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Content-based instruction in Electrical Engineering: Collecting, organising, and utilising data

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1 The full title of my presentation could actually read as follows “Content-based language instruction in Electrical Engineering in a French-speaking environment: Collecting, organising, and utilising Data”. The object of analysis is indeed not electrical engineering; yet the subject area will be my central concern.

2 Thus after a brief introduction about the current views on content-based instruction as related to English for Specific Purposes (ESP), and a definition of electrical engineering, I shall develop the rationale: teachers of English in technological settings, who have rarely had any training in English for Science and Technology (EST), need user-friendly resources, e.g., data banks, where they can tap into up-to-date information about their students’ content areas easily.

3 The first part of my presentation will deal with the way some documents were collected, the second part with the way they were organised and a computer application was created. In the third part, I shall give examples of how these documents can be put to use and how links can be created among learners, content and language teachers.

Collecting documents

4 My basic assumption is that the knowledge of the learners’ field influences the behaviour of the practitioner in his or her teaching acts. According to Hutchinson and Waters:

   ESP teachers do not need to learn specialist subject knowledge. They require three things only:
   i) a positive attitude towards the ESP content;
   ii) a knowledge of the fundamental principles of the subject area;
   iii) an awareness of how much they probably already know. (1987: 163)

5 Robinson, in her chapter on the role of the ESP teacher, gives an overview of the “conflicting viewpoints about the qualifications and capabilities needed by the ESP teacher” and considers the degree to which the teacher should be knowledgeable about the students’ specialism” (1991: 79). One of the aspects she underlines is the influence the knowledge of the students’ field has on the practitioner’s confidence (1991: 86).

6 Starting from that assumption, I decided to investigate my field from the content area teaching point of view. In ESP, content and language teaching have always been closely related. As Flowerdew points out

   One way of viewing content-based instruction is as a logical extension of English for Specific Purposes. [...] ESP, in common with content-based approaches, has traditionally exploited content texts (both written and oral) and activities as part of the language curriculum. (1993: 123)

7 Content-based instruction seems to be the continuation of what was called language across the curriculum developed in the mid-seventies. The idea of integrating language and content in English as a second, or foreign language (ESL/EFL), certainly draws from tertiary programs in ESP (see Widdowson 1978). Crandall and Tucker add the element of academic language in their definition

   Content-based language instruction is an integrated approach to language instruction drawing topics, texts, and tasks from content or subject matter classes,
but focusing on the cognitive, academic language skills required to participate effectively in content instruction. (1989: 83)

Of the three models for content-based instruction that were defined by Brinton, Snow, and Wesche —theme-based, sheltered and adjunct— only the last two fit the ESP model, the first model being found in elementary and secondary settings, where the ESL instructor teaches both content and language.

The sheltered model, which is aimed at non-native speakers and stresses content only, is being used in some French institutions, for instance engineering schools (see Attal & Mémet 1993). As for the adjunct model, where a regular content course is paired with a language course, it is sometimes referred to as “team teaching”, as exemplified by Johns and Dudley-Evans (1985) who seem to see the term content-based instruction as “an alternative U.S. term for ESP” (Flowerdew 1992: 124).

Mohan adds another dimension to the concept of integration of language and content (ILC). In his “systematic review” of ILC (Mohan 1990), he advocates the use of content schemata which facilitate comprehension. Of course, learning strategies —metacognitive, cognitive and social-affective— are to be used with Limited English Proficiency (LEP) students, the term which has now superseded the word “sheltered”.

French practitioners, in two-year colleges especially, have been following the task-based path opened by Roe in the eighties (Roe 1981); their approach has been dubbed the “multidisciplinarity” approach. The notion of collaboration between language and content teachers has been at the core of their teaching as numerous articles published in French LSP journals testify (see Mémet 1995).

**Electrical engineering**

My own field encompasses electrical engineering (EE), a subject area which I would like to define briefly before broaching the subject of ESP materials. The concept of mathematics is easy for a literary mind to grasp; defining the semantic or conceptual field covered by the signifier “electrical engineering” is not such an easy task, as electrical engineering is not a core science.

One definition from the *Encyclopedia of Electronics* is as follows

> Electrical engineering is the study of the application of physical and mathematical skills to the solving of electrical problems. [...] Electrical engineering has become synonymous with electronic engineering in recent years. (Gibilisco 1985: 307)

A diagram can illustrate the definition, showing electrical engineering in relation to core sciences —physics and mathematics—, as applied to electrical phenomena, and their main applications: electrical machines, circuits and components, signals and systems, computer systems technology, and television and communications (see appendix 1).

