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Thoughts on LANSOD Teaching and Learning in France: The Example of English for Science

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Abstract

For over 30 years, demand for English courses in LANSOD (Languages for Specialists of Other Disciplines) has been high in French universities. In response, universities have created new jobs and new needs have been identified. Consequently, two important problems have emerged: student management and teacher training. A more coherent structure should be considered to develop specialized language teaching. The question then arises of how this can be achieved? We address the issue by drawing upon research conducted in the course of our practical work as an English teacher in a French university specializing in science and medicine.

Key words: Languages for Specialists of Other Disciplines – scientific English – French scientific universities.

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Introduction

In France, university-level language teaching became widespread following the LMD (*Licence-Master-Doctorat*) reform in 2002.Such teaching is known as LANSOD (Languages for Specialists of Other Disciplines) and, unlike courses in English studies, which are intended for language specialists, it is addressed at a non-specialist audience. Nevertheless, it usually includes courses that are tailored to specific purposes, known as English for Specific Purposes in the Anglophone world, or specialized English courses (*anglais de spécialité*) in the Francophone world (Petit 2002).

For over 30 years, demand for English courses in LANSOD has been high. In response, universities have created new jobs and new needs have been identified. Consequently, two, equally important problem shave emerged: student management and teacher training. Moreover, little thought has been given to how these courses fit into the broader disciplinary curricula, as the decree of 25 April 2002[1]simply specifies that students must "master at least one foreign language". Without a more coherent structure, it is difficult to develop specialized language courses as a real teaching discipline. Given the complexity of the situation, the problem must be framed more globally, as it affects not only the individual learner, but also professional training in general, and society. The question then arises of how this can be achieved? We address the issue by drawing upon research conducted in the course of our practical work as an English teacher in a French university specializing in science and medicine.

First, we present an overview of the LANSOD domain and take stock of pedagogical practice in this field, focusing specifically on the case of teaching scientific English. Next, we take a step back and revisit teaching practices, both in the light of theoretical scientific work, and from a humanist perspective (partly) based on the working document prepared by the European Commission (*Rethinking education – Investing in competences for better socio-economic outcomes*, European Commission, 2012). Finally, we propose some new pedagogical scenarios.

1. LANSOD practice in France

1.1. A review of LANSOD teaching

The question of specialized language teaching in the LANSOD sector in France has generated much thought. A problem arises when teaching is provided by linguists who have not received the adequate teacher training and who pursue their research in fields such as literature, linguistics, or civilization. The risk is that teaching becomes distinct from research, unless close attention is paid to the specific nature of the problem and the challenges; more often than not this requires the associate professor/professor (AP/P)to familiarize her/himself with a new field. Moreover, it seems that this training occurs on the ground, as teachers become familiar with their students' discipline. In many cases, language teaching only becomes an issue as courses are designed and specific needs emerge. The natural corollary of this problem is the ability to master concepts, reasoning processes, and documents in the disciplinary field

[1]Article 6 of the Decree relating to the award of a Master's degree in France, which made competence in a foreign language a requirement.

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in question. The method linked to teacher training is therefore crucial and inextricably linked to how this knowledge can be integrated into a course of "specialized language".

Researchers have defined this expression in various ways: it can concern the language used in communication situations that require the exchange of information in a particular domain of knowledge (Galisson & Coste, 1976), or a "natural language used as a vector for specialized knowledge" (Lerat, 1995), or a linguistic subsystem (Dubois *et al*., 2001). In the classroom, the language teacher prioritizes vocabulary, syntax, and grammar drawing upon the specialized domain, and not the other way around, a practice that is itself part of the debate regarding the definition of 'specialized language'. There is also the question of teaching materials: should (can) we design a course based on specialized, technical documents, or should we also draw upon general materials such as newspaper articles intended for a non-specialist readership that discuss concepts relevant to the domain? The risk here is that we fail to address the fundamental mechanisms that structure the discipline, which we call, for want of a better term, the 'non-linguistic discipline' (NLD).

In French higher education, the majority of specialized language courses are taught by linguists, which is an important point when setting up specialized training prior to the hiring of LANSOD teachers. It highlights a situation that can be complicated for the AP/Pwho, ideally, has been recruited on the basis of their coherent teaching and research profile. However, this is rarely the case and, in reality, the accent is put on one or the other. Moreover, while schools have teaching teams that can coordinate NLD and language competences, this is rarely the case at university level, as language teachers rarely communicate with colleagues working in specialized domains. Where interdisciplinary collaboration does exist, it is informal. As discussed above, language teachers tend to use course materials they are familiar with, such as films or documentaries, which contain a mix of fictional and factual content and can be used to create individual or group activities and tasks.

