Applications of cognitive theory to interdisciplinary work in Languages for Specific Purposes

Ana María Roldán Riejos,
E.T.S.I. Caminos, Canales y Puertos. Universidad Politécnica de Madrid.

Abstract

Interdisciplinary work is one of the most prominent features in the Language for Specific Purposes (LSP) field. However, little research has been carried out in this area. The main aim of this paper is to present some ideas on interdisciplinary application in LSP teaching and research. It likewise seeks to clarify the concept of interdisciplinary work. Following a cognitive approach, some examples of civil engineering terminology are analysed. This highlights practical ways in which interdisciplinary action can be implemented and improved upon from within the LSP sphere.

Keywords: LSP interdisciplinary work; cognitive approach; technical terminology; semantic study; metaphor; polysemy; meaning.

1. Introduction

It is a well known fact that LSP teachers will have to deal with interdisciplinary activities at any time during their career. This applies not only to teaching but also to research. Despite that, a lack of descriptive frameworks hinders their implementation. This paper starts by tackling some well-known difficulties that the novice LSP teacher is usually confronted with. This is followed by an analysis of the concept interdisciplinarity both in LSP teaching and research and some considerations on actual discipline boundaries. A cognitive study of technical terminology has been finally carried out expecting that this type of analysis can contribute to the clarification of scientific and technical discourse.

In course design, it makes sense for the general language teacher to take into account the other subjects included in the curricula (Widdowson, 1978: 74). This task becomes, however, crucial in LSP. LSP professionals have to take into account the composition of the subjects that their students are required to learn. Apart from that, they should apply a comprehensive approach towards those curriculum materials as well. This is a decisive step to achieve motivation. The question is how can this be done. We will deal with this problem below.

2. Some implications of LSP teaching

General language or LSP teaching thus require a thorough analysis of the various aspects concerning the student's profile. The following factors must be taken into account: social, economic, psychological and occupational ones. Standing in a paramount position are, however, those affecting curricula. Ideally, the LSP teacher should revise each of them in the course planning stage. Thus, 'input assessment', which mainly consists of 'individual and organizational variables' (Giménez, 1996: 234) can be established. This type of study has proved to be highly effective when identifying accurate target and needs analysis variables (Hutchinson & Waters, 1985). However, serious difficulties are likely to arise at this stage. These difficulties occur as LSP teachers are expected to handle a wide range of material that they are not familiar with. Since an open attitude to their curriculum is what students and their respective institution require from LSP professionals, cooperation and guidance from other departments is advisable both in the materials selection process and in syllabus content arrangement. Unfortunately, however, this assistance is not always given or available. Resorting to the university libraries, consulting specific journals or looking at newspaper classified ads can be other strategies that the LSP teacher can follow. Students can also provide information by answering questionnaires, in personal interviews, etc. (Edwards, 1996). Nevertheless, the ideal situation would be the creation of organized interdisciplinary work teams that could be coordinated by a group of tertiary educational experts (from Educational Science Institutes, for instance).

3. The concept of interdisciplinarity

If we first consider the meaning of the word 'discipline' in the specific teaching context, one definition is: 'an area of knowledge included in the curriculum'; or more strictly: 'a particular area of study, especially a subject in a college or university' (Sinclair, 1987). Three prefixes are commonly associated with the term 'disciplinary'. These are: 'multi, 'pluri' and 'inter'[1]. They have been selected for their higher salience in the literature handled.

As it will be shown, 'multidisciplinary' and 'pluridisciplinary' are analogous concepts, especially if they refer to the whole curriculum that students are required to know. In my particular case, students are civil engineering undergraduates whose degree course includes: Applied Physics and Mathematics, Soil Mechanics, Topography, Structures or Construction Materials. Consequently, at the end of their studies, they have been acquiring knowledge in a wide range of subjects. This would account for the 'multi' or 'pluridisciplinary stage. However, what is still needed in

[1] The Webster's, OED and COBUILD dictionaries include the entry 'interdisciplinary' as an adjective. 'Interdisciplinarity' as a noun is not registered in any of them. It is, however, used in Kelly, 1974.

the learning process is the organic and holistic interaction of the knowledge previously acquired. In other words, the stage of 'interdisciplinary' competence. Whereas either 'pluri' or 'multidisciplinary' stand for quantitative concepts, 'interdisciplinary' is directly related to quality. Traditional tests or exams can check undergraduates' multidisciplinary or pluridisciplinary abilities. However, if the aim is to produce a scientific project on tunnel construction or a sewage plant, then the student first needs to handle mathematical, geological, material, economic, legal or safety aspects. The next step would be to bring together all these elements in a logical process. By doing so, the student would start to realise that what has been learnt starts to fall into place.

