY</u>	16	755	<u>CELLS</u>	12	550	<u>OVERALL</u>	16	455

<u>FACTORS</u>	16	736	MANAGEMENT	14	540	<u>VARIABLE</u>	15	453
<u>METHODS</u>	16	736	<u>NETWORK</u>	16	537	<u>TECHNOLOGY</u>	16	451
<u>SIMILAR</u>	16	736	<u>INDIVIDUALS</u>	16	534	<u>CULTURAL</u>	12	450
CONSIDERED	16	734	ACCURACY	16	526	<u>COMPLEX</u>	16	446

Word Types	R	F	Word Types	R	F	Word Types	R	F
<u>CONCEPT</u>	16	445	<u>ABSTRACT</u>	16	366	<u>VIA</u>	16	313
DISCUSSION	16	445	<u>CONCLUSION</u>	16	366	FORCE	15	311
<u>PHYSICAL</u>	16	445	<u>FUNCTIONS</u>	16	363	<u>IDENTIFIED</u>	16	310
ESPECIALLY	16	439	<u>REGION</u>	16	363	ABILITY	16	309
<u>TEXT</u>	16	433	FAILURE	13	361	<u>RELEVANT</u>	16	308
<u>ENVIRONMENT</u>	16	430	EFFICIENCY	16	360	<u>STATISTICAL</u>	15	308
SOLUTIONS	15	427	<u>FINALLY</u>	16	360	<u>PUBLISHED</u>	16	307
<u>GLOBAL</u>	16	422	<u>HENCE</u>	16	352	CRITICAL	16	304
ACTIVITIES	16	421	<u>AREAS</u>	16	351	<u>TRANSFER</u>	14	304
FINANCIAL	15	418	<u>INDEX</u>	15	351	<u>CONTRAST</u>	16	301
<u>ISSUES</u>	16	418	<u>THEORETICAL</u>	14	350	<u>COMMUNITY</u>	16	300
<u>SCORES</u>	12	418	<u>SPECIES</u>	14	349	NORMAL	16	300
<u>CELL</u>	12	416	<u>SPECIES</u>	16	346	<u>AUTHORS</u>	16	299
RELATIVE	16	412	<u>FOCUS</u>	11	345	<u>SOFTWARE</u>	16	299
<u>RESPONSE</u>	16	412	<u>GENDER</u>	10	345	<u>SELECTED</u>	16	297
<u>CORRESPONDING</u>	16	411	<u>GRADE</u>	10	345	<u>CAPACITY</u>	15	297
REDUCTION	16	407	FINDINGS	16	343	<u>INTERNAL</u>	16	296
<u>IDENTITY</u>	14	403	BELIEFS	11	341	<u>INVOLVED</u>	16	295
ECONOMIC	15	402	<u>ESTIMATE</u>	14	341	<u>ITEMS</u>	12	295
<u>FACTOR</u>	16	401	<u>WHEREAS</u>	16	335	<u>AUTHOR</u>	16	294
<u>INTENSITY</u>	13	400	<u>FEATURES</u>	16	332	<u>REFERENCES</u>	16	294
<u>POLICY</u>	13	393	TRANSMISSION	14	332	SERVICE	14	294

<u>REQUIRED</u>	16	392	<u>REGRESSION</u>	15	327	<u>TRADITIONAL</u>	16	293
<u>CONTEXT</u>	15	391	<u>CONSTANT</u>	16	326	<u>ESTIMATED</u>	16	289
COEFFICIENT	12	390	<u>RANDOM</u>	16	324	<u>ERROR</u>	16	288
<u>COMPONENTS</u>	15	390	TOGETHER	16	322	<u>MULTIPLE</u>	16	288
<u>PROCEDURE</u>	15	388	<u>INITIAL</u>	16	321	<u>ASSESSMENT</u>	16	280
<u>MAXIMUM</u>	15	386	<u>DEMONSTRATED</u>	16	320	<u>INDICATES</u>	16	280
<u>SECURITY</u>	12	386	<u>ELEMENTS</u>	16	320	<u>APPROPRIATE</u>	162	279
EFFECTIVE	16	381	<u>IMAGE</u>	15	315	<u>ACCESS</u>	16	278
<u>PREVIOUS</u>	16	375	ADDITIONAL	16	314	EXPRESSION	16	278
<u>INTERACTION</u>	16	371	<u>MEDIA</u>	16	314	<u>MECHANISM</u>	16	278
PROBABILITY	15	371	<u>CORRELATION</u>	15	313	<u>RESEARCHERS</u>	16	277
<u>ISSUE</u>	16	371	<u>FINAL</u>	16	313	ACTIONS	14	276