A key question concerns the extent of the domain-specific competences required of the language teacher who attempts to develop hybrid disciplinary knowledge, notably with respect to the learner-specialist who gradually becomes an expert in their domain as their studies progress. A question arises regarding the appropriate mode of "acquisition by the language teacher of competences in a professional culture that is not their own" (Isani 2004: 15). The teacher's competences can also be judged by the extent to which they understand the specialized domain they are working in. The underlying question is: can a teacher really teach something that they do not fully understand?(*Ibid*: 159). There are many answers to this question: specialized knowledge can develop over time through exposure; interdisciplinary work can help, etc. However, we argue that this is insufficient, especially at Master's level.

Some researchers have claimed that specialized English teachers do not have to "become a specialist in the discipline", or replace specialized colleagues (Dudley-Evans, 1993: 2; Perrin, 1995: 9) while others argue that specialized knowledge is as important as linguistic knowledge. Weagree with Combes- Joncheray (1999),who argues that it is necessary to be competent in the specialized domain for several reasons. On the one hand, the teacher's credibility is at stake and, on the other, he or she must be able to discuss the domain of specialization with a certain degree of confidence, "The learner's discipline should not be *terra incognita* for the teacher" (Percebois, 1996: 118). Furthermore, the teacher cannot rely on help from students who are still learning, especially at Master's level (Faure, 2014).

We now turn to the current situation in specialized English teaching, notably scientific English. We begin with the example of the language department at Paul Sabatier

University(PSU) in Toulouse, France, before proposing a new way to approach teaching scientific English courses.

1.2. A variety of pedagogical practices

Pedagogical practices are varied. They depend on the teacher: their status (associate professor/professor (AP/P), higher education professor, reader, temporary staff) but also their professional experience. Most have followed the traditional French language training path(see note 2) and consequently have a "disciplinary professional loyalty that tends to frame teachers' educational responsibilities" (Beacco,2017: 27).In practice, they are unprepared to teach in this context. Most often, they have trained themselves on the job. Course content is primarily the responsibility of teachers and is the result of their professional experience, in particular:

- The type of institution (e.g. university, engineering school);
- The existence (or not) of a language policy: the distinction between general and specialized English courses, TOEIC courses. These courses are complementary and cannot substitute for each other – each has a particular function in the student's training.

1.3. Example of teaching scientific English in the French system

Here, we present one typical example of Master's degree in a science university - Paul Sabatier University (PSU-Toulouse, France), rather than carry out a comprehensive review of different pedagogical practices. The following teaching unit (TU) concerns the objectives and contents of language teaching (mainly English) for the first year of all Master's degrees at PSU.

Objectives:

- Develop the key competences students need to **integrate** into professional life.
- Perfect the communication tools that make it possible to express oneself in today's international context and acquire the linguistic autonomy necessary for this **integration.**

Contents:

- **Scientific writing** communication tools (e.g. project reports, summaries).
- Tools required to make an oral presentation or contribute to a critical discussion in the **scientific domain**.
- Linguistic foundations for discussing a project on a **specific theme in the specialized domain**.
- Communicative and linguistic structures used in the simulation of a work-related task.

It can be noted that these objectives and contents include the key words 'tools', 'foundations', and 'structures'. These terms underline the instrumental aspect of language and highlight a fragmented perspective: on the one hand, communication; on the other, the domain of specialization (scientific domain, scientific writing, specialized theme). The objectives also include the words 'perfect' and 'develop' because students have already studied the language in secondary school, therefore there is a continuum between specialized language and general language.

1.3.1. Discussion

The approach is essentially based on language communication or other unspecified competences. The exceptions are interaction and mediation, as detailed in the Common European Framework of Reference for Languages (CEFR 2001).The ability to mediate (with respect to language or culture) is neglected, while it has become essential: examples include language mediation between the scientist and the public, or cultural mediation in the context of the diffusion/communication of science in pluri- and/or intercultural contexts.

The notion of 'knowledge' in the sense of standardized knowledge (Fourez, 1996) is also neglected: knowledge, know-how, interpersonal competences, or learning competences. The keywords are 'communication', 'international', 'professional life'. Content is addressed through 'language' and based on competences, while the link between language and the specialization is not made. The absence of knowledge is particularly noticeable, given that it has a supporting role in the context of 'data', which is common to both general and specialized science. In France, students of English are taught about, for example, civilization (British, Irish, American history); a similar scenario could be envisaged for science students with respect to Anglophone scientific culture.

