

# 科技英语 结构与功能

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The Structure and  
Function of English  
for Science and Technology

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哈尔滨工程大学出版社

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## 前 言

《科技英语结构与功能》一书是编者们在多年英语科技文体教学基础上,参考了大量国内外最新有关资料编著而成。该书从交际功能观点出发介绍了特种用途英语(ESP)在不同阶段的发展状况,描述了科技英语语域特征及与日常英语在词汇、句式等表达方面的明显区别。本书着重选编和总结了在进行科技交际活动中常见的各种修辞功能,如定义、分类概括、例证、假设、比较对照、报导、描述和非言语表达手段,书后附有编者近年来在有关杂志发表的科技英语语篇分析论文,以利读者更好地了解和探讨语篇分析模式。

该书适用于英语专业大专院校学生及作为科技文体教材参考用书。由于编者水平有限,错误在所难免,欢迎同志们批评指正。

编 者

1998年6月

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# Chapter One

## The Origins and Development of ESP

### 1. An Overview of the Origins of ESP

According to Tom Hutchinson and Alan Waters, ESP was a phenomenon that grew out of a number of converging trends. We can identify three main reasons common to the emergence of all ESP.

#### 1.1 The Demands of a Brave New World

The end of Second World War in 1945 heralded an age of enormous and unprecedented expansion in scientific, technical and economic activity on an international scale. This expansion created a world unified and dominated by two forces — technology and commerce which soon generated a demand for an international language. This role fell to English.

The effect was to create a whole new mass of people wanting to learn English, not for the pleasure or prestige of knowing the language, but because English was the key to the international currencies of technology and commerce. As English became the accepted international language of technology and commerce, it created a new generation of learners who knew specifically why they were learning a language. For example, businessmen who wanted to sell their products, mechanics who had to read instruction manuals, doctors who need to keep up with development in the field and a whole range of students whose course of study included textbooks and journals only available in English. Since the mid 1950s, an increasing number of the former colonies have gained independence. Having achieved political independence, they are aware that they could not maintain and develop their independence without economic development. So the emerging third world began to embark on their new schemes to develop their own economy, esp. science and technology. They have to introduce advanced science and technology from developed countries. Learning English as a working tool becomes more and more important. The development of ESP was accelerated by the oil crisis of the early 1970s, which resulted in a massive flow of funds and Western expertise into the oil – rich countries. English suddenly became big business and commercial pressure began to exert an influence. The general effect of all this development was to exert pressure on the language teaching profession to deliver the required goods. Whereas English had previously decided its own destiny, it now became subject to the wishes, needs and demands of people other than English teachers.

#### 1.2 A Revolution in Linguistics

At the same time as the demand was growing for English courses tailored to specific

needs, influential new ideas began to emerge in the study of language.

Traditionally the aim of linguists had been to describe the rules of English usage, that is, the grammar. However, the new studies shifted attention away from defining the formal features of language usage to discovering the ways in which language is actually used in real communication ( Widdowson 1978). One finding of this research was the language we speak and write varies considerably, and in a number of different ways, from one context to another. In English language teaching, this gave rise to the view that there are important differences between the English of commerce and that of engineering.

These ideas married up naturally with the development of English courses for specific groups of learners. The idea was simple if language varies from one situation of use to another, it would be possible to determine the features of specific situations and then make these features the basis of the learner's course.

### 1.3 Focus on the Learner

New development in educational psychology also contributed to the rise of ESP by emphasizing the central importance of the learners and their attitudes to learning. Learners were seen to have different needs and interests, which would have an important influence on their motivation to learn and therefore on the effectiveness of their learning. This lent support to the development of courses in which relevance to the learners needs and interests was paramount. The growth of ESP, then, was brought about by a combination of three important factors: the expansion of demand for English to suit particular needs and development in the fields of linguistics and educational psychology.

## 2. The Definition of ESP/EST

English for Science and Technology is a functional varying style. It is a scientific and technological register formed by scientists and technicians to meet the needs of scientific communication. From the point of a register view, we can say that English for Science and Technology(EST) is the register of science and technology for modern English. It is a language used by the scientists and technicians in a special situation. While ESP stood for English for specific purpose. Many writers have attempted a definition of ESP and we will look at a few of the most helpful definitions.

