PERSONAL DATA

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BIOGRAPHICAL AND ACADEMIC DATA

Born in 1971, Spanish nationality. Doctor in English Studies by the University of Salamanca (1999). Currently working as a Technical English teacher at the Technical University of Cartagena and also as head of the Language Service at the same University. Working as a part-time teacher of English Literature at the Spanish state distance University (UNED) as well. Main lines of research: ESP and Literature of the Elizabethan period. Member of the Chief Committee of the Language Teaching in Higher Education Centres Association (ACLES), and organiser of its latest conference (February 2002).

1.   The cognitive approach

Traditionally, the teaching of vocabulary has been a synonym of the teaching of meaning; that is, vocabulary belongs to the field of semantics. Recent cognitive studies and their applications on thrilling teaching experiments like the multilingual class –a language class where several languages are taught at the same time- contradicts this theory. According to Spoettl and Hinger (2002), a linguistic item is in fact a two-faced coin: one of its sides is ascribed to semantics, the other one to pronunciation, and neither of them can be conceived without the other. In the multilingual class, it has been proved that, without a more or less distinct phonemic mental association, the students will not dare to use a term, regardless of their knowledge of its

meaning, at least for oral purposes. There is not meaning without pronunciation, and viceversa. This is the last conclusion of a logical path already undertaken, among others, by Van Dijk and Kintsch (1982: 333) when they affirmed that:

"An iconic stream of sounds must be interpreted as phonemes < morphemes < clauses. Meaning must be assigned to these various structures within a few seconds per phrase."

The association between sound and meaning, however raised by the cognitive theorists, was already established by the structuralists. In the 70s, for instance, Prator (1971) establishes that "phonemic distinctions correlate with meaning". Indeed, many teachers of LSP have complained about the lack of phonetic instruction in their classes, for example professor Alcaraz in the work already mentioned (2000: 38):

"Oral comprehension and expression command (...) demand an evaluation of the role of phonetics and phonology in professional and academic English, an issue somewhat relegated in some works on specialised languages." (My translation)

It seems our duty, then, to integrate the phonetic side of our LSP teaching, as it has been stated both from linguistics and general language teaching, in our own syllabuses.

A relevant specification, nevertheless, has to be pointed. For the same reason that LSP students do not have to command the fundamentals of phonetics, they are not taught grammar or expression if the specific needs of the content discipline do not require it. In fact, we teach them phonetics not *per se,* but because it is a clear component of the conveyance of meaning. As we will not be working, therefore, at the level of specialists, we must clearly establish the difference between phonetics and phonemics, and move only in the second level:

"Phonemes are communication code units of which the speaker is aware (...) Unlike phonetic level, which is a level of specialists analysis, phonemic level is the level of communication, the level the speaker uses efficiently on speaking." (Mosterín 1987: 21) (My translation)

This distinction allows us to take up again Prator's previous quotation , in all its length:

"Since phonemic distinctions correlate with meaning, they are more important than allophonic distinctions to a student who is learning a language in order to be able to communicate meaning in it." (62) (My underlining)

We call allophones the different pronunciation variants corresponding to a single phoneme, a too subtle exercise for our students' needs.

The conclusion for our thesis on vocabulary teaching is as follows: sustained-content vocabulary has to be taught in a unified LSP course, together with academic vocabulary. And it has to be done in spite of the fact that students already know most of this vocabulary, because they will not really become aware of their possibilities of use until they command the other side of the vocabulary coin: pronunciation.

2. The text-linguistics approach

The consideration of vocabulary as a two-faced coin whose phonemic side, for the reasons already brought forward, will prove of utmost importance on teaching sustained-content terms, must be enclosed in a more general reflection on the way such terms are intertwined within a text and endow it with meaning further than the specific sense of every single term. This task has been traditionally based on linguistic concepts such as reference or cohesion and coherence, and their conclusions come to enrich and enlarge the process of meaning ascription.