It is clear that certain constituent elements defined in the CEFR are indispensable: this is the case for language activities and linguistic competences. However, the objectives of English courses are poorly defined. French students begin to study English in middle school but, at university, they repeat the same exercises (oral and writing competences and production), and revisit the same grammatical, lexical and phonological issues drawn from general scientific themes (e.g. genetic modification). The link between language and science remains inconsistent in the context of the student's overall education.

1.4. LANSOD constraints and pitfalls

LANSOD can be characterized by certain constraints and some pitfalls that we formulate as questions. First, typical institutional constraints concern the lack of teaching hours (e.g. 24hours per year), the lack of ECTS[2] credits (3 or 6), and the large number of students per group (20–28). Moreover, English levels are heterogeneous. Given these conditions, what is the best way to improve spoken interaction and production?

1.4.1. Representations

There is another type of constraint: actor's representations. According to Castellotti and Moore (2002: 10), "representations have strong links with learning processes, which they help to strengthen or slow down". The teacher must rethink their role in the teaching-learning situation, i.e. they are no longer the exclusive holder of knowledge, but a mediator. This assumes that they are aware of the role played by their representations, in order to analyze and modify them if necessary (Haramboure, 1996). It is important to take account of how teachers appropriate their new role. Teachers construct socially-situated representations from the world around them, which induce attitudes and postures. According to Jodelet, "[T]he concept of social representation designates a specific form of knowledge, common sense, whose contents

[2]European Credits Transfer System**.**

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demonstrate the operation of socially-marked generative and functional processes" (1984: 357).

Today, the notion of representation is increasingly present in research on the appropriation and transmission of language. In particular, speakers' representations of languages, their norms, and their characteristics influence the procedures and strategies they develop and implement to learn and use them (Dabène, 1997). Consequently, knowing and being aware of representations can change ways of learning. However, the notion has many meanings, due to its application in different disciplines, and the term must be clarified. The concept has been studied in disciplines such as social psychology, and by many authors[3]notably social scientists working on the design and evaluation of systems. In the field of linguistics and language teaching, several schools draw upon the notion. For acquisition linguists, representations structure language appropriation.

Learning specialists have adopted representations as a fundamental concept. Science educators in particular have sought to clarify and deepen the notion from a didactic perspective (Giordan& De Vecchi, 1987).Giordan and de Vecchi (1994) define representation as follows:

> A conception (or representation) is an individual's explanation of the world around them, via the explanatory models they have at their disposal. When we observe something, we relate to this 'spontaneous' representation of the world, to this initial model. In other word, judgments are based on the experience of the individual who interprets it based on their cultural references.

The above suggests that we understand that some judgments reflect surrounding concepts and are therefore linked to the socio-cultural context in which they emerge. Every individual has a mental representation of surrounding phenomena from a very early age. This mental representation forms the individual's beliefs that are intrinsically linked to their environment or socio-cultural context.

Here, we focus on two aspects: 1) The weight of institutional constraints cannot be ignored; and 2) The system can only 'come to life' once actors have grasped it. In practice, each person understands the system as a function of their representations, in their own way.

1.4.2. Actors' representations in LANSOD-sciences

We examine the case of English in science. The situation of the English AP/P in the science domain with regard to actors' representations is shown in the following figure (Author 2017). First, English teachers and AP/P have their own vision of the English course: they are shaped by their training and envisage the course from this point of view. Teachers reason in terms of meeting pre-defined objectives that will be evaluated, and these representations differ as a function of their professional experience.

Then, the English teacher is constrained by the demands of science managers and AP/P. The latter's vision of the English course differs from the former. Specifically, they do not have a

[3] Several researchers have devoted themselves to the topic. The sociologist Durkheim considered that representation is a collective interpretation of certain social realities, while the concept acquired a transdisciplinary status with Piaget (1965) and Bruner (1966). In didactics, representation refers to the "already conceptual" (Astolfi & Develay, 1989).

clear vision of the content their students need: some like to see a course based on vocabulary or specialized terminology, others think that something general will suffice.

In addition, the English teacher may be indirectly constrained (depending on their personality) by professional requirements based on their representations. This is true for Anglicist researchers (research oriented towards literature, civilizations or linguistics) whose representations are different. Finally, during the course, they come face-to-face with students' representations of the English language (language-tool) and the course. It could therefore be said that the teacher is a 'prisoner' of the representations of teachers, students, their professional peers and, to a certain extent, society.