The concept thus covers different subjects, electronics and information technology in particular. Moreover, because of the extremely rapid pace of technology changes, and the difficulty for engineers in agreeing on the exact definition of certain technical terms, grasping the content of what our students have to study is rather difficult. In French the field of *informatique industrielle* is certainly a case in point; it is best rendered by “computer systems technology” in English, but some French content teachers argue about what their curricula will include. Another example might be the first stage of meetings between specialists in electrical engineering or robotics; who start by defining the terms before delving into the topic of the meeting itself.

One of the reasons that led me into collecting data was the desire to understand the conceptual field of my learners. Before embarking on a students’ needs analysis, a wider range of documents than those used by the students was collected so as to get a clearer view of the topic of electrical engineering and of the different types of registers and discourses pertaining to the various genres.

Providing easily accessible information to users, meaning here ESP teachers and teacher trainees, is providing information about information. Such a task is now rendered necessary.
because of the glut of data available. One of the specialists of new technologies, Negroponte, the Founding Director of the Media Lab at MIT, has a very apt comparison

The fact that *TV Guide* has been known to make larger profits than all four networks suggests than the value of information about information can be greater than information itself. (1995: 154)

How was my information collected? Different sources were tapped: students, content teachers, and component manufacturers.

The learners are students in French two-year colleges (University Institutes of Technology) in an Electrical Engineering department. The study of English as EFL is required for the use of documents during their tutorials —hands-on classes— and later for their work environment.

The data were collected from reports written by second-year students during job placements. Over 50% of the documents that were listed in the students’ appendices as the documents that were necessary to carry out their projects were data sheets and data books; those are the documents that have formed the bulk of my analysis (see Mémet 1994).

### Data books

Since data books have not been studied in the ESP literature —only research articles on electrical engineering have— I would like to specify the origin of the use of the word, from a diachronic and historical perspective.

The term *data book* is used by French electronic technicians and engineers. Unlike related terms, such as “data sheet” and “handbook”, which were translated into French long ago, data book has no Gallic equivalent.

*Data book* is not to be found in either general or specialised English dictionaries, such as those for information technology. The definition of “data sheet”, which cites a reference as early as 1898, is given in the *Oxford English Dictionary Supplement*: “a leaflet containing a summary of useful information on some subject”. According to the same source, handbook, which comes from Old English, is “a compendious book or treatise for guidance in any art, occupation, or study” (1814).

*Data* [plural of datum] is defined by the Institute of Electrical and Electronics Engineers (IEEE) as “any representations such as characters or analog quantities to which meaning might be assigned”. In the field of electronics, a data book is the most thorough collection of technical data, whereas a handbook —often an application handbook— is a collection or an overview of application notes. Thus, a data book is a collection of data sheets which the manufacturer's marketing department or the department of technical publications puts together, updates, and to which it adds an introductory note.

It seems that the term data book was first used by Lyon Metallic Manufacturing Company for its *Data Book* published in 1921 (*Data Book*, Aurora, Ill.: Lyon Metallic Manufacturing Company, 1921). From a historical point of view, the use of the term in the field of electronics comes from data sheets. The first documents with the name of data sheets were published by the *New York Sun* in their *Saturday Radio Supplement* as of 7 October 1922.

The term was only used where numerical data were required. Another example of the use dates from 1929: the magazine *Radio Craft* gave its readership, “the Professional-Serviceman-Radiotrician”, information about radio models. Although there were technical sheets for the first components (e.g., transistors and vacuum tubes in the 1920s), the term data sheet was not used then; the title of the sheet read “Instructions for using the ...”. *Data sheet* appeared in its modern usage in the 1960s only.


According to a Motorola engineer—whose company no longer uses the term data book, but that of “reference manual”, often with a subtitle, “technical data”—the evolution of the morpheme is related to the evolution of technology. As components and systems become more and more complex, so do the books; the word data book would not be inclusive enough. “Data sheet” is sometimes replaced by “spec (specification) sheet” in electronic jargon.

The data book, as used by the community of experts—engineers, technical writers and technicians—seems to constitute a genre as defined by Swales:

A genre comprises a class of communicative events, the members of which share some set of communicative purposes. These purposes are recognized by the expert members of the parent discourse community and thereby constitute a rationale for the genre. (1990: 58)

To re-capitulate, the documents collected originated from the students’ work environment; they were checked (e.g., source, year, etc.) against the component manufacturers’ originals as well as the content teachers’.

Organisation of the data

Organising documents is almost a field in itself. David Bickerton gave a paper on the “Organisation of information for multimedia learning” at ESSE’s second symposium in Bordeaux (see Bickerton 1994). He made a clear distinction between physical data—books, disks, etc.—and the non-physical kind—the ‘content’, ‘subject’, and ‘value’ (e.g. suitability for purpose) attached to or represented by the “physical data”. He also established a list of parameters for the language learner search: “linguistic, pragmatic, psychosociolinguistic, didactic, functional, and thematic” parameters (1994: 79-80).