Word Types	R	F	Word Types	R	F	Word Types	R	F
<u>FURTHERMORE</u>	16	275	<u>RESPONSES</u>	16	249	<u>CONDUCTED</u>	16	228
<u>THROUGHOUT</u>	16	275	SOMETHING	14	249	MENTIONED	16	228
<u>EXTERNAL</u>	16	274	<u>VARIANCE</u>	14	249	AGREEMENT	16	227
<u>PEAK</u>	15	274	<u>LAYER</u>	15	248	<u>CORE</u>	16	226
<u>DENSITY</u>	14	173	<u>NOVEL</u>	16	248	<u>FORMATION</u>	15	226
DECISION	15	272	<u>PERSPECTIVE</u>	14	248	<u>STRATEGY</u>	16	226
<u>PRIOR</u>	16	272	SCIENTIFIC	16	248	ACHIEVED	15	225
SOURCES	15	272	<u>DEFINITION</u>	15	247	COMBINATION	16	225
<u>OBTAIN</u>	16	271	DESCRIPTION	16	247	<u>COMMUNICATION</u>	15	225
<u>TARGET</u>	16	271	EXTENT	16	247	<u>ANALYSES</u>	16	224
<u>TECHNIQUES</u>	16	271	<u>DESIGNED</u>	16	244	REALITY	15	223
<u>ALTERNATIVE</u>	16	270	<u>FUNCTIONAL</u>	16	244	<u>AFFECT</u>	16	220
ATTENTION	16	270	<u>PARTICIPANT</u>	15	244	<u>COMPONENT</u>	15	219
<u>VISUAL</u>	12	270	CHOICE	16	243	<u>TASK</u>	16	219
<u>EMPIRICAL</u>	16	269	<u>HYPOTHESIS</u>	16	243	<u>INVESTIGATED</u>	16	218
<u>RESOURCES</u>	14	268	<u>PERCENTAGE</u>	15	242	OUTSIDE	14	217
ACTIVE	16	267	<u>DERIVED</u>	16	241	<u>ASPECTS</u>	16	216

<u>FRAMEWORK</u>	15	267	COLUMN	14	240	<u>ACCURATE</u>	16	215
<u>CONSISTENT</u>	16	266	<u>PRIMARY</u>	15	240	<u>SHIFT</u>	16	215
<u>TOLERANCE</u>	14	266	<u>CONCEPTS</u>	14	239	<u>GOAL</u>	16	214
<u>INDICATED</u>	16	264	<u>ESTABLISHED</u>	16	39	<u>INTERPRETATION</u>	15	214
KEYWORDS	16	264	<u>STRUCTURES</u>	16	238	<u>OUTPUT</u>	12	214
<u>PARAMETER</u>	12	264	PREVIOUSLY	16	237	POSSIBILITY	14	213
<u>SELECTION</u>	16	263	<u>RELEASE</u>	16	236	<u>DOCUMENTS</u>	13	212
<u>SERIES</u>	16	263	EXAMINED	16	235	CONSUMPTION	13	210
<u>AFFECTED</u>	16	262	<u>REACTION</u>	15	235	<u>DEVICE</u>	15	210
EDUCATION	16	261	<u>ELEMENT</u>	16	234	<u>MEDIUM</u>	16	210
<u>STRATEGIES</u>	16	260	EARLIER	16	233	APPROACHES	16	209
RELATIVELY	16	257	<u>FEATURE</u>	15	233	<u>IMAGES</u>	12	209
<u>TECHNIQUE</u>	16	254	<u>UNIQUE</u>	16	232	<u>VARIATION</u>	16	209
<u>INDICATE</u>	16	252	<u>FUNDAMENTAL</u>	16	231	<u>EXPOSURE</u>	15	20813
<u>CREATED</u>	14	251	<u>GENERATED</u>	16	231	<u>STATISTICS</u>	13	208
<u>PERCENT</u>	15	251	<u>MODIFIED</u>	15	231	<u>STATUS</u>	16	208
<u>MODE</u>	15	250	<u>INPUT</u>	14	29	<u>SIMILARLY</u>	16	207