4. LSP interdisciplinary research

In academic, scientific or professional settings, it is becoming increasingly important to build bridges between disciplines. These should be capable of producing loans, influences, impacts and model comparisons amongst them. In LSP interdisciplinary research, the aim will be to draw upon different knowledge areas trying to present valid and enriching approaches.

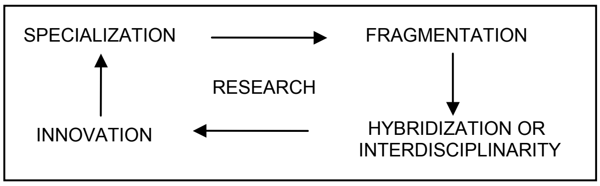

Figure 1. The Research Flow Chart

Dogan and Pahre (1990) make reference to the concept of interdisciplinarity by using the term 'hybridization'. They argue that only through the intersection of different disciplines can progress and innovation be achieved in specific knowledge areas. Therefore, if too many researchers are working in the same field (stage known as specialization), disciplines are likely to advance more slowly. This is due to what Dogan and Pahre call 'the paradox of density', which can make innovation more difficult in a specific discipline. Nevertheless, this does not mean that specialization should be criticized, on the contrary, it is a basic and necessary stage in the process of innovation. In fact, to integrate something new, it is essential to start from a previous deep analysis in specific knowledge fields. According to this, as figure 1 shows, the research flow would follow this pattern: specialized research that is too concentrated on the same area is likely to produce fragmentation, which will lead to hybridization or interdisciplinarity. This step will bring innovation, which should lead back to specialization. This process highlights the role of interdisciplinary research as an innovative and influential agent in scientific work. Accordingly, LSP teaching has to conform to what today's society demands from professional engineering: an interdisciplinary role and with a result-oriented focus. Certainly, disciplinary collaboration will be an essential task for the University's future at all levels. As professor Michael Gibbons from Essex University explains:

> *much leading science nowadays proceeds not by placing one brick upon the other within a single discipline, but by solving complex problems that cut across many disciplines. Unless the universities adapt to this change, they will be pushed back to the margin of science.* (*The Economist.* October 97: *'Inside the knowledge factory'*)

The application of interdisciplinarity is likewise important in both facets of LSP: teaching and research. First, as it has been shown, because of the nature of LSP practice, especially as far as course design is concerned. Secondly, because the existing boundaries between disciplines are mainly a matter of convention. They are subject to change according to historic or cultural circumstances. There is sufficient evidence that shows that sciences were not structured in the same way during the Middle Ages or later in the Renaissance as they are structured nowadays. Similarly, we can consider how differently are disciplines organized in Oriental and Occidental cultures. The outstanding role of Economics today comes from the prevailing world market economy. A similar phenomenon applies to the importance attached to technological advancements.

On the other hand, the importance of interdisciplinarity is also growing because of the wide specialization demanded by job markets and partly assumed by universities (masters proliferation, special and new specialities, etc.). This situation should eventually give way to a more complete, flexible and versatile model. As Kelly (1974: 130) remarks:

> *The current vogue of the term interdisciplinary stems in large measure from the recognition that we have probably gone too far in specialization . With increasing urgency, present cultural needs demand that separate disciplines integrate their concepts and methods as they apply to both teaching and research.*

In this section the importance of interdisciplinary activities in LSP has been explained, it is necessary now to deal with possible ways to carry out this task. We will try to show below how the cognitive approach can serve this purpose.

5. Some ideas to implement interdisciplinary work in LSP

5.1. The cognitive approach

In my view, interdisciplinarity can be conceived of as an interactive, and practical task. An activity to apply to everyday professional practice. Thus, there can be many different ways to develop its practice. Again it is a question of creativity and initiative. Some tentative experiences about the practical implementation of interdisciplinary action in LSP teaching have been recently proposed (Rigol Verdejo & Roldán Riejos, 1992: 58-70).

For our purposes, Cognitive Science can provide an adequate model for interdisciplinary investigation. Cognitive Science actually integrates linguistic, psychological, philosophical, neurological, computer science, anthropological or historical contributions. Therefore, the cognitive approach will provide a suitable theoretical context to the practical examples shown below.

One of the prevailing assumptions about technical language claims that terminology mainly consists of neologisms or special terms designed 'ad hoc'. Nevertheless, this is not by any means the case. A great deal of technical terms are also part of the more general repertoire of everyday vocabulary. Their meanings may have been expanded (by metonymy or metaphor) or may be highlighting a specific sense derived from a common semantic core (by polysemy).