Often these representations are negative and have an impact on the teaching and, consequently, the learning situation. It is therefore necessary to intervene at the level of the representations that teachers and students have of the context (courses, university, the world of work) and modify them. Representations exist and cannot be neglected. On the other hand, they can be modified within a teaching-learning situation: some can be linked to the 'good language course', while others, such as financial constraints, are more difficult to address.

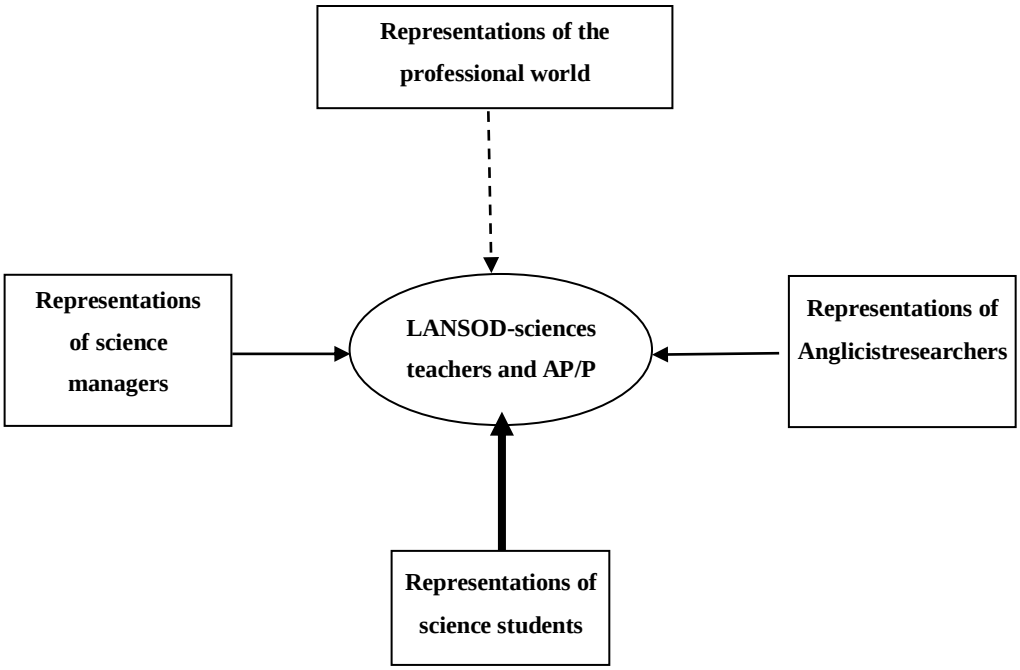

Figure 1: Network of actors' representations in LANSOD-sciences (Author,2017)

Legend

- - - - → indirect impact on the teacher-AP/P

——→ pressure that determines the conditions and constraints for the existence and development of the 'scientific English' object

▬▬→ direct impact on the teacher-AP/P

1.4.3. Pitfalls in LANSOD-sciences

The following outlines some of the pitfalls concerning such practices:

- Are language and the specialization truly integrated? If so, how?

- How can we understand the specialization given that the language teacher does not teach it in the foreign language?
- Is the notion of 'culture' considered? What is understood by 'culture'?

We argue that it would be useful to think again about this kind of teaching in terms of integration, links, and organization. For example, what links could be made in a teaching-learning situation in the context of LANSOD-sciences?

- How should we set the objectives of the English course?
- What is the role of 'knowledge'?
- What competences need to be developed?
- What is the best way to work with/ reconcile different representations, given that the current system strengthens divergent representations between actors?

Thought is required at several levels: The Ministry of Higher Education, Innovation and Research, the University, research and teaching.

A discussion was initiated on foreign language teaching at the University and, in particular, LANSOD between the French Group of Associations of Languages and Foreign Studies (*Groupement des Associations de Langues et Etudes Etrangères*) and the Ministry, via the Secretary of State (2016 and 2017). This type of discussion is rare because in practice, language teaching in an international context equates to teaching English (without considering the cultural aspect). However, this type of discussion-thinking is also essential at this level.

But how will this process be continued by President Macron's new government and extended to the university level—and what will its role become? France cannot do without a language policy at the present time. And, going forward, how can we incorporate the results of research, and benefit from the accumulation of pedagogical experience. Research will allow us to think about this link.

1.5. The importance of culture

The link between language and specialized science is not fully understood, notably the relationship between language and scientific culture. On the one hand, the convenient, but falsely symmetrical notion of 'language–culture' juxtaposes the two elements—but this juxtaposition is not problematized (Beacco,2017: 23). On the other hand, the gap is due to the difficulty of understanding what a language is in a scientific context, a lack of clarity regarding terminology (are we talking about science or sciences?), and the complexity of the term 'culture'.