Word Types	R	F	Word Types	R	F	Word Types	R	F
<u>STABLE</u>	16	206	<u>STRUCTURAL</u>	16	187	<u>PRIMARILY</u>	16	177
<u>IDENTIFY</u>	16	205	<u>DEFINE</u>	16	186	SENSITIVE	15	177
MAINLY	16	204	<u>DIMENSIONS</u>	15	186	<u>BENEFIT</u>	51	176
<u>SPECTRUM</u>	16	204	<u>INTERACTIONS</u>	15	186	CENTER	16	176
<u>OPTION</u>	15	202	<u>DYNAMICS</u>	14	185	<u>DISTINCT</u>	16	176
<u>CONVENTIONAL</u>	16	201	<u>PRINCIPLE</u>	16	185	GENERATION	16	176
DEPENDENT	16	201	<u>SUM</u>	15	185	<u>PERCEIVED</u>	15	176
STABILITY	15	201	<u>VALIDITY</u>	15	185	<u>PRINCIPLES</u>	16	176
<u>DESPITE</u>	16	20	<u>DISTRIBUTED</u>	15	184	CONTINUOUS	16	175
MECHANISMS	15	200	<u>CYCLE</u>	16	183	<u>DYNAMIC</u>	14	174
SOMETIMES	16	200	<u>MAJORITY</u>	16	183	<u>CONSTRUCT</u>	15	173
REGIONS	16	199	SENSITIVITY	15	183	<u>CONTEMPORARY</u>	13	173

<u>THEORIES</u>	15	199	DIFFERENTIAL	15	182	<u>ASSUME</u>	16	172
<u>CONFLICT</u>	13	198	EXAMINE	16	182	<u>CREATE</u>	16	172
<u>OBJECTIVE</u>	16	198	FINDING	16	182	<u>SIGNIFICANCE</u>	16	172
<u>ANNUAL</u>	14	197	<u>IMPLICIT</u>	13	182	CONSIDERATION	16	171
NAMELY	16	197	<u>MEDICAL</u>	15	182	<u>REQUIRE</u>	16	171
<u>PROCESSING</u>	16	197	ANALYTICAL	13	181	<u>UNDERLYING</u>	15	171
RELATIONSHIPS	16	196	<u>CHALLENGE</u>	16	181	CONCLUSIONS	16	169
EQUILIBRIUM	13	194	<u>ESTIMATION</u>	13	181	<u>ATTRIBUTES</u>	14	167
<u>INSTANCE</u>	16	194	<u>SPECIFICALLY</u>	16	181	OPTIMAL	14	167
<u>OCCUR</u>	16	194	TYPICAL	15	181	<u>PROCEDURES</u>	14	166
REPRESENTATION	15	194	<u>ACHIEVE</u>	16	180	SITES	13	166
CHOSEN	15	193	<u>FORMULA</u>	16	180	<u>VERSUS</u>	15	166
MOVEMENT	15	192	<u>REQUIREMENTS</u>	16	180	<u>BIOLOGICAL</u>	15	165
PREPARATION	16	192	<u>CREATION</u>	12	179	<u>COGNITIVE</u>	13	165
TYPICALLY	15	192	<u>INTERVAL</u>	14	179	<u>PREDICT</u>	15	165
ELECTRICAL	13	191	<u>EVALUATION</u>	16	178	<u>CONSISTS</u>	16	164
<u>INJECTION</u>	11	190	<u>SITE</u>	16	178	<u>OCCURS</u>	16	164
<u>REVEALED</u>	16	190	VARIETY	16	177	<u>PROJECT</u>	15	164
<u>SIMULATION</u>	9	190	<u>APPROXIMATELY</u>	16	177	ABSOLUTE	15	163
<u>PERIODS</u>	15	188	<u>ASSUMED</u>	16	177	<u>MENTAL</u>	14	163
<u>REQUIRES</u>	16	188	<u>CONSTRUCTION</u>	15	177	<u>VERSION</u>	15	163

Word Types	R	F	Word Types	R	F	Word Types	R	F
<u>CONSEQUENTLY</u>	16	162	<u>NEVERTHELESS</u>	16	149	<u>CONTRIBUTE</u>	16	134
<u>SUMMARY</u>	16	162	<u>SUBSTANTIAL</u>	16	149	<u>LOCATED</u>	16	134
<u>CATEGORIES</u>	13	162	<u>INVOLVES</u>	16	148	SUCCESSFUL	15	134
<u>CHALLENGES</u>	15	161	<u>LEGAL</u>	11	148	MIXTURE	15	133
RECOGNITION	15	161	<u>PHENOMENON</u>	16	148	<u>MONITORING</u>	15	133
SETTING	16	161	<u>ANALYZED</u>	16	147	<u>OCCURRED</u>	16	133