My documents are what he calls raw “realia”—“authentic documents” was the set phrase for many years. These are not aimed at learners, but at teachers; moreover the parameters Bickerton determined are applied to data banks against which my application software can by no means be measured, e.g., he applied his criteria to the Library of Congress, and four other nation-wide catalogues.

In other words, the scope of my project is radically different from his organisation of data; moreover, the documents are virtual insofar as this is information, not an on-line retrieval system. Nevertheless, the idea of a dynamic form of storing and retrieving information, which he made very clear, is at the core of my project.

The idea that presided over the creation of this project came from the previous designing of tools for aiding researchers: one computer application for bibliographic data, and the other for an index of LSP journals (also in paper form, see Mémet 1993). The application software runs on a Macintosh computer with Claris Filemaker Pro® 2.0. The user-friendly data base hardly requires any computer knowledge. Of course, it cannot hold an unlimited number of data. The hardware and software which seemed rather powerful a few years ago now seem almost antiquated. For instance, Filemaker Pro can now process 30 megabytes per file, i.e., about 2,000 pages of text. However, since software companies frequently upgrade their programs, the capacity of the database will no doubt be increased.

The data base

The criteria which prevailed over the creation of my application—henceforth referred to as the EE file—were flexibility, ease of use, and organisation in multiple layers.

Flexibility is provided by the way the fields are organised, and can be re-organised almost ad libitum. Ease of use originates from the friendly hardware and software devices, now common to most programs and personal computers. What are they? What does the data base look like?

A few years ago only, data bases required the knowledge of a programming language; nowadays, the user can have access to the various functions by clicking with a mouse, a track ball, or a track pad onto the menu at the top of the screen. Navigating in the data base is done with the help of icons—also called “buttons” by Claris®.

The documents are ordered according to topics as shown on the “home page”: it presents the different categories included in the EE file: academic publications, patents, standards,
manufacturers' documents, technical magazines, didactic tools, dictionaries and encyclopedia, periodicals, advertisements, and mail.

Each item is then subdivided into other types. If we take the example of academic publications, they then subdivide into dissertations, journals, scientific publications, proceedings of symposia, and abstracts.

Like Russian dolls, each item may open; if we proceed with the example of academic publications, information about journals can be retrieved. The fields that have been entered include those typically used in catalogues, e.g., title, ISSN, keywords, date, etc. They also include categories of potential users, the level of knowledge required, and the sites. The periodicals are categorized and labelled, e.g., *Electrical and Electronics Abstracts, IEEE Spectrum* in periodicals for academe aimed at researchers, doctoral students, etc., whereas magazines such as *Business Week, or Byte* are to be found in popular magazines. Extracts of the documents are also given, so that the magazine can be located from a genre perspective. The same holds true for other types of documents such as standards.

The parameters given for books follow the pattern of library catalogues, i.e., title, author, site, etc. Personal or publisher's comments are added (e.g., for a dictionary the number of entries).

Of course, the purpose of the data base is to offer the user the opportunity to look for a specific item. That is why each piece of information can be searched for from any field, e.g., title, author, date, publisher. Function keys allow the user to choose from the items that have been entered, and browsing is done by clicking on an icon, turning the pages of a book as it were.

Since the data collected mainly dealt with manufacturers' documentation, the EE file contains a larger amount of information in that area. The user has at his or her disposal the organisation of the literature; it is grouped in three categories:

- the first aimed at customers, either users or potential customers;
- the second aimed at the customers indirectly, i.e., via the media and
- the third aimed at the company staff.

Each category of document is then defined, and the user of the EE file can navigate from one item to another, e.g., by clicking on an icon. Lastly, technical brochures are also part of the data base, as well as other practical pieces of information, e.g., addresses of associations connected to the content area teachers.

To sum up, the EE file is designed for teachers and teacher trainees especially in ESP for EE. It enables them to become familiar with various types of EE-related documents. Of course, none of the lists of dictionaries, periodicals, journals, etc., is exhaustive. The documents should be viewed as examples of genres.

The data base is modifiable in relation to the researcher’s needs. The modifications can be brought along a vertical axis so to speak, i.e., each category can be extended—magazines, publications can be added. Along the horizontal axis, the elements can be adapted to create a data base for other scientific or technical subjects, e.g., mechanics, or information technology.

**Pedagogical purposes**

The EE file has another purpose: it is a tool to retrieve ideas for pedagogical purposes. Which leads me to my third part, organising the data. It has been mentioned that the realia come from various sources —manufacturers and publishers. There is another source: an electrical engineering department in an American college. These documents can be used in EFL classes to enhance the links between language and content, and so to create links among learners, content and language teachers. Another objective is also aimed at: reducing the psychological difficulties of the learners with the use of English documents during their hands-on classes. It has been shown that many are reluctant to browse through the documents they should read in class and that their confidence in their reading abilities need to be built up (see Mémet 1994).