1. LANGUAGE: Whether in research or teaching, language in the scientific context is considered as a tool. However, language is not only an intermediary for the communication of knowledge; it is also an instrument for the discovery of knowledge. In teaching, the cultural dimension is (often) hidden by the functional dimension. In practice, it cannot be dissociated from its cultural dimension because there is a scientific culture, which must be considered. On the other hand, a distinction must be made between the language of teaching and the language of knowledge flow: in the first case, it is preferable to teach science in the students' first language; in the second case, flow can be in the vehicular language (as was the case for Latin in the past) (Beacco, 2017).
2. THOUGHT/THINKING: Boroditsky(2001) asks the following question, "Does the language you speak affect how you think about the world?".She concludes that:

> (1) language is a powerful tool in shaping thought about abstract domains and (2) one's native language plays an important role in shaping habitual thought (e.g., how one tends to think about time) but does not entirely determine one's thinking in the strong Whorfian[4] sense.

Moreover, her experiments "show an effect of thinking in the mother tongue on second language comprehension using the implicit measure of reaction time" (Boroditsky, 2001: 3).

On the other hand, Beacco (2017) claims that:

> This 'thought' vaguely defined [in this way] has often been characterized as a 'world view', starting with W. Humboldt. But in the discussion of his theses, we have often noted (recently, Debono, 2013: 25 and following) a distinction between a vision of the world and 'creation of the world' through the filter of languages (*Weltansicht*), which is only a perceptual grasp, and a conception of the world (*Weltanschauung*), which would determine thinking in a radical way, what we call 'linguistic relativism' (2017: 142).

We can therefore say that language in science is not only a vehicle; it also reflects a scientific way of thinking that is specific to each language culture (Francophone versus Anglophone).

3. The term SCIENCE: Science is considered a 'finished product' (Latour, 1989). However, it is also a practice carried out by men and women, which is constantly being constructed, and is made up of both successes and errors and failures ("science in action", *Ibid*.).
4. The type of SCIENTIFIC CULTURE: Here the question concerns culture in the pragmatic sense (to produce knowledge) or in the critical sense (to understand and measure production challenges). We consistently refer to the monolithic sense of culture in science; we are not interested in the complex and composite nature of its construction.
5. CULTURE: If culture is addressed, it tends to be the question of the working culture. Anthropological culture, i.e. how this scientific culture has developed, is rarely examined.

Science is not part of the culture linguists take an interest in. An example will help to demonstrate how culture is integrated in some specialized languages and neglected in others: law compared to science. While legal language is closely linked to the history of systems and institutions that have developed their own concepts and principles, the language of science is unrelated to economics, history, or politics. It is not therefore the case that science could be taught in the context of the culture in which it was born and developed. This is strange, because science is composed of a mosaic of knowledge conceived in various languages and cultures, and therefore cannot be dissociated from its cultural dimension.

[4] This is a reference to the linguistic relativism of Sapir and Whorf. The languages we use influence our vision of the world. They determine our interpretations to such an extent that two individuals with two different languages react differently to an observed state of affairs. Whorf says on this subject, "We cut nature up, organize it into concepts, and ascribe significances as we do, largely because we are parties to an agreement to organize it in this way—an agreement that holds throughout our speech community and is codified in the patterns of our language". However, the concept is more complex than it seems because while both authors affirm that language determines thought, they also admit that the development of language also depends largely on that of thought, "the instrument makes possible the product, the product refines the instrument" (Sapir 1949).

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2. Some new ideas about teaching practices

2.1. Questions about the purpose of English courses in the sciences

Teachers often ask themselves the question: What do I teach? How? (what activities and what resources?) but the questions Why? In relation to what? To whom? are not always asked. These other questions should also be asked from the student's perspective: What are we learning? What's the point?

It seems useful to think about this relation between practice and its justification through a 'discourse'(*logos* and *praxis*). Research is approached praxeologically. Praxeology is understood in the sense of Chevallard (1992) and is broken down into *praxis* (type of tasks and technique) and *logos* (technology and theory): the first refers to practice, know-how, while the second refers to theory, discourse that describes, legitimates, and explains *praxis.* Moreover, all human activities can be analyzed using four principal terms: task, technique, technology, theory (Chevallard,1992).

Another question remains: What is the added value of this specialized English course, compared to a general English course, in the student's training?