### Quotations from Mackay

ESP is generally used to refer to the teaching or learning of a foreign language for a clearly utilitarian purpose. It is generally conceived of as clear aims and successful performance in work in which the English language plays an auxiliary role. Thus by ESP is meant the teaching of English not as an end in itself but as an essential means to a clearly identifiable goal.

Another definition of ESP is given by Munby. Munby's communication syllabus design gives an exhausted list of micro - skills and micro - function, from which a selection can be

made after the analysis of communication needs of the learners.

Robison described in full length ESP as:

In conclusion we may say that ESP course is purposeful and is aimed at the successful performance of occupational or educational roles. Any ESP course may differ from another in its selection of skills, topic situations and functions and also languages.

Tom Hutchinson and Alan Waters gave the definition of ESP as follows:

ESP is a kind of teaching based on designing courses to meet the learners' need. ESP, like any form of language teaching, primarily concerned with learning. ESP has paid scant attention to the question of how people learn, focussing instead on the question of what people learn. It has, in other words, been language – centered approach. It has provided some very important insights into the nature of specific language needs.

How many faces of ESP/EST

ESP (English for Specific Purpose) has emerged as a branch of English language study. Mackay and Mountford suggest ESP consists of

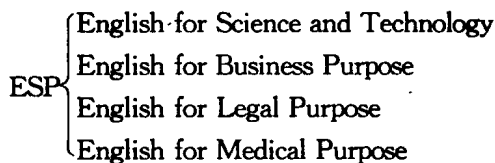


English for Academic Purposes is defined with reference to the study skills necessary for some academic or professional course of study. It may be necessary to a student following scientific courses and lectures through the medium of English practicing in note – taking and mastering the language appropriate to seminar discussion.

English for Occupational Purposes is defined with reference to some occupational requirements, e. g. for international telephone operators, international air traffic controllers, international commerce, railway, tourism, computer programs.

English for Vocational Purposes is defined with reference to vocational training programs, e. g. for hotel and catering staff, technical trade, etc.

There are other attempts to draw up a classification for different branches of ESP. We can cut the cake in another way, for example, according to disciplines or subject matter.



We can further sub – divide a particular discipline in the light of delicacy of analysis.





- C. following and taking notes on lectures
- D. carrying out and writing up experiments
- E. writing examination questions
- F. answering examination questions
- G. writing technical reports
- H. taking part in seminars and tutorial
- I. using technical manuals and other instructional literature

The previous paragraphs give three separate ways of looking at EST, but of course they are all interrelated.

### 3. The Development of ESP

From its early beginning in the 1960s, ESP has undergone three main phases of development. It is now in a fourth phase with a fifth phase starting to emerge. It should be pointed out first of all that ESP is not a monolithic universal phenomenon. ESP has developed at different speeds in different countries.

ESP has now gone through three stages.

#### 3.1 Pre – 1960 Traditional Attitude towards ESP

The traditional view took language learning as a subject. From the late 1940s to the early 1950s the influence of literature dominated a period when it was still believed that English should be taught through literature humanities. The approach to language teaching and language learning was a literary one. Though in the science class, scientific prose was assigned as the very stuff to be read and digested in the process of becoming scientists. However, in the language class, students had to learn classical literature irrelevant to their professional and interest.

Scientific writing was severely criticized as a stylistically poor use of language. There are so many words in the vocabulary of science which are ugly. Language teachers kept to their traditional way of explaining grammar and interpreting the quality of the reading texts. To many, scientific English was not different from general English except for its historic vocabulary and its needlessly complicated and specialized and passive way of saying things. In sum, people ignored the existence of EST all together. They drew a simple formula like this:

$$\text{EST} = \text{General English Grammar} + \text{Technical Words}$$

They thought they would understand EST by simply mixing grammar with some of technical words. During the first stage of the development of ESP, linguistics was unheard of or even if heard, unworthy of consideration. So it was called pre – linguistic, that is not influenced by any particular theories of linguistics.