A Ph. D. defended by Pilar Durán in 1999, *Análisis y evaluación del texto científico: Aplicaciones didácticas a la enseñanza del inglés con fines académicos,* puts the realm of text linguistics at the LSP's service, mainly for comprehensive reading purposes. She explains that the receptive use of a word must lead to the productive one, a process absolutely governed by the textual and co-textual, we could add, circumstances:

"There is a relation of significant dependence between meaning deduction of general vocabulary and specific terms unknown to the students, with topic knowledge, informative content organisation and text acceptability". (212) (My translation)

Vocabulary is regarded, from this point of view, as a textual element, which it certainly is, but not less than it is a semantic and a phonemic unit. The text and its immediate context –in the case of a scientific text, the content subject related with that text- provide a knowledge schema, activate mental associations based on background information and shape not only the word meaning, but also the clause, sentence, paragraph and text meaning. The role of the sustained-content terms or key words in this process, as Olsen and Huckin

(1991: 397) have highlighted, is indispensable:

"1. They trigger vivid imagery in the reader's mind,

1. are related in a obvious way to the topic of the passage, and

2. are related to the reader's purpose in reading the passage."

From all the above exposed, we could draw a diagram, following the model of medieval *exempla*, Chinese boxes, mounted Arab tales and short poems or Russian dolls, containing three frame levels and a title: the teaching of meaning. On the outer level we would place the scientific text, a unit by itself, and the last stage on meaning assignment; immediately inside we would find academic vocabulary, that is, the metalanguage common to all scientific disciplines and prone to certain rhetorical patterns imposed by the very use of the terms (linking words, prepositions, relatives, expressions for definition, classification, etc); and inside the two previous levels, at the core of the diagram, we would situate what we could call the *technical kernel:* that set of words exclusive from one discipline, usually known by the students, which singles out the text among many others. Each level has to be present in our teaching, and each one flows in both directions. The kernel is also what allows us to situate our text within a genre and a knowledge area.

A PRACTICAL EXAMPLE

The activity presented subsequently has the purpose of covering the different aspects related to sustained-content which have appeared so far: phonemic identification in isolation; complete meaning identification in context through an audiovisual exercise; and complete meaning identification within the text as a reading activity. Phonemic awareness, as we will see, constitutes the bridge between receptive and productive meaning comprehension, thus making the latter an ultimate objective in the whole activity.

1. <u>The course</u>

The activity presented constitutes, in fact, an interdisciplinary experience set by the ESP class but spread onto a content class for which the vocabulary taught is useful. Thus, we are not only teaching *real* sustained-content vocabulary, but we are complying with an old ideal of ESP teaching: we are making it all-purposeful. The content subject we have chosen for our interdisciplinary approach, "Technology and Electronic and Photonic Components", is a third course, second term, core subject in all the specialities of Telecommunications Engineering at the Technical University of Cartagena.

On the other hand, the students who take Technical English for Telecommunications can choose it in both terms during the second or third year. For third year students, the situation they must face is quite stimulating: in the English class, they will see in advance the linguistic structure of topics related to the content class, as the sequencing will have been previously established by the two teachers involved in the process. In fact, the activity takes place in both classes and in the following stages:

1. Language class and language teacher: students perform different oral and written tasks destined to the learning and correct pronunciation of the sustained-content vocabulary appearing in the lesson, a task which is also reinforced with other activities such as definition, classification or explanation of processess where such terms are likely to appear. They have not dealt with the topic in all its depth in the content class yet, but they have gone through all the previous units, that is, they have background notions to which they can add the new information.

2. Content class (content and language teacher): students view a video sequence from "The making of a microchip" corresponding to the vocabulary learnt a few days before. The content teacher stops the video whenever he considers that certain clarification is needed. To make sure that his explanations are fully understood, he produces them in Spanish. After the complete viewing, the language teacher checks the level of comprehension by means of spontaneous questioning. Thus, students receive the combined experience of a class in which two languages are used indistinctly for the same topic.

