

The place of the languages of schooling in the curricula

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An approach with reference points:

Items for a description of linguistic competence in the language of schooling necessary for learning/teaching *history, literature, mathematics and sciences* (end of obligatory education)

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LINGUISTIC DIMENSIONS OF KNOWLEDGE BUILDING IN SCHOOL CURRICULA

Jean-Claude Beacco, Daniel Coste, Piet-Hein van de Ven and Helmut Johannes Vollmer

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Introduction

Purpose of this text¹

Whatever the subject, all knowledge building in the school context involves working with language. The purpose of this text is to suggest a general approach enabling different levels of specification of these language dimensions to be classed in transversal descriptive categories. The aim is to describe the process leading from units for analysis of actual uses to the identification of linguistic forms and mechanisms appropriate to those uses².

The emphasis here is more specifically on the relationship between knowledge and the language of schooling. The *Platform of Resources and References for Plurilingual and Intercultural Education* includes two documents illustrating ways of moving, in a given school subject, from educational values to linguistic forms in several analytical stages. One of these documents deals with history, the other with experimental science. They are the work, respectively, of Jean-Claude Beacco and Helmut Vollmer (see 4.2.2.). This document generalises and offers arguments in support of the procedure employed for these two somewhat illustrative cases.

It is aimed not only at the authors of curricula and textbooks and the designers of tests, but also at teachers, and especially teachers of subjects sometimes quite wrongly described as “non-linguistic”, to draw their attention to the language components of work in their subject. It is also relevant to teacher trainers, particularly those responsible for the teaching of disciplines other than languages taught as a subject.

The underlying assumption for such an approach, therefore, is that knowledge building in the different subjects depends to a great extent on a better command of the scientific, artistic and technical discourses³ produced in the language of schooling. Often, however, this language is deemed to be common and assumed to be transparent, in other words the specific nature of scientific discourses is reduced to a specialised lexicon. A good many pupils – and particularly a good proportion of those from disadvantaged backgrounds – encounter learning difficulties which are due not only to a discrepancy between their spontaneous knowledge and the knowledge to be acquired, but also to the fact that their discursive repertoire (the discourse genres which they know and practise) does not include – or includes only to a small extent – scientific discourse genres⁴.

Role of this text in promoting plurilingual and intercultural education

Enhancing and broadening learners’ language repertoires and improving their command of discourse genres is one of the goals of plurilingual and intercultural education. The right to quality education therefore includes the right for children attending school to gain practical experience of discourse genres whose command (to varying degrees) is necessary for personal development and the exercise of critical citizenship. In such a perspective, it is also the function and responsibility of education systems to familiarise all the young people who go through them with discourse genres having a social, professional or practical relevance, and especially with those involved in societal choices and those produced by the scientific communities. The inclusion among the goals of education of both democratic citizenship and the knowledge society means giving young people attending school the language resources needed for

¹ This text draws on numerous bibliographical references. However, given that it is not an academic text but a document mapping out a curriculum, aimed at readers who are not necessarily specialists in linguistics or teaching theory, the authors have decided, with the occasional exception, not to mention them.

² In the work of the Council of Europe’s Language Policy Division, this objective is in line with a set of tools available to the parties concerned (curriculum designers, textbook writers, teachers). For example, in the case of foreign languages, the different *Threshold Levels* sought to relate functional descriptors (e.g.: “congratulate”) and notional descriptors (e.g.: “anteriority”) to linguistic utterances in a given natural language (e.g., in English, for “congratulate”: *Well done!* or, for “anteriority”: *before, previously*). The language-specific reference frameworks represented by the *Reference Level Descriptions*, which are aligned with the levels of the *Common European Framework of Reference for Languages*, meet this same need for instruments linking communicative uses and linguistic material, via a kind of “embedding” of operational categories.

³ This refers to school subjects other than the language of schooling as a subject.

⁴ For the purposes of this document, « scientific » is used to refer to all sciences, whether « natural » or « social ».

membership of and participation in different communities of practice, i.e. components of society characterised, inter alia, by the discourse genres prevalent within them.

Specifying the linguistic dimensions of knowledge building is not confined, therefore, to proposing descriptive categories that serve to bring out linguistic characteristics and conditions of the operation of scientific discourses. Insofar as the most generic of these categories take account of the social groups and practices with which such discourses are associated, they apply transversally to other discursive practices, and in particular those found in educational contexts, and link the latter with the outside world and with their overall educational goals.