The documents collected were not all entered into the database; the documents originating from the American college mentioned above could easily be included, as well as the manufacturers' documents because these organisations provide authorization for the use of their documents willingly. The question of authority and copyright that Bickerton raised for information distributed electronically also applies here for documents originating from...
publishers (Bickerton 1994: 91). That is why the data used for pedagogical purposes are mainly those from the first two categories. These data can be used both for content and for language knowledge. Since one of our assumptions is that the ESP course should create links among learners, content and EFL classes, activities that involve the retrieving of information from electronics classes have been devised. The first example of such activities, shown on page 3 of the handout, deals with the observation of components during an electronics class. Once the information has been found by the learner, he or she will report it to the EFL class in a “show and tell” fashion. The technical vocabulary focuses on the content knowledge, the exercises on word formation are to promote general reading skills.

In order to build up the learners’ confidence and help them suppress some of their hesitancy for the use of EFL, various recommendation sheets have been drawn. They are handed over to the learners either by the content or the language teacher depending on the degree of collaboration (on the topic of collaboration see Platt 1993).

One document which can be retrieved directly from the EE file deals with laboratory instructions. The genre is particularly suitable to first-year students in terms of content and language knowledge. The activities are essentially centred on socio-affective strategies aimed at developing various skills and functions: here using a unilingual dictionary aptly (e.g., finding the right grammatical category and its meaning in context). Other activities involve what Widdowson called “information transfer” (Widdowson 1978: 141) with the help of visual aids. The purpose of the exercise is to help students locate the main functions of the discourse. What is required of them during their electronics hands-on classes is to “find, compare, and select”.

Some of the activities mentioned hitherto mainly dealt with written comprehension; others, drawn from similar material, are mainly used for oral skills, and done in pairs or in groups. Technical prompts are given to start the conversations.

Some documents were not originally included in the EE file for a lack of available technologies — or in other words no direct access to the Internet network. They now have been. At ESSE’s Bordeaux conference, N. Chenik (1994) provided a thorough overview of on line retrieval of information and its pedagogic interest. Documents can thus be added more easily. The history of the Internet serves as another example of articles from general magazines.

The EE file is not meant to be used directly. An analysis of the groups of students targeted has to be carried out, their learning strategies and the materials need to be worked on. For this phase, I would recommend West’s comprehensive state of the art article in Language Teaching (West 1994) which provides an extensive overview and bibliography on the subject.

The EE file is part of a trend characterized by Negroponte, who envisages that in the next decades, bits that describe the other bits, tables of contents, indexes, and summaries will proliferate in digital broadcasting. (1995: 179)

Being trained in ESP teaching requires a wide range of language skills and know-how, as Lerat points out in the last pages of his comprehensive book on specific languages (1995). My contribution to teacher training materials and approaches comprises but a tiny fraction of what an ESP teacher should know.

Bibliographie


Annexe

Appendix 1: The field of electrical engineering
Appendix 2: Examples of activities
During your lab classes, you handle a lot of components. Some have nothing written on them. Which ones? What is the symbol?

Others bear the manufacturer's logo, and the code of the product with the manufacturer's initials.

Draw the logo, find the code, and say what it stands for, e.g.,

AM27C010 This is the logo for Advanced Micro Devices

Look at the front panel and at the controls and switches. Find 10 abbreviations and state what they stand for: e.g., CAL = calibrate

Notes

1 The information and reproductions of the documents concerning the first data sheets and data books were supplied by a private collector.

2 A bibliographic data base on a much greater scale has been designed by Dr. Robert Clark, 5 Devonia Road, London N1 8JQ, United Kingdom. Fax (44) 171 354 4734. *The European Bibliography of Resources for English Studies*.

3 The 2.1 version is PC compatible. Version 3.0 is due out at the beginning of 1996.


5 According to a colleague at the University of Créteil, the EE file could also be of use to pre-doctoral students in EE.

6 During oral delivery of this paper at the 3rd ESSE Conference, Glasgow, September, 1995, a 14-page handout was given to the participants; one page only is reproduced in appendix 2.

7 Its beginning and source were shown on pp. 11-12 of the handout. The Internet site for the document is: <http://www.lysator.liu.se/etexts/the_internet.html>.
The author draws from her dissertation research, and starts from a postulate: being aware of the learners' content subject area helps both teacher and students to study the language. English for electrical engineering is taken as a case in point. It is suggested that a data base of ESP materials be utilised so that the teaching staff can locate the learners' needs within the general framework of a wide range of authentic documents (e.g., types, genres, registers), and choose the best materials to be didactised. The data should be readily available to language teachers and teacher trainees before the beginning of the course, in the form of application software. Hands-on examples of didactised texts are provided.