3. Language class (language teacher): students are given the transcription of the video watched in the previous content class and work on different tasks with it, now trying to fix expressions and understanding text features such as cohesion and coherence, rhetorical patterns, and so on. Further exercising is also provided, this time incorporating pedagogical materials such as technical grammars or vocabulary and phonetic exercises from different manuals (an appendix of the transcription used as an example and the suggested exercises is provided).

In this activity, the role of the content teacher is mostly that of materials provider, whereas the language teacher is in charge of adapting them and creating *ad hoc* exercises. The most interesting part of their collaboration is, no doubt, the working with the common class, which can be included, according to Dudley

Evan's three stages (1997: 3-11), in the part of *team teaching.* Staging in class only takes place after a careful pre-elaboration between both teachers which involves material presentation as well as sequencing.

Now let's try to answer relevant questions involved in the activity: the reason why this, and not another subject was chosen –apart from the willingness of the content teacher-, and the contribution of language practice to the content class.

1.1.   Why this content subject?

The reasons for choosing this content subject are as follows:

1.   All our students of Technical English for Telecommunications will sooner or later have to face this subject.

2.   The real development of electronic and photonic components takes place almost entirely out of our frontiers: in Europe (France, Germany and Holland above all), US and the Southeast Asian countries. Thus, a potential researcher will have to be familiarised with the language in which this research is mostly carried out, and with the international context it requires.

3.   More than 90% of the publications on the subject are in English. The basic bibliography given by the content teacher is almost entirely in English (the 6 basic titles or primary sources and 20 out of 22 secondary references, leaving aside web links and electronic journals which are edited, of course, in English).

4.   Spanish translations of the references given are not available: this knowledge area is so quickly developed that most of the manuals would be outdated even before their distribution.

5.   Many key words are self-defining in English, the translation sounds awkward or too long (a compound usually gives way to a paraphrase), or specialists simply do not agree on a unique version. There are very curious examples about this: an electronic Spanish journal invites its readers to provide translations of new terms whose introduction in the technical jargon proves too fast for the finding of an equivalent term in Spanish. Sometimes the translations given lie entirely on the phonemic side of meaning and absolutely regardless of semantics, as it is the case with *photoresist = fotoresina*, a paradigmatic example of what we have previously discussed on the matter of sustained-content vocabulary [i] ; on other occasions, the choice is simply the creation of a new anglicism (*to link = linkear*). These and many other examples turn out the content class, for a teacher with certain sensitiveness towards a correct use of language, into a complicated task for which the two languages, English and Spanish, have to be alternated.

In sum, we think that the introduction of this subject in the language class can:

a)   help the content teacher to use his own material in English, avoiding unfruitful translations or, in the best of cases, daring exercises of "Spanglish", and

b)   enhance students' interest both in the language and the content class, as we are reinforcing their practice in both directions.

c)   For the language teacher, the experience is a methodological step onto a fulfilling application of interdisciplinarity and the meeting of students' more urgent linguistic needs. As for the theory of the phonemic importance in the teaching of sustained-content vocabulary, it utterly confirms certain expectations and intuitions in which we established our theoretical basis.

1.2.   What do we do through content language practice?

We have summarised the benefits of practising sustained-content vocabulary in the English class in three groups, depending on the emphasis we place on the starting point (pragmatics and text linguistics, cognition and interdisciplinarity).

1.   From pragmatics and text linguistics, what we are doing is to turn an informative text into a communicative text, be it oral or written. "Pragmatically" speaking, the primary function of the scientific text, i.e. to convey certain pieces of knowledge, is temporarily suspended in order to exploit its communicative possibilities through all possible language games: discussion, summarising, etc. On the other hand, the main feature of a scientific text, which is its informativity, is partially betrayed because we do not elicit a response to this information. Rather, we explore the rhetorical patterns that turn it into an informative text, so as to provide students with the necessary expressions on performing a similar task by themselves.