#### 3.2 1960s Register Analysis

As we have mentioned in the background of ESP, the development of ESP has something to do with the changing requirements of English learning and Halliday's work on regis-

ter analysis. Beginning in the early 1960s there was a significant move away from the traditional point of view. As Brumfit observes:

ESP is indebted to the tradition of analysis of register. Register is defined as a variety of language according to use. And it becomes a highly popular idea among many British linguists. They were aware that EST presents linguistic varieties with its own characteristic features. Some typical sentence patterns and a large number of technical terms and semi-technical words make EST different to a very wide extent from ordinary English.

EST was established as a variety of English. Lee Kok Cheong divides register analysis into two stages:

Firstly the analysis of the lexicon ; considering in particular the frequency of occurrence of items and the presence or absence of items, and secondly the study of the syntax as for example by Barber.

The article written by Barber clearly demonstrates that the descriptive technique of modern linguistics as most influentially represented in the linguistic schema by Halliday, could be successfully applied to the language of science and technology. The concept of register analysis was important to describe this largely structural and lexical analysis of scientific style.

A course in basic scientific English developed in Chile by Ewer and Latorre (1969) is an excellent example of this; the notion of frequency of syntactic and lexical items was considered as of great significance.

### 3.2.1 lexicon

The study of the lexicon of scientific writing has been conducted generally on three levels.

A. ordinary language (non-technical)

B. scientific language

C. (sub or semi) technical language

### 3.2.2 syntax

Huddleson set out to investigate a group of primary data comprising some 135,000 words of written EST (twenty-seven texts, each about of 5,000 words). He selected texts from different levels and took a framework of analysis on the basis of structure or grammar. The items they studied included interrogatives imperatives modals. In all, registers analysis has tended to focus attention on the incidence of formal features such as the passive, relative clause, together with specialist vocabulary. Their work was heavily structures-based and did little to characterize scientific discourse as communication.

## 3.3 Discourse analysis

Then comes the present stage, discourse analysis may refer to a stretch of language either spoken or written, analysis of which will consider aspects of sentence connectives or cohesion. Widdowson has suggested that we have to distinguish between discourse analysis and text analysis. If we view a stretch of language as an exemplification of the structure of lan-

guage especial of devices to indicate structuring about the level of the sentence, it may be called text analysis. Viewing a stretch of languages as a unique piece of communication is discourse analysis. For example, in Halliday's work, text refers to the way language makes link with itself in a neat way of describing the formal devices that glue a text together. Halliday and Hasan list the following principal elements of cohesion reference, substitution, ellipsis, conjunction, lexical cohesion, etc. Here we won't go in detail on the text analysis.

Discourse analysis is engaged in the functional use, the identification of rhetorical functions in any given texts or groups of texts, communicative use. The present registers analys, discourse analysis, need analysis and communicative language teaching are the several stages of developing and creation at different stages.

## Chapter Two

### Features of EST

#### 1. EST Vocabulary

EST exhibits its own various characteristic lexical features. It is generally accepted (assumed) that EST vocabulary can be divided into three categories. The study of the lexicon of scientific and technical writing has been conducted on three levels.

- A. technical words
- B. semi – technical words
- C. non – technical words, including functional words

The distinction between technical and semi – technical words was essentially instinctively determined, because there is no clear definition of these words or a demarcation between them.

Technical words are highly specialized vocabularies with precise narrow meaning used for a given scientific discipline. They denote the phenomena, process, characteristics, relation, state, amount, and degree etc. In the field of science and technology. Every subject has its own set of highly technical terms which are intrinsic part of the learning of the discipline itself.

Sub – technical words are defined as context – independent words which occur with high frequency across discipline, such as inference, stimulate, isolate, function. Semi – technical words can be seen both in EST and ordinary English. However, the meaning of these words in their technical use are likely to differ from their non – technical meaning. Although they are common to all scientific disciplines. They may have different precise meanings in different technical fields.

The following statistics regarding the number and percentage of TW, STW and functional words were obtained.

The ten words on the list. . . . .

All ten words occur in all ten fields. They represent approximately 25 per cent of the total sample. The ten most frequently occurring sub – technical words are:

Table 2 – 1

Position	Word	No. of Occurrence
33	high	292
34	system	288
40	result	265
43	process	241
47	function	227
51	form	213
55	temperature	195
57	large	193
58	solution	193
62	structure	182

The technical words appear quite far down on the list

Table 2 – 2

Position	Word	No. of Occurrence
121	neutron	132
162	oxide	106
194	DNA	91
195	nuclear	101

All ten STW occurred in all ten fields.

