

English for Science and Technology

A discourse approach

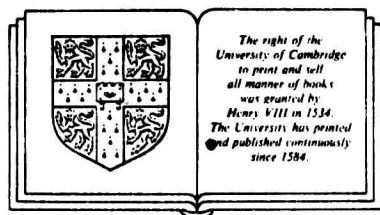
Louis Trimble

English for Science and Technology

A discourse approach

Louis Trimble

Professor Emeritus
University of Washington, Seattle



Cambridge University Press
Cambridge
London New York New Rochelle
Melbourne Sydney

Published by the Press Syndicate of the University of Cambridge
The Pitt Building, Trumpington Street, Cambridge CB2 1RP
32 East 57th Street, New York, NY 10022, USA
10 Stamford Road, Oakleigh, Melbourne 3166, Australia

© Cambridge University Press 1985

First published 1985

Printed in Great Britain at The Bath Press, Avon

Library of Congress catalogue card number: 85-4210

British Library cataloguing in publication data

Trimble, Louis

English for science and technology: a discourse
approach. – (Cambridge language teaching library)

1. English language – Text-books for foreign
speakers

I. Title

428.2'4'0245 PE1128

ISBN 0 521 25511 2 hard covers

ISBN 0 521 27519 9 paperback

English for Science and Technology

CAMBRIDGE LANGUAGE TEACHING LIBRARY

A series of authoritative books on subjects of central importance for all language teachers.

In this series:

Teaching the Spoken Language: an approach based on the analysis of conversational English by Gillian Brown and George Yule

Communicative Methodology in Language Teaching: the roles of fluency and accuracy by Christopher Brumfit

Foreign and Second Language Learning: language-acquisition research and its implications for the classroom by William Littlewood

A Foundation Course for Language Teachers by Tom McArthur

The Context of Language Teaching by Jack C. Richards

Communicating Naturally in a Second Language: theory and practice in language teaching by Wilga M. Rivers

Speaking in Many Tongues: essays in foreign language teaching by Wilga M. Rivers

Teaching and Learning Languages by Earl W. Stevick

English for Science and Technology: a discourse approach by Louis Trimble

Acknowledgements

The author and publishers would like to thank the following for permission to reproduce material:

Cascade Corporation: examples 6.23 and 7.17; John Fluke Manufacturing Co. Inc.: examples 7.11 and 7.12; Harper & Row Inc.: examples 4.4. and 7.19; Honeywell Marine Systems Division Inc.: example 6.9.

Contents

1	Introduction	1
1.1	A bit of background	1
1.2	Some terminology	3
1.3	How to use this book	4
2	Orientation	5
2.1	What EST is	5
2.2	Approach	6
2.3	Organization	8
3	The rhetoric of EST discourse	10
3.1	Introduction	10
3.2	Basic premises	14
3.2.1	The EST paragraph	14
3.2.2	Rhetorical techniques	18
3.2.3	Rhetorical functions	19
4	The individualizing process	22
4.1	Introduction	22
4.2	Individualization: a definition	23
4.3	Determining class make-up	24
4.4	Parallelism	25
4.5	Types of texts	27
4.5.1	'Genuine' materials	27
4.5.2	Adapted materials	33
4.5.3	Synthesized and created materials	38
4.6	Individualizing: examples	41
5	The paragraph in EST	44
5.1	Introduction	44
5.2	The EST paragraph	45
5.3	Application	51
6	The rhetorical techniques	52
6.1	Introduction	52
6.2	Natural patterns	54
6.2.1	Time order	54
6.2.2	Space order	57
6.2.3	Causality and result	58