2.   From cognition, we make the text "recognisable", leaving the field prepared for its automatic working in

the content class. By activating the students' previous knowledge, as they have already read similar texts, we are not providing them with any new information, but making them aware of the expressive means available for comprehensive and productive activities.

3.   From interdisciplinarity, we comply with the ideal of relevance in language teaching activity. If all language teaching must be purposeful, in the case of ESP this is doubly true. By establishing a close collaboration with the content teacher and class, students perceive the pertinence of their Technical English learning, to the point of enacting situations halfway between reality and simulations.

Now we can proceed, without further delay, to present the activity chosen as it has been carried out in class.

2.   <u>Class activity</u>

The activity chosen corresponds to the sequence of *Ion Implantation.* Let's see its place in the whole programme:

MAKING OF A MICROCHIP – THE MANUFACTURING PROCESS OF INTEGRATED CIRCUITS

1. INTRODUCTION
2. SILICON PURIFICATION
3. GROWING A SILICON INGOT
4. WAFER PROCESSING
   -DEPOSITION
   -METALLIZATION
   -DIFFUSION
   -ION IMPLANTATION
   -PATTERNING
   -ETCHING
   -CHARACTERIZATION
   -PACKAGING AND TESTING
5. CONCLUSION

Considered as a whole, the lesson has all the elements typical from the scientific style: lexical fields (materials properties), passive, causative verbs, prepositions, process temporal sequencing, compounds, relatives, linkwords, and many others.

At the stage of *Ion Implantation*, students are already familiarised both with the mixed teaching model and sustained-content vocabulary. However, prior to the text or video approach and, in isolation, we give students the keywords corresponding to this part, which are as follows:

MICROCHIP, INTEGRATED CIRCUIT, DOPANT, WAFER, BEAM, CURRENT, TARGET, MAGNETIC FIELD, ELECTRON, CHARGE, VOLTAGE, SCANNER, ION IMPLANTATION.

We divide the class in groups of ten students holding a similar level of English (Intermediate) and taking the same content subject. We assign a different task to each group:

1.   To recognise the words.

2.   To pronounce them.

3.   To translate them.

4.   To define them.

In the following chart we can observe the results; from left to right, we spot the number of students who succeed in tasks 1, 2 and 3, as well as the general level of success (medium, right or wrong) corresponding to task 4:

Microchip	10	6	10	Medium
Integrated circuit	7	6	10	Right
Dopant	9	10	10	Right
Wafer	5	4	9	Medium
Beam	5	5	6	Wrong

Current	6	5	8	Medium
Target	4	2	2	Wrong
Magnetic field	8	7	10	Right
Electron	10	10	10	Right
Charge	6	5	6	Medium
Voltage	6	4	10	Right
Scanner	10	10	10	Right
Ion implantation	5	4	10	Right

We reinforce these tasks with others like urging students to form collocations or family words from the terms given. Some of their contributions were:

COLLOCATIONS

Integrated circuit system

Silicon wafer

Electron beam

Laser beam

Magnetic card

Ion beam

Ion accelerator

FAMILY WORDS

Implantation / to implant

Scanner / to scanner

Ion / ionic / ionisation

Dopant / dope / doping

From these data, we can extract the following partial conclusions:

1. Of all the primary tasks, students have the least difficulty in translating, followed by defining and recognising (at the same level) and pronouncing, except in the cases where the phonemic similarity with the Spanish language facilitates the process.

2. Their semantic familiarisation with the terms (secondary tasks) lays mainly in the lexical content, but also in the phonemic similarity.

3. The phonemic part of meaning has to be reinforced up to the level of translation if we expect students to use those terms by themselves (not simply through receptive skills).

Prior activities finish here, and then the topic is retaken in its real place throughout the unit, following the subsequent steps:

a) To hear the words in context and with visual aids (diagrams). **Video**

b) To work on the text transcription (morphosyntactic aspects, set of activities). **Transcription**

c) To ask the students for their own explanation of the process of ion implantation, using the adequate vocabulary and the nearest phonemic reproduction.