But the occurrence of items was fairly limited across the discipline.

#### Conclusion

The result clearly indicates it is ST vocabulary that should be focused on in EST. These words have more different meanings in EST than in GE. (general English)

Technical vocabulary occurred for about 20%. It has concrete nature and one – to – one correspondence to term in the students native language. TW (technical word) do not present a great language problem. They can be learned through the discipline itself.

#### Examples:

	GE	EST
Resistance	An act of resisting opposition	the power of a substance to resist the passing of an electric current through it
conductor	a person who directs the playing of a group of musicians; a person who collects fares from passengers	a substance that readily acts as path for electricity
energy	the quality of being full of life and action	the power which does work and drives machine
mass	lump quantity of matter	amount of material in a body measured

	without regular shape	by the power used in changing its movement
bolt	strength, physical power	measurements of a power that changes or may produce changes of movement in a body on which it acts or presses
work	activity	force multiplied by distance

## 2. Features of EST Vocabulary

### 2.1 As EST is a formal written style, formal words are preferred.

Colloquial, spoken words, slangs are rarely occurring. EST writers tend to use 'absorb' in place of 'take in', 'ignite' instead of 'catch fire', 'approximately to' instead of 'about'.

EST	GE
accomplish	do
acquire	get
additional	extra
anticipate	expect
assistant	help
application	use
attempt	try
commence	start, begin
concerning	about
construct	build
consequently	so
convert	change
demonstrate	show
disperse	scatter
develop	grow
object	thing
state	condition
remainder	rest
however	but
illustrate	show
inferior	not as good as
in addition to	as well as
in the absence of	without
therefore/thus	so
over	more than

nowadays	today
frequently	often
elevate	raise
equal	same
ancient	old
certain	some
tiny	very small
superior	better than
as a general rule	usually
at a high rate	quickly
at a distance	far away

**2.2 Scientists and engineers are likely to substitute one word equivalents for less technical verbs or phrases in order that the conciseness of the writing is obtained.**

One word is used instead of the phrasal verbs.

EST	GE
emit	give off
discover	find out
remove	take out
emerge	come out
absorb	take in
eliminate	get rid of
repel	push away
insert	put in
transmit	pass on
exhaust	use up
derive	come from
combine	join together
consume	burn up, use up
displace	push aside
ignite	set fire to
extinguish	put out
escape	get away
accelerate	speed up
decompose	break down
suspend	hang about
penetrate	pass through
extract	take out
determine	find out



add

put in

A. Such formal verbs make the writing more dignified.

The bridge was constructed (built) over a period of 6 years.

B. More accurate

It was necessary to augment the existing facilities.

(augment ; increase and improve)

C. More concise

When water is boiled, it evaporates. (evaporates ; turn into vapor)

**2.3 Another aspect of EST vocabulary is the presence of a great number of Greek and Latin roots and affixes, such as aqua - , zoo - , pre - , - ice and so forth. A large portion of English words especially those used in EST are formed by adding their prefixes and suffixes.**

We can often detect the meaning if we know the meaning of the Latin or Greek prefixes. Many items of EST vocabulary both technical and semi - technical are made up of a root plus a suffix or prefix deriving from Greek and Latin such as mono - , neo - , hyper - , -logy, - meter.

derma -      refers to the skin

- itis              means inflammation

so, dermatitis skin inflammation

Other examples: tonsillitis, bronchitis, appendicitis, meningitis

some prefixes and suffixes

hyper - (over)

hypertension

hypo - (below)

hypothesis

di - (two)

diode

tri - (three)

triangle

tele - (far away)

telescope

poly - (many)

polyvinyl

photo - (light)

photosphere

micro - (small)

microphone

ultra - (to an usually high degree)

superheated

holo - (completely oneself)

holograph

inter - (between, among)

interface intersection

count - (against, opposite to)

countershaft counterpoise

sub - (beneath less than)

subsoil subspecies

- ics(subject)

dynamics

- itis(inflammation)

arthritis hepatitis

- cle(small)

particle

- logy(subject)

anthropology

- ism(action or result of action)

mechanism