But where does meaning come from? For both the cognitive and the structuralist schools, meaning comes from context. However, whereas the structuralists think in terms of linguistic context, for the cognitive linguist the notion of context is much wider, taking into consideration external non-linguistic factors.

Within the cognitive paradigm, a linguistic term does not exclusively exist because of its relations with others (syntagmatic or paradigmatic relations). A linguistic term exists because of culture-based and conventionalized background knowledge.

A semantic domain generally consists of different image schemas[2]. Some of these schemas, such as those which map the conceptualizations of three-dimensional space are so basic that they can be common to different cultures. The same term can activate different schemas, its understanding depends on the domain where it is, at any one moment, perspectivized. For example, if we speak of 'resistance' in Mechanics, what matters is 'the ability of a material or structure to remain unharmed or unaffected by an external force' (figure 2). The rest of the domains associated with the term: political, medical, or even electrical are therefore irrelevant, even though they may share similar image schemas[2] too, such as proximity and distance or force schema.

Resistance	
IMAGE SCHEMAS: PROXIMITY/DISTANCE FORCE	
Domains	**Associated senses**
Political	Opposition
Medical	Immunity
Mechanical	Ability to remain undamaged or unaffected
Electrical	Capacity to resist the flow of an electrical current

Figure 2. Polysemy in 'resistance'

At a higher level, domains are organized into frames. These frames can be considered as gestalts or global configurations (figure 3). For example, the whole knowl-

[2] Some authors use 'schema', plural 'schemata', as equivalent to 'frame'. This usage should be distinguished from Lakoff's 'image schema', plural 'schemas', also followed in this paper.

edge that our culture has about 'Monday' constitutes a frame. This knowledge includes pleasant or unpleasant associations, depending on individual appreciations of its position as the first day of the working week. The applications of this theory are particularly appropriate in the teaching of vocabulary.

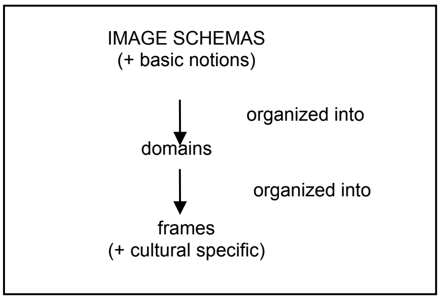

Figure 3. The organization of meaning in the cognitive model

5.2. Technical terminology: Polysemy, Metonymy and Metaphor

When teaching vocabulary, LSP teachers frequently note that a high proportion of terms in specialized terminologies consists not only of neologisms or highly technical words but, also, of sub-technical lexical items. Whereas the first group does not cause difficulty to the knowledgeable reader, except perhaps finding their meaning and translation in a good technical dictionary, the second will require more attention. As Kennedy and Bolitho explain, this type of vocabulary can cause ambiguity: 'the learner may know the 'general' meaning already and may be confused when he meets it in a context with a different meaning' (1984: 58).

Polysemy is a good example of this situation. It happens when a specific term can be used in two different domains. There are many examples of polysemy in technical terms. 'Pig', 'slag', 'vice' or 'die' to mention but a few. Strictly speaking, terms are polysemous if they share a common core meaning. If they do not share it, they are homonymous.

Let us consider now the meaning of one of the most salient and ambiguous terms taken from Urban Planning, 'development'.

Some of the senses recorded in the COBUILD dictionary are:

> 1.1 N UNCOUNT. The gradual growth or formation of something, especially a process in which a person matures, changes, or advances to another stage.
>
> 1.4 N UNCOUNT. The process of making an area of land or water more useful or profitable.

2.1 N COUNT. A development is an event or incident which has recently happened and is likely to have an effect on the present situation.

2.2 N COUNT. An area of houses or buildings which have been built by property developers.

From these selected items, an identical semantic core can be profiled: the coming into existence of something by a gradual process. However, though 1.1 and 1.4 seem to adjust to this specification, 2.1 and 2.2 are somehow less typical examples. Instead of a gradual process, 2.1 reflects a punctual aspect and in 2.2, the process is not even relevant, only its result.

On the other hand, in Urban Planning literature, the prevailing meaning of 'development' is better expressed in 2.2, 1.4 only occupying a secondary position.

However, despite its polysemous nature, i.e. two co-existing senses in the same term used in the same discipline, ambiguity does not necessarily have to occur. There are grammatical reasons for this, 1.4 is an uncountable noun, while 2.2 is countable. Moreover, only 1.4 frequently collocates with the adjective 'urban'. Indeed, some words or phrases seem to attract other words in strong collocations and that fact may even have an influence on grammatical features (Sinclair, 1991:112).