2.2. Rethinking the course: Objectives and competences

The LANSOD English course in the sciences is seen from the point of view of language teaching – you teach something to someone; you train someone to do something – and learning that language. However, two other dimensions are relevant, as they are part of the teacher's job and must also be considered here: 1/ Training, in the sense that training is the preparation of the individual for a more global (integrated) social function. At university level, teaching also includes professional scientific training. 2/ And education, in the sense that education is learning how to be an individual: citizenship. This course could be enriched by adding an objective related to:

- Developing critical thinking competences (i.e. in the sense of ethics training)

The main objective would be to emphasize the importance of understanding science – in addition to its production. The epistemologist and physicist Lévy-Leblond states that we should, "attach as much importance to understanding knowledge as to its production" (1996: 23). This means that a great deal of attention would be given to asking questions; this would, in turn, help to develop communicative language competence, which comprises linguistic, sociolinguistic and pragmatic competences (CEFR, 2001).

- Emphasizing the cultural dimension of science

The English course can be a bridge between general culture and the scientific domain. This can be achieved by research based on interdisciplinary competences. For example, understanding the history of science helps students to understand the historical, sociological, philosophical evolution of the discipline. Teaching in English meets the intellectual requirements of modern universities, and the requirements of scientific thinking. It also makes it possible to decompartmentalize domains and enrich knowledge.

The competences or abilities that could be assessed would be the following:

- Acquire the scientific knowledge necessary for understanding scientific thought and conceptualization,

- Analyze scientific professional activity:

  - Identify scientific approaches from a cultural and language perspective to understand scientific activity,

  - Analyze language exchanges in these activities (Author, 2017).

At this stage, we must underline that our aim is not to transform the English course into classes on the history or philosophy of science. Moreover, we are not specialists in these disciplines. Rather, they make it possible to integrate the English course into a broader context: the language and culture of science. For many people, although English is currently the language of international scientific communication, this has not always been the case. This poses a number of problems that can be addressed in this type of course: the dominant role of the English language in knowledge. Moreover, it is interesting to see how language and its culture influence the way of thinking: for example, we can examine how texts from two different cultures (e.g. the work of Maxwell rewritten by Poincaré) can help in writing research articles.

When a French academic reads a text written by the Scottish physicist and founder of electromagnetism, James Clerk Maxwell, for the first time, the experience can be disconcerting as the reader is unfamiliar with the intellectual and cultural context of the text and the author. The French mathematician, Poincaré argued that readers reacted in this way because Maxwell's theories did not conform with the expectations of French scientists. He therefore reformulated Maxwell's work into a format that would be considered coherent, rational, and Cartesian by a French audience. His translation was fundamental rather than literal. He rethought Maxwell's ideas in ways that would make them understandable and acceptable to French academics who were acculturated to different standards of expression and rigor.

2.3. What should be the "stable core" of the "English for science" course?

While constraints are part of the LANSOD landscape, paradoxically their urgency and strength drive didactic innovation among specialist language practitioners. Constraints are inevitable but can be a force for creativity and inventiveness in teaching and learning, suggesting that it is possible to build a 'stable core' of knowledge in the LANSOD sector.

The stable core of English for science[5]should incorporate not only all educational goals, but also some of the CEFR principles of language learning and teaching, together with proposals regarding research into science teaching. These principles are: Educational research into teaching sciences; intercultural approach (UNESCO, CEFR).

Citizens are increasingly confronted with 'science in action', which is rarely found in current science and technology education in France. Teaching has been criticized by researchers in the domain for its lack of relevance and coherence for learners, teachers, the professional world, and citizens (Fourez, 2002). It is out of step with day-to-day reality and has evolved with the emergence of technoscience. Citizens therefore lack the knowledge that is needed to understand, debate, and form an opinion on scientific and technical issues (Nicolas, 2012: 127).At university level, science students acquire techniques (such as solving an equation), and learn theories, but they do not know what scientific thought is (Lecourt 2003: 105–108). And as the French philosopher Lecourt says, they do not have "the intellectual instruments necessary to answer the questions that will certainly be asked of them" (*Ibid.*,2005: 451).

[5] English for science is different from scientific English (see Author, 2016, 2017).

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Science education should provide tools to better understand the world (critical thinking) and provide a scientific culture.

In addition, science students are not taught about the working life of scientists, although it is their future profession.

> By 'life', we mean cognitive expectations (what types of reasoning and intellectual approaches are expected in the laboratory and social expectations (what are the collective rules that govern contradiction, controversy, validation, publication, distribution of resources and rewards, recognition, promotion, etc.) (Lecointre, 2013: 5).