Contents

6.3	Logical patterns	59
6.4	Application	65
7	The rhetorical functions	69
7.1	Introduction	69
7.2	The rhetoric of description	71
7.2.1	Physical description	71
7.2.2	Function description	71
7.2.3	Process description	72
7.3	The rhetoric of definition	75
7.3.1	Formal definition	75
7.3.2	Semi-formal definition	77
7.3.3	Non-formal definition	78
7.3.4	Complex definition	81
7.4	The rhetoric of classification	85
7.4.1	Complete classification	86
7.4.2	Partial classification	89
7.4.3	Implicit classification	90
7.4.4	Classification as a process	93
7.5	The rhetoric of instructions	95
7.5.1	Nature of the discourse of instructions	96
7.5.2	Teaching the rhetoric of instructions	98
7.6	The rhetoric of visual-verbal relationships	102
7.6.1	Examples of types of visual-verbal relationships	103
8	Rhetorical-grammatical relationships	114
8.1	Introduction	114
8.2	Passive-stative distinctions	115
8.3	Modal use in the rhetoric of instructions	119
8.4	Problems with the definite article	121
8.5	Non-temporal use of tense	123
8.5.1	Description of apparatus	124
8.5.2	Visual aids	125
8.5.3	Reference to previous research	126
8.5.4	Application	127
9	Lexical problems in EST discourse	128
9.1	Introduction	128
9.2	Sub-technical vocabulary	128
9.3	Noun compounds	130
9.4	Application	135
10	Teaching the rhetorical process	137
10.1	Introduction	137
10.2	Course pattern	138
10.3	The rhetorical approach: preliminary remarks	141
10.4	Teaching the paragraph	142
10.5	Teaching the rhetorical techniques	144

10.6	Teaching the rhetorical functions	146
10.6.1	Description	148
10.6.2	Definition	150
10.6.3	Classification	152
	Partition	155
10.6.4	Instructions	156
10.6.5	Visual-verbal relationships	158
10.7	Teaching the rhetorical-grammatical relationships	161
10.8	Teaching the lexical elements	163
10.9	Controlling writing assignments	165
10.10	Conclusion	170

Notes	171
--------------	-----

Further reading	175
------------------------	-----

Index	179
--------------	-----

1 Introduction

1.1 A bit of background

This book has grown out of research into the characteristics of written scientific and technical English (EST) and out of teaching the findings of this research to non-native students. Although over the years the majority of students have been at university level (primarily engineering and science undergraduates and postgraduates), work has also been carried on with a wider range of non-native learners – from those in vocational training and those at secondary level to those taking pre-university preparation.

We began our study of written EST discourse in 1967 at the University of Washington (Seattle). In this book I use 'we', 'our', 'us', etc. because from the beginning there have been at least two of us working together. Originally, Larry Selinker¹ and I began teaching specialized courses for non-native undergraduate engineering students. We very quickly realized that before we could adequately teach the English of science and technology we had to learn something about it. Our research began with an effort to determine the essential nature of scientific and technical English by finding its major characteristics and where it differed (if it did) from other forms of written English. Initially we brought in two postgraduate students studying for their doctorates: John Lackstrom² in linguistics and Robert Vroman³ in Germanics. Later we were joined by another doctoral candidate in linguistics, Thomas Huckin.⁴ The results of our work during this period can be seen from the initial entries in the last section of 'Further reading', pp. 176–8 below.

In 1974 Mary Todd Trimble joined Larry Selinker and me, and after his departure she and I carried on the research and teaching together. The most important shift in emphasis at this time was our moving away from wholly academic EST discourse and applying the rigorous investigative techniques we had developed to occupational English; that is, to materials for a readership ranging from vocational trainees to skilled technicians. From the very beginning of this shift, Mary Todd Trimble was (and remains) the force behind the application of our principles to the several levels at which EST discourse can be researched and taught. The 'we', 'us', 'our', etc. thus refer to those who helped establish our approach

to the field and to the still functioning team of Mary Todd Trimble and myself.

In developing the results of our research into teachable classroom materials, we created terms and gave special meanings to already existing ones. For example, insofar as we have been able to determine, Larry Selinker originated the term *EST* to mean 'the written discourse of scientific and technical English'. Before this, we had tried various abbreviated forms, primarily *STE*, but all seemed to call for additional terminology: 'written *STE*', '*STE* discourse', and so on. However, since the term *EST* became part of the currency of ESL/EFL/ELT, its meaning has broadened until now for many it means 'the field of English for science and technology'; thus it includes oral as well as written discourse.