Once the activity is finished, that is, at the end of both the ESP and the content class, students are given a questionnaire which is afterwards compared with previous ones, when students watched the same video in the content class without having practised sustained-content vocabulary in the ESP class in advance. The statistics shows us a 90% who understood between 75% and 100% of the video information after the ESP class, facing an only 20% stating the same on the former occasions. What regards the ESP class itself, students showed, in general terms, a higher degree of interest and participation, an they explicitly acknowledged the combination of content and ESP class as purposeful, innovative and gratifying in both directions.

CONCLUSIONS

On the academic side, the exploration of the phonemic face of vocabulary teaching in multilingual contexts, taken to the field of sustained-content vocabulary in a uniform environment, as it is the case, leads us to demanding from ourselves (language teachers) a higher effort on research, in order to place the necessary emphasis on pronunciation in our LSP courses and to find the adequate balance between the teaching of academic and sustained-content vocabulary.

The experience displayed here, considered in relative terms, has only constituted the first step for further exploration and interdisciplinary collaboration. It is essential, most of all, that this way of implementing mixed teaching finds its proper scope in a reasonable span of academic years. The initial effort we have to make now in order to prepare students for a totally new situation should become commonplace, not only in this concrete teaching experience, but in all facets of academic activity (for example, the possibility of defending Final Degree Projects in English should be considered, at least in those cases when the student has carried out his work in a foreign university). Teachers from all disciplines must get involved in the process as much as language teachers, and for all possible purposes. The teaching and practice of sustained-content vocabulary is only a small contribution to the immense challenges this proposal can meet. However small, we hope that our contribution will have been representative enough of the available paths for language teaching in more and more multiple, creative and changing contexts.

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[i] There is a similar example in the case of acronyms, a very frequent vocabulary unit in telecommunications vocabulary. If we think, for instance, of the DGS, as the elements of a bipolar transistor are known (*Drain, Gate and Source*), we find two choices of translation: the literal one (*Drenador, Puerta y Fuente)* and the phonemic one (*Drenador, Graduador y Surtidor).* Although the second version is not semantically accurate, it is preferred by specialists because it keeps the initials and the sound of the English words, i.e., professionals rely on mental associations provoked by sound more than in any other considerations. Without knowing it, engineers are thus placing all the weight on phonemics to the detriment of semantics, and they understand one another perfectly.

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APPENDIX: TEXT TRANSCRIPTION AND SUGGESTED EXERCISES

MAKING OF A <u>MICROCHIP</u>: THE MANUFACTURING PROCESS OF <u>INTEGRATED CIRCUITS</u>.

Ion implantation

There is another way to introduce <u>dopants</u> into a <u>wafer</u>: it is a process called *ion implantation*. This process uses a carefully controlled *ion* <u>beam</u> from a linear accelerator called an *ion* **implanter** to bombard the *wafer* <u>target</u>.

<OSTENSIVE INFORMATION: DIAGRAM EXPLANATION IN THE VIDEO> The admitted ions travel through a <u>magnetic field</u> which bends the <u>electron *beam*</u>. **Depending on** the <u>charge</u> of the particles **passing through** the *magnetic field*, different species of *ions* would be separated from the *beam* **by changing** the angle of the exit trajectory. The desired *ions* are focused by the *beam* scanner and **onto** the *wafer.*

The accelerated *ion beam* is electronically *scanned* **over** the surface of the wafer. **The more** *ions* in the *beam*, and **the higher** the *beam* current, **the more** *dopants* the *beam* will deposit in a given time. **The higher** the *beam* <u>voltage</u>, **the deeper** the *ions* will be **implanted** in the *wafer.*

- Underlining: first appearance of technical terms.
- Italics: subsequent appearances.
- Bold type: morphosyntactic aspects (comparatives, word formation, prepositions, etc).
- Other aspects: collocation (*electron beam, beam current, ion beam...*)