Anyone seeking to make a career in scientific research should be able to identify the personal qualities that are expected in their intended professional sphere.

Our aim is that the teaching of scientific English should be founded on an educational basis that is in keeping with today's world and "reconnect […] with one of the primary functions of language knowledge: humanistic education" (Beacco,2017: 13): the promotion of a scientific and technical culture, and thus citizen action in a technoscientific world. We suggest that the English teacher can act as a linguistic, cultural and social mediator in the sciences by contributing the knowledge outlined above: students should reflect on what they do and why they do it, they should analyze their scientific practices, by using oral and written English.

How to constitute this core?

Given that each actor has their own knowledge and representations, and remains within their domain of expertise, knowledge is not shared between the various actors, nor is there any 'disciplinary dialogue'. It therefore appears to be a question of building a *common knowledge* space (Author, 2017,Chevallard, 2016)that facilitates dialogue between scientists (teachers and students), and linguists. This would make it possible to think about the 'human sciences' dimension: How was science created? By who? What's the aim? In other words, thinking about the link between science and society. We argue that it is wise to draw upon the history, sociology, and philosophy of science. In this way, the English for science teacher can reconcile two aspects of science ('hard' science and 'human' sciences). As Guillaume Lecointre, Professor at the French Museum of Natural History, points out, there is "an organized divorce between those who do science and those who talk about science being done" (2013: 8), which prevents a holistic vision of 'science'.

The history of science could shed light on the scientists and researchers who have made science an independent discipline, and establish closer links between science and society. Atthe same time, the philosophy of science enables us to describe its modes of reasoning and can highlight contributions from different cultures from contrasting perspectives (for example, Descartes and Bacon in Francophone and Anglophone countries). Our aim is to transform the relationship of the language teacher to the knowledge they teach, enabling a dialogue of representations between the various actors.

Students would become more adaptable and flexible. They would learn something other than techniques (knowledge), and would also be trained in critical, scientific thinking. This implies an expansion of communicative language competences: both linguistic competence and sociolinguistic and pragmatic competences (cf. CEFR).

2.3. Redefining the role of the actors

Students would have a 'shared' learning relationship with teachers; this redefinition would require closer and systematic collaboration between science teachers and linguists. We would move towards a convergence of representations. Thus, the language teacher would become an "enlightened mediator" (Author 2017). This role would require specific training, and we have addressed this need by following GERAS [6]recommendations regarding the link between linguistic and cultural dimensions. In addition, together with colleagues at the Interuniversity Research Laboratory for LANSOD Didactics (LAIRDIL), we have begun to reflect on training methods for both initial student training and those who are already working. This led us to create a Master's program, the Didactic of Languages in Professional Activities. This program will contribute to recognizing LANSOD as a teaching domain within language teacher training; in order for this to happen, proposals from actors in the field must be approved by the Ministry of Higher Education, Research and Innovation.

3. Some ways to create classes based on knowledge in science

The avenues that we propose here appear logical, but they are necessarily incomplete as they only reflect the perspective of a linguist associate professor. We have not explained what the knowledge that is transmitted to teachers consists of, nor its interactions/relationships at different levels (Author 2017). The organization of these scenarios may vary according to the discipline, type of training, political, economic, epistemological orientations, etc., and different choices will result in different transpositions. The proposed avenues take the form of pedagogical activities that are focused on knowledge in science (scientific practice rather than established scientific knowledge). Some potential themes are discussed: the scientific approach, controversy, thought processes (Author2017).

3.1. Approach

These pedagogical applications are consistent with the course objectives, and the language activities and competences to be worked on, which constitute the key foundations for a language course. It would be useful to add *logos* to practice, which would justify teaching practices. In concrete terms, the teacher's work translates into the question 'What do I teach?' –the *praxis* part (What activities? And how?)– thinking the *logos* part (Why? / Based on which conceptual framework?). We could equally well begin with practice, but we argue that both must be included in the process.

Three aspects are addressed: goals, links (praxeological sheet), the pedagogical aspect.

Language activities of production, reception, interaction and mediation.
Linguistic competences: Lexical competence, grammatical competence, phonological competence.
Sociolinguistic/cultural competences: Scientific thinking, such as methods.
Pragmatic competences: Written and oral communication formats in the scientific field.
Contents: The current theme.

Figure 2–Goals for teachers

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The 'links' aspect (praxeological sheet) considers the 'how' (*praxis*) and the 'why'(*logos*). This sheet is an important element when talking to specialized teachers.