An example of giving special meanings to already existing terms is the word 'discourse' (already used three times above). Here 'discourse' means a collection of connected language units – such as sentences and paragraphs – that together make up a coherent, cohesive text. We began our work on the assumption that from the point of view of use, language must be studied beyond the level of the isolated sentence. We think, then, in terms of units of text, with the paragraph being the most easily and usefully analyzable such unit.

Thus, when we say that we are presenting a discourse approach to *EST*, we are taking a short-cut way of saying that we are discussing the teaching of those special characteristics of scientific and technical texts written in English – those characteristics that make scientific and technical English writing different from other forms of written English discourse. A word of caution: 'different' here means 'different in degree' not 'different in kind'.

To sum up, in this book we use the term '*EST*' in its earlier sense, as a cover term for the *written* discourse of English for science and technology. Also, we use 'discourse' with the somewhat restricted meaning given it above.

As our research gave us greater insight into the nature of scientific and technical discourse, our teaching changed to take the new information into account. Originally we designed the curriculum for non-native undergraduate engineering students who were advanced both in their use of English and in their subject matter. Later, we broadened the curriculum to include any interested non-native student working in a scientific or technical field. In the last few years of our work at the university, native students taking advanced degrees in teaching English as a second/foreign language (TESL) used our courses as a laboratory. They would sit in on the discussions and workshops and tutor those students who felt the need for special assistance. Each of these changes required us to broaden our research to take the new needs into consideration and to shift our teaching emphasis by broadening this as well.

When we began, we limited our research to what we have called the 'rhetorical techniques' and the three 'rhetorical functions' of *definition*, *classification*, and *description*. As our teaching and research developed, we added the rhetorical functions of instructions and visual-verbal relationships, refined our list of rhetorical techniques, and developed the notion of the 'conceptual' paragraph. Finally, we integrated into our approach the rhetorical – grammatical relationships we found to be most important – and most difficult – for the non-native learner, and we began research on troublesome lexical elements.

There are, of course, several areas of written EST discourse that we have not yet begun to work with. Among these are the rhetoric of introduction and conclusions, and of hypothesizing and argumentation. These and others not mentioned here are clearly fruitful areas for researchers and teachers to work on. Two areas in which research has begun but in which more is needed are treated in chapter 8: 'Tense shifts in the rhetoric of visual-verbal relationships', specifically in the text for a given visual, and tense shifts in the rhetoric of background information. Both of these are important areas of EST discourse, particularly for the more advanced learner.

While these shifts in emphasis had a strong effect on our teaching methodology, they did not alter our basic approach. Early in our work we developed what we call the 'rhetorical approach' to both our research and our teaching. As we refined our research techniques and our teaching methodology, we found more and more support for this approach. Even today we find that in presenting our work at conferences and seminars, in preparing specialist teaching materials, and in furthering our research the rhetorical approach is still a valid and viable instrument. Its continuing use by others in the fields of teaching, materials preparation, and new areas of EST research also indicates that this approach is relevant to today's developing EST needs.

Much of the work described in this book was carried out in the United States, primarily at the University of Washington. The approach, modified as necessary, has also been used in vocational and survival English courses in the United States and has been tested in university, secondary, and vocational classrooms in many countries around the world.

1.2 Some terminology

In addition to 'discourse', I have used another word to which we apply a special meaning: the word 'rhetorical'. This, and its companion 'rhetoric', are defined in chapter 3, along with a detailed examination of the concept 'rhetorical approach'. Here, however, it might be profitable to

Introduction

note that the term 'rhetoric' refers both to organization and to content. 'Rhetoric' is not a substitute for the term 'discourse'; rather it is one part of the concept of discourse. While in our usage both rhetoric and discourse refer to the presentation of information in written (not oral) form, they are not synonymous terms.