General structure of the text

This text reiterates the complex nature of the relationship between knowledge and language (1), emphasising that the specific nature of scientific communication is not confined to the terminology used. It stresses the concept of discourse genre, describing it in particular, but not exclusively, in relation to texts circulating within scientific communities. The general forms of classroom communication are analysed in (2) and discussed in relation to forms of learning. Scientific, artistic and technical subjects are then addressed per se: the relationship between forms of discourse and forms of knowledge building is shown. The latter follows a path that goes from a speaker-centred to de-centred utterances, then to text sequences produced in isolation or as part of classroom interactions representing intellectual operations (such as comparing or deducing), and finally to texts satisfying genre norms, those of “school scientific genres” (also known as “parascientific” genres, which are not used outside school), or sometimes to prescientific genres (report on an experiment, data commentary etc), especially in upper secondary education, where they provide an introduction to the scientific texts of university education and those of scientific communities (4). As the text proceeds, an indication is given of the approaches which should make it possible to identify, for each language and each subject, the forms of language that should be systematised with learners, thus moving from descriptors similar to those of the *Common European Framework of Reference for Languages* to shared description protocols or approaches.

1. Language and knowledge

The comments below are intended to enable the main language of schooling (French in France, Polish in Poland, Greek in Greece etc) to be given its rightful place in the teaching of school subjects. By school subjects we mean subjects as they are named and defined in primary and secondary education. These divisions into school subjects do not necessarily correspond to disciplinary fields: for example, there are courses in history/geography, physics/chemistry and life and earth sciences, which do not coincide with scientific domains. Classes devoted specifically to the language of schooling (“French”, “Polish”, “Greek” etc) must also be included among these subjects: in some respects, they are also a medium for knowledge transmission (history of the language, word formation, analysis of sentence construction, stylistics etc), and it is often their role not only to develop communicative abilities but also to encourage thinking about the language, verbal creativity and an aesthetic appreciation of creative work in the language (literature). These classes in the language (of schooling) have transversal responsibilities because they are about language and the language(s) of schooling, but they serve their own purposes and are therefore not necessarily open to other subjects: while a command of spelling is an asset for written texts in all subjects, the texts to be produced in the subject “language (of schooling)” are probably not transposable as such to other subjects. These have, as it were, a specific “linguistic responsibility”, which does not lie exclusively with the subject “language”.

Before addressing the language dimensions of the teaching of knowledge (scientific, technical and artistic; see 2), we will address the issue of the relationship between language and knowledge.

1.1. The relationship between knowledge and language

Language is not only an instrument for social communication. Language has been used, through oral transmission and writing, to fix and store information and knowledge. As well as enabling it to be transmitted over time, this verbal representation of knowledge has allowed for discussion and scientific disputes, which are essential, from the epistemological point of view, to question and ensure its validity. It also makes it possible to disseminate knowledge in such forms as

education in the strict sense or popularisation (which takes place outside educational institutions), or operational formulations within specific applications (e.g. in the form of instructions, directions for use, protocols, recipes etc).

Many types of knowledge can be expressed in semiotic systems specific to them which make little use of language: mathematical writing, symbols, formulae, statistics, maps, diagrams, photos etc. These codes are self-contained, but they need to be verbalised for purposes of discussion, commentary or teaching.

Lastly, it must be borne in mind that some subjects (e.g. social science) do not use language solely as a means of representing knowledge established outside the texts recording it. A report on an experiment or research report transposes into the language of protocols data or findings established independently of their textual expression and fixation. But some knowledge has no existence or substance outside its verbal representation: for example, there is no historical knowledge outside the texts of historians, even if it is built up from data and evidence of all kinds which are commented on and analysed. In this case, language is not only a transmission medium, but a “place” where knowledge is created. This function is also present in the so-called “hard” sciences, which also use language for heuristic purposes.

This brief outline emphasises the diversity of the relations between knowledge and language. The latter combines functions of:

- representation: expounding and disseminating knowledge established independently of language;
- mediation: verbalisation, making it possible to go from one semiotic system to another;
- interaction, allowing exchanges (discussion, debate, disputes) between the producers of knowledge and between the producers and users of knowledge, which may lead to advances in knowledge;
- creativity, because language can be a means of creating knowledge, the creation and writing of knowledge thus being the two sides of one and the same process.

This diversity of relations between language and knowledge prompts us to consider that language is essential to knowledge and to take the fullest possible account of the variety of functions that language can perform (expounding, transposing, transforming and creating knowledge) in the teaching of school subjects and their appropriation by learners.