<u>EQUIVALENT</u>	15	160	<u>CRITERIA</u>	16	147	<u>CONSEQUENCES</u>	15	132
PHILOSOPHY	10	160	<u>OUTCOME</u>	14	147	<u>CRUCIAL</u>	16	132
<u>ENSURE</u>	16	159	<u>INVOLVING</u>	16	146	DIGITAL	13	132
<u>INVESTIGATION</u>	16	159	MINIMUM	15	146	<u>DOMAIN</u>	16	132
<u>TREND</u>	16	159	ARGUMENT	13	145	<u>MAGNITUDE</u>	13	132
PHENOMENA	15	158	EXPANSION	15	145	SUITABLE	16	132
SCHEME	14	158	<u>GOALS</u>	14	145	<u>CREATIVE</u>	13	130
ASSUMPTION	15	157	LONG-TERM	14	144	<u>SUBSEQUENT</u>	15	130
REPRESENTATIVE	16	157	<u>PROPORTION</u>	16	144	<u>ISOLATED</u>	14	129
BACKGROUND	16	156	<u>FOCUSED</u>	16	143	<u>CONSTRUCTED</u>	15	127
MAINTAIN	15	156	<u>INVESTIGATE</u>	16	143	<u>EVIDENT</u>	16	127
RESISTANCE	14	156	<u>SEQUENCE</u>	15	143	REPRESENTING	14	127
<u>STATISTICALLY</u>	14	156	LOGICAL	14	142	<u>ERRORS</u>	13	126
<u>IDENTIFICATION</u>	16	155	COMPOSITION	14	141	<u>STYLE</u>	14	126
<u>SURVEY</u>	15	155	SECONDARY	16	140	<u>ASPECT</u>	15	125
<u>COMMENT</u>	12	154	<u>CONFIRMED</u>	16	139	<u>CULTURES</u>	14	125
EVOLUTION	15	154	<u>TRANSPORT</u>	15	139	<u>PANEL</u>	12	125
<u>DEMONSTRATE</u>	16	153	COLLECTION	16	138	<u>INTEGRITY</u>	13	124
<u>DEVIATION</u>	15	153	OUTCOMES	14	138	LIMITATIONS	16	124
<u>IMPLEMENTATION</u>	15	153	COMMERCIAL	15	137	<u>PHASES</u>	15	124
<u>INTERVALS</u>	14	153	<u>METHODOLOGY</u>	16	137	<u>CONSEQUENCE</u>	16	123
<u>CRITERION</u>	15	152	EXPLANATION	15	136	<u>EVALUATE</u>	15	122
ASSUMPTIONS	14	151	<u>NORMS</u>	12	136	<u>REGIME</u>	14	121
<u>INDICATING</u>	15	151	<u>LINK</u>	14	135	<u>CREATING</u>	13	120
DECISIONS	15	150	VEHICLES	11	135	<u>LINKED</u>	15	120
<u>EVALUATED</u>	14	150	<u>BRIEF</u>	11	134	<u>CHANNEL</u>	14	119
INNER	15	119	MOVEMENTS	14	111	USAGE	14	100
MAINTAINED	15	119	NEURAL	11	111	<u>DIMENSION</u>	13	100
<u>MINOR</u>	14	119	<u>ATTRIBUTED</u>	16	110	<u>NOTION</u>	15	99