1.3 How to use this book

For those who wish to apply this book quickly to their teaching without having to go through the entire text here is a suggested procedure. To get an orientation to the 'rhetorical process', skim through chapters 6 and 7 and then work more slowly through chapter 10. Both chapters 6 and 7 are designed to be used for references and can thus be profitably referred back to whenever necessary. This is especially true of chapter 7. It is somewhat longer than the other chapters in the book because it develops in detail the most essential elements of the rhetorical approach – the rhetorical functions – and is thus the central feature of the book, and also because of the many examples used to illustrate these functions. These examples, along with all the others in the book, serve two purposes: to help clarify the rhetorical points being made; and to provide material that can be used in all types of EST classrooms. Referring back to chapters 6 and 7 will be found an especially useful technique when working through chapter 10, which presents a step-by-step procedure for teaching an EST course.

2 Orientation

2.1 What EST Is

The 'Spectrum' (chart 2.1) shows the way in which we conceive EST discourse: it covers that area of written English that extends from the 'peer' writing of scientists and technically oriented professionals to the writing aimed at skilled technicians. In between are shown several of the types of instructional discourse that can be thought of as intermediate between the two extremes.

Peer writing is exemplified by books and articles written by experts in one field for other experts in the same field or for experts in a related field. Skilled technicians are those who differ from engineers in the same field only in that they (sometimes) lack equivalent training in theory. 'Learning texts' and 'Basic instruction' refer primarily to teaching texts although they can include supplementary reading on various levels of difficulty, including journals such as *Scientific American* and do-it-yourself publications for the layman.

A linear spectrum such as this suggests a clear-cut distinction between English for Academic Purposes (EAP) on the one side and English for Occupational Purposes (EOP) on the other. However, a good deal of overlap exists between the two: an electronics engineer and a skilled electronics technician, for example, have a good deal of the same technical language in common and both may rely on the same service manuals for much of their work in the laboratory. At the same time there will be many discourse units they do not share – the engineer will make use of theoretically oriented texts often heavily laced with quite abstruse mathematics, while the technician will have no reason to consult these types of texts. Further, the engineer will read journals that are of interest to him but would not be to most technicians. Similarly, the technician will often deal with manuals of little interest or use to the engineer. Whatever the differences between those operating at either end of the spectrum, neither end is 'better'; each simply represents written EST discourse with some (but hardly all!) different characteristics.

Such differences exist in most scientific and technical fields. One possible perspective on these differences can be seen in chart 2.2, which shows one possible breakdown of academic and occupational fields. The

Orientation

lists shown here are intended to be representative rather than all inclusive. Although 'General English' is set off as quite separate from the other 'kinds' of English, it is, of course, the mainstay of all fields, whatever the purpose for which the language is used.

In sum, EST covers the areas of English written for academic and professional purposes and of English written for occupational (and vocational) purposes, including the often informally written discourse found in trade journals and in scientific and technical materials written for the layman.

CHART 2.1 SPECTRUM OF TYPES OF DISCOURSE

Peer writing	Learning texts				Basic instruction	Technician writing
	Advanced	Intermediate	Elementary			

CHART 2.2 ONE POSSIBLE BREAKDOWN OF ESP/EST FIELDS

<i>English for Academic Purposes</i>		<i>English for Occupational Purposes</i>
<i>General English</i>	<i>EST fields</i>	<i>EST occupations</i>
	Engineering	Engineering technicians
	Forestry	Laboratory technicians
	Computer sciences	Mechanics
	Electronics	Electricians
	Mining	Plumbers
	Medicine	Computer operators
	Dietetics	Etc.
	Nursing	
	Etc.	

2.2 Approach

While the approach described in this book was originally developed for particular groups of students in academic environments and our early published research was directed at the EST teacher who is in a university or an institute of technology, the principles presented are applicable to a considerably wider spectrum of non-native learners and to other types of teaching institutions.

Both our subsequent research and the successful application of our approach by teachers faced with students less academically oriented than ours suggested to us that the principles of the rhetorical approach are

applicable to a much wider range of users than we had originally envisaged. Later research and application, not only by us but by colleagues in several parts of the world, have shown that by modifying the course design to suit the circumstances (types of students, course purpose, environment, etc.) the concepts presented in this book can be applied not just in courses designed for academic and vocationally oriented EST students but also in those designed for professionals in industry, for journeyman technicians, for technical writers – in fact, for anyone concerned with reading and writing scientific and technical English.