1.2. The “conventions” of scientific, technical and artistic communication

The scientific and technical fields are defined by shared forms of knowledge building based on common protocols and concepts. In this respect, they are communities of practice which bring together social players sharing research objects, ways of building, discussing and validating knowledge, and a collective history. This collaborative knowledge building, where ideas and results are shared, creates a specific culture and interrelated institutions: team, laboratories, research centres, academies, journals etc. These may be in competition (for funds, patents etc), but they share values (e.g. scientific ethics) and norms (e.g. defining “good” knowledge building or the quality of technical work).

Some of these “norms” define, more or less strictly and explicitly, conventions relating to (verbal) communication in these scientific and technical professional communities. These conventions concern the form of the texts which are produced and circulated in these communities: thesis, paper to a colloquy, report on an experiment, publication of an excavation site etc. To gain access to these communities, there are “rites of passage”, including those providing the opportunity to show that one belongs to the community by mastering its communication conventions (see 1.3.2.).

There is no ritual filtering of this kind at school, although a command of what is considered “proper” language does play a role in this context. But it is well-known that an insufficient command of language can be an obstacle to the acquisition of knowledge, especially for groups of “vulnerable” learners (from

disadvantaged or immigrant backgrounds, marginalised groups, etc). If being good at science means also being good at talking about science, acquiring knowledge at school means getting closer to the communities which produce that knowledge by familiarising oneself also with forms of communication specific to them and appropriating some of them.

In other words, it is clear that a command of knowledge can by no means be reduced to a command of the language through which it is expressed: one can know a text by heart without understanding what it is about and without being able to use or explain the knowledge expounded. The language used by learners in scientific, artistic and technical subjects (including, partially, courses in the language(s) of schooling) should be regarded by the teachers of those subjects as a set of outward signs allowing them to observe indirectly the learners' cognitive gains. But conversely, as it were, if learners master the "right" linguistic means of communication in relation to the particular area of knowledge, that mastery may be able to have a positive influence on their gains and help them to develop the desired scientific attitudes and approaches.

1.3. Linguistic characteristics of scientific, technical and artistic communication

So far, we have talked about scientific "language", but this concept requires clarification, in particular because the ordinary view would be that it consists of the terminology which essentially characterises science and technology.

1.3.1. Vocabulary and texts

The teaching of these subjects is not simply a matter of learners learning new words denoting new concepts or new categories related to the particular area of study, in the first instance because the words of knowledge are also ordinary words and it therefore involves something other than a set of strictly defined and unambiguous lexical items. It will be important, however, to master, to varying degrees depending on the level of scientific competence aimed for, the rules for forming the terms of specialist vocabularies (e.g. the significance of suffixes (-*isis*, -*asis*, -*osis* etc in medicine or chemistry), the role played by abbreviations (*DN A*), compound word formation, etc). In some national traditions, terms are derived from Greek or Latin (*céphalée* in French), while in others they are closer to the ordinary lexicon (*headache*).

The need for a shared terminology is undeniable (in botany, for example, in view of the many different ordinary names for plants in the different languages). But the teaching (and the practice) of science should also lead learners to relate these terms to one another and understand how they are related. Clearly, that cannot be done simply by naming (defining) things, but involves the use of texts. *Text* will be taken to mean any finite verbal sequence (i.e. having a beginning and an end) produced by a speaker (or by several speakers in the case of teacher-learner or learner-learner interaction), be it oral, written, audiovisual, multi-channel etc, constituting a scientific or pedagogical task. A text consists of one or more utterances (mathematical theorem, description of an experiment, of a mediaeval town etc) linked together to convey existing or evolving knowledge.

So, acquiring the "language" of a science or a technology is not just a question of handling individual terms properly or complying with the general rules of a language (spelling, correct forms etc); in fact, it means showing that one is capable of understanding and producing texts which are consistent with the culture of the particular field or which enable learners to get closer to it.

1.3.2. Discourse genres

These concrete texts do not have a random form left to the personal initiative or creativity of the person producing them: as they are verbal representations of forms of knowledge and modes of communication deemed appropriate in a community of practice (to explain, justify, discuss, disseminate etc), they take on forms that are ritualised to varying degrees depending on the particular field. These rituals may take the form of explicit good formation norms and are to some extent "text rules" comparable, all other things being equal, to grammatical rules. In the case of articles published in journals concerned with

experimental science, these rules (specified by the editorial board) concern, for example, the basic structure of texts:

- review of literature on the subject
- problem or question to be resolved
- description of the experiment/ data collection...
- findings
- interpretation of the findings
- contribution to existing knowledge (progress, reassessment).

These forms shared in varying degrees by categories of texts may be termed *discourse genres*. As can be seen, the concept of discourse genre does not only apply to literature (novels, plays, poetry etc), but also serves to define specific categories of texts, of whatever type, which can be described from the linguistic standpoint as