Thus, 2.2 is more salient in the Urban Planning discipline than 1.4. Within this discipline and also in common folk knowledge, 2.2 is graded as a superordinate category, as it includes a definite group or class of elements (in this case, types of buildings). The prototypical or more basic category would be illustrated by 'house' and specialization by the subordinate ones, exemplifying different types of houses: 'detached', 'semi-detached', 'terraced' or 'office block', etc. (figure 4).

Categories	Examples
Superordinate	Development
Basic level	House
Subordinate	Detached,Semi-detached,Terraced, Office block, etc.

Figure 4. Categorization of development 2.2

On the other hand, we can speak of metonymy when meaning is expanded or extended, allowing the name of a container to refer to its content as in: 'The city was collapsed'. A special case of metonymy is synecdoche, when reference to the whole is made by mentioning a salient part (the 'Big Apple' for New York), or the name of an institution: 'The Town Hall has built it'.

Metaphor is used when a word belonging to one cognitive domain is conceptualized in terms of a different one. Usually, an abstract domain is conceptualized in terms of a more familiar, more physical one. That is probably one of the reasons why metaphor abounds in technical or scientific discourse, i.e. because of its abstract nature. Plenty of examples of metaphor can be found in technical English. For example, civil engineering structures can undergo ‘stress’ or ‘strain’, ‘torsion’, ‘tension’ and ‘fatigue’. They can also ‘age’, ‘fracture’, ‘be dynamic’ and ‘have degrees of freedom’. Concrete can be ‘cured’ and can also ‘bleed’, ‘sweat’ or ‘weep’.

The underlying mapping in these examples consists of conceptualizing these elements as if they were living things. In words of Lakoff (1992: 37), this is ‘the experiential basis of metaphor’. Their function is making technical descriptions more accessible by establishing parallel correspondences between two different conceptual domains: an abstract one on the behaviour, functions or reactions of engineering structures is conceptualized using physical terms on body behaviour, functions or reactions. The latter domain activates physical and concrete mappings which are more immediate to our experience (figures 5 & 6). Interestingly enough, the civil engineering field is just one of many where similar metaphors can exist[3].

Mapping	Source Domain BODY → Target Domain ENGINEERING STRUCTURES
	CORRESPONDENCES
Engineering structures undergo physical damage	stress strain fatigue torsion fracture collapse

Mapping	Source Domain BODY → Target Domain CONCRETE
	CORRESPONDENCES
Concrete has physical reactions	bleed sweat weep

Figures 5 & 6. Examples of metaphorical mapping in technical language

What are the didactic implications of highlighting the use of metaphor in technical terminology? First, it could make easier the teaching of vocabulary. The metaphor mechanism provides a certain unity to the otherwise isolated terms, directly fostering their retention in long-term memory. Secondly, the study of sub-technical vocabulary can be better appreciated if structured in terms of meaning extensions or meaning chains. In other words, through the study of metaphor, polysemy or metonymy. Finally, how can the cognitive approach in LSP contribute to interdisciplinary studies? We believe that LSP professionals should not only teach a specific type of language. As Widdowson (1984: 201-204) claimed, the LSP teacher’s role should be more than that of an instructor, students need to be taught how to be creative and not only to reproduce a set of specific techniques. Likewise, the analysis and the clarification of technical terms and discourse fall well within the LSP scope. The cognitive approach can provide an ideal tool to implement them. As we know, technical language can serve for multiple purposes, especially our concern here is for academic and occupational needs. Students and engineers, as its major

[3] For an extensive treatment of metaphor in a specific environment, see Roldán Riejos (1995).

users, ought to benefit from scientific approaches applied to its study. Whatever they need the language for: writing, reading, or even translating reports, letters, publications, or manuals, they will cope with it better if they can understand its most basic mechanisms at work. This is one of the most important LSP tasks. This is also a means of demystifying the idea of technical discourse as cryptic and incomprehensible for the non-specialist.

6. Conclusions

The aim of this paper was to prove that it is possible to offer innovative insights from the LSP sphere. Some of these may be useful in the study of the technical discipline language.

Starting from its possible application in the first stages of LSP teaching, i.e. course design when establishing target and needs analyses, the concept of interdisciplinarity has been described. After presenting some considerations on interdisciplinary research, the cognitive theoretical model has been introduced to study various examples of technical terminology.

In this constantly changing technological world, communication is crucial. LSP practice, which includes teaching and research, can be the best tool to collaborate in its improvement and clarification. This task would also enhance the LSP position in academic, occupational and scientific forums.

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