<u>REMOVED</u>	16	119	<u>CODE</u>	14	110	<u>TECHNICAL</u>	16	99
<u>SIMULTANEOUSLY</u>	15	119	<u>THEREBY</u>	16	110	<u>AXIS</u>	15	99
<u>CONCLUDED</u>	16	118	<u>GENERATE</u>	16	109	<u>INVOLVE</u>	16	98
NUMEROUS	16	118	<u>ASSESSED</u>	15	108	ONLINE	13	98
<u>SUFFICIENT</u>	16	118	<u>CORRESPONDS</u>	15	108	<u>PROFILE</u>	13	98
<u>FOUNDATION</u>	15	117	<u>EXPLICITLY</u>	12	108	ESSENTIALLY	15	97
<u>LABORATORY</u>	16	116	<u>OBVIOUS</u>	16	108	<u>QUANTITATIVE</u>	15	97
<u>LOCATION</u>	16	116	<u>CONSIDERABLE</u>	16	107	<u>SELECT</u>	13	97
MEASURING	15	116	<u>ASSUMING</u>	16	106	<u>SOMEWHAT</u>	15	97
<u>REGULATION</u>	12	116	<u>MOTIVATION</u>	12	106	<u>TRANSITIONS</u>	8	97
<u>RELIABLE</u>	16	116	<u>PRINCIPAL</u>	16	106	<u>CONTRIBUTIONS</u>	15	96
DIFFER	16	115	REALIZED	14	105	<u>DIVERSE</u>	16	96
<u>REVEAL</u>	15	115	SEPARATION	16	105	<u>PARTNERS</u>	12	96
<u>SURVIVAL</u>	16	115	<u>EXPOSED</u>	13	104	<u>INTEGRATED</u>	15	96
<u>CONTRARY</u>	15	114	EXTENSIVE	15	103	<u>INTEGRATION</u>	15	96
<u>IMPLICATIONS</u>	14	114	<u>RANDOMLY</u>	16	103	<u>VARYING</u>	16	96
<u>ULTIMATE</u>	14	114	<u>DISPLAY</u>	13	102	VERTICAL	11	96
CLASSIFIED	16	113	<u>EMPHASIS</u>	14	102	<u>CAPTURE</u>	12	95
<u>EXPLICIT</u>	13	113	<u>ENHANCE</u>	15	102	<u>DURATION</u>	12	95
<u>INTERACT</u>	11	113	<u>PLOT</u>	13	102	EQUALLY	16	94
<u>CONTRIBUTION</u>	16	112	<u>VALID</u>	15	102	<u>IDENTICAL</u>	16	94
ELECTRONIC	14	112	<u>ASSIGNED</u>	16	101	<u>AFFECTS</u>	15	93
<u>IMPLIES</u>	14	112	<u>CATEGORY</u>	15	101	<u>INSTANCES</u>	13	93
<u>INHERENT</u>	15	112	<u>CONTACT</u>	14	101	<u>VARY</u>	15	93
INSTITUTE	15	112	<u>INITIALLY</u>	16	101	<u>DECADES</u>	16	92
<u>TOPIC</u>	14	112	VISION	14	101	<u>ILLUSTRATED</u>	15	92
<u>ENHANCED</u>	13	111	<u>REACTIONS</u>	14	100	RECOMMENDATIONS	12	92
FORMULATION	12	111	<u>TRANSFORMATION</u>	14	100	VARIED	16	92
<u>ZONE</u>	13	92	<u>SYMBOLS</u>	13	85	<u>RESTRICTED</u>	16	77
<u>ESTABLISH</u>	16	91	<u>BRIEFLY</u>	16	84	<u>INSTRUCT</u>	11	77

MOMENTS	12	91	<u>CONTEXTS</u>	14	84	ACCORDINGLY	16	76
<u>NEGATIVELY</u>	13	91	PARTIAL	16	84	<u>COLUMNS</u>	14	76
<u>POTENTIALLY</u>	15	91	<u>VARIATIONS</u>	15	84	<u>THESIS</u>	14	76
SUCCESSFULLY	16	91	<u>ANALYZE</u>	14	83	<u>ATTACHED</u>	14	75
<u>PARADIGM</u>	14	90	<u>CAPABLE</u>	16	83	<u>INTERPRETED</u>	15	75
APPARENT	14	89	<u>INSIGHTS</u>	15	83	<u>PORTION</u>	16	75
VALUABLE	16	89	<u>PUBLICATION</u>	16	82	<u>ILLUSTRATE</u>	14	74
<u>SUBSEQUENTLY</u>	14	88	TENDENCY	15	82	<u>OBVIOUSLY</u>	14	74
<u>ARGUMENTS</u>	12	87	<u>ULTIMATELY</u>	15	82	<u>PRECISELY</u>	14	74
<u>COMPUTED</u>	11	87	SUBSTANTIALLY	14	81	<u>SECTIONS</u>	16	74
<u>COUPLED</u>	13	87	<u>VARIABILITY</u>	11	81	<u>DISCOVERY</u>	14	73
<u>DECLINE</u>	13	87	<u>ASSESSMENTS</u>	13	80	<u>EDIT</u>	11	73
<u>INSTITUTIONAL</u>	11	87	<u>RESOLUTION</u>	14	79	<u>PERSPECTIVES</u>	13	73
<u>CONCLUDE</u>	16	86	<u>CONCENTRATED</u>	16	78	<u>COMPREHENSIVE</u>	14	72
<u>CIRCUMSTANCES</u>	15	85	<u>ISOLATION</u>	16	78	<u>DEFINES</u>	12	72
PARTIALLY	15	85	<u>VISIBLE</u>	15	78	<u>PROMINENT</u>	14	72
<u>SUPERIOR</u>	15	85	<u>INVESTIGATIONS</u>	16	77	<u>EXPERT</u>	8	72