As noted in section 1.3 above, the examples have been chosen for use with more than just the academic student. Only a few of the examples have been taken from highly technical sources; the majority have been chosen to illustrate the entire spectrum of EST discourse. Also, some are not examples of EST *per se* but are about EST. As the later discussion of 'parallelism' (section 4.4) points out, since the purpose of most examples used in the EST classroom is to demonstrate the rhetorical features of EST discourse, those taken from general rather than specific EST discourse are that much more functional in the learning process. The majority of the examples in this book were chosen for just this reason. Further, I have not made 'age' a criterion. The most recently written pieces of discourse are not always those that best illustrate particular rhetorical features; therefore, I have included examples from the 1960s and 1970s and even one from the late 1950s. A comparison of examples will show that the rhetorical features of EST discourse have not changed in the last twenty-odd years.

The students taking a course similar to that outlined in this book are assumed to be fairly advanced in English. Unfortunately, this does not mean that all students are equal in all of the language skills. As teachers we can be faced with students well advanced in, let us say, three of the skills but woefully weak in the fourth: in our experience it is common for students to be fluent in oral production, to have a high level of comprehension in both listening and reading, and yet not be able to write adequately, especially at the level that their scientific and technical studies demand. A similar pattern often exists in respect to the students' technical knowledge. When classes are formed only on the basis of language ability, we can find ourselves with students ranging from rank beginners to experts in their professional fields: we seldom find a truly homogeneous group – either in language or in technical subject matter – in any given class. As a rule we find ourselves working not only with students representing broad ranges of language ability and of technical subject matter but also representing equally broad ranges of personal and subject-matter interests. (It is worth noting here that student interests, for example, hobbies, music, sports, etc., are not always even related to their fields of professional interest.)

Orientation

In schools that train students for vocational or occupational purposes, a homogeneous class is much more probable: an entire group may, for example, consist of electronic trainees or potential welders. This book, however, assumes that any class the teacher faces will be more heterogeneous than homogeneous in all three areas of language ability, subject-matter knowledge, and personal and subject-matter interest; for this reason, the examples and discussion are oriented toward a 'general' group of students of science and/or of technology rather than those representing any single, specific field of study. (For a detailed discussion of how to work with heterogeneous classes, see especially chapter 4.)

While this book is oriented mainly toward reading skills, it also considers both writing and oral practice. As we will see in the 'Application' sections of the chapters dealing with the basic elements of the rhetorical process (and in more detail in chapter 10), writing can be taught by having the students transfer the strategies developed in analyzing EST discourse from 'reception' to 'production'. We meet this analysis process in chapters 5, 6 and 7, where it is discussed primarily in relation to improving the non-native learner's reading speed and comprehension. It is also treated in chapter 4 when we consider the individualizing process.

Oral production is not discussed directly in this book. However, as a basic step in the rhetorical process is the frequent interchange between teacher and students during the discussion sessions, a good deal of oral work takes place on a non-formal basis. Since the immediate concern of the students during a given class is the material being analyzed and since they are able to identify much of this material as relating to their fields of study (thus giving it a feeling of 'genuineness'), the oral element is, in this environment, authentic. In our experience, the majority of students feel that they are discussing matters similar to those discussed in their technical classes. The result is, then, that we have a 'real' oral situation rather than a contrived one.

2.3 Organization

The body of this book is organized to reflect the patterns of presentation that we devised for our university-level courses. This pattern will be found beginning with chapter 5, which treats the EST paragraph in detail. Chapter 3 provides an overview of our discourse (rhetorical) approach by introducing the basic rhetorical concepts and by defining and exemplifying them in order to orient the reader toward the more detailed presentations later. Chapter 3 also introduces the basic unit of rhetorical analysis, the EST paragraph, and it outlines the rhetorical techniques and the rhetorical functions that play the dominant roles in the analysis process.