Type of task (knowledge-based approach in science): Is expressed by a verb (write an article) on a relatively specific object.
Technique: How to perform the task.
Technology: Discourse that justifies the use of this technique (objective).
Theory: Discourse that justifies the use of this technology.

Figure 3 -Praxeological sheet for the teacher

The pedagogical aspect is addressed at the student and indicates how the activity unfolds, notably the language exercises and activities designed improve linguistic competence that is essential to any language course. Cultural notes are included that clarify certain notions or cultural facts.

3.2. Example of a theme: Ethics in science

Including the notion of ethics in scientific English courses is consistent with the expectations and concerns of current science research and the recommendations of the educational system. The question of the 'other' seems to be the "blind spot of the French education system" (Mutuale, 2017: 16). For Mutuale, this question is primary in the educational relationship, the relationship being an "ethical interpellation"(*Ibid.*: 20)[7]. This experience, which he called the "phenomenology of presence"(*Ibid.*: 32), emphasizes the attention given to the other. It is a question of "becoming curious about the other"(*Ibid.*: 33). In addition, Beacco invites to "develop an experiential approach" (2017: 31) that integrates the dimensions of culture, interculturality and otherness, and the principles outlined below. These ideas are part of what Morin calls the "development of anthropo-ethics" (2000: 127), i.e. the regeneration of solidarity and responsibility that is based on the "teaching of understanding", which he advocates in the seven areas of knowledge.

Ethics is defined as reflection on human behavior and the values that it is founded upon. It allows us to ask questions along the way, to reflect, to decide on a case-by-case basis. It is an approach that is implemented in order to act as well as possible, to make an informed decision. It is not the result of a rule. Jürgen Habermas provides some specific rules for any discussion of ethics in his book *Discourse Ethicssuch as "*Listening, open-mindedness, consideration of the other's arguments; Express yourself, express your opinion. Encourage the shyest and least articulate" (Durand, 1999).

Various classroom approaches can facilitate the development of students' ethical thinking competences:

- Case studies: the teacher tells a true story or presents a scenario and students discuss the ethics.
- 'What if...' scenarios: this activity is similar to case studies – imaginary examples of what the consequences might be in a particular situation.
- Reciprocal reading: reading an article at the same time as new or difficult scientific concepts. This involves multiple discussions and the clarification of ideas. This activity can be done in small groups or in class.

[7] "It is the ethical question that will re-examine and re-found the epistemological question". This "interpellation by the other leads me to a work of knowledge".

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- Role play, which may include meetings to reach agreement.
- Transactional writing: argumentation/reporting.
- Continuum of values: Students' values related to an issue are ranked in order of priority. Students line up in a continuum ranging from 'strongly disagree' to 'strongly agree'. Alternatively, they can record their thoughts on a line, place their card on a line, or list options ranging from acceptable to unacceptable. This activity can be used as a pre-test and then as a post-test, to help students see changes in their thinking and understand the reasons.
- Oral/ written course activities: who chose the subject of the course? Why this subject? What motivates me to work on this topic? This activity can be extended to the thesis topic with the same questions, and adding the following two: Who am I funded by, employed by? Who does my research belong to?

All of these approaches make it possible to practice language, sociolinguistic/cultural and pragmatic competences as well as to develop cultural/intercultural awareness in languages (foreign and mother tongue) in sciences that are not only at the crossroads of disciplinary cultures, but also national cultures. In a way, these approaches can aim to develop the 'ethical competences' students will need in their various careers.

Starting with the theme of ethics and these approaches, the teacher can develop their objectives and praxeological sheets before drawing up the classroom session.

Conclusion

Ourarticle aims to contribute to building the foundations of LANSOD and, eventually, the inclusion of LANSOD science courses in the French university context. More broadly, it raises the question: What is the contribution of our applied research to LANSOD?

It is clear that it does not produce recipes for courses. As practitioners, we develop courses that are tailored to student profiles, their training, our training, and our past experience. Next, as researchers, we step back and analyze what we have done in terms of various scientific theoretical contributions (e.g. neuroscience). We explore learning mechanisms and teaching situations by considering all of the elements that are present and may interact. These observations allow us to intervene in practice.

This research is neither normative nor prescriptive, and the objectives are twofold:

- Observe/analyze what is happening in the field to understand and explain the phenomena that occur in teaching-learning situations; and
- Identify what works well when analyzed with research tools, remedy certain learning problems, and design systems based on scientific knowledge and theories.

It necessarily draws from models and theories, but also pedagogical practices, as they begin in the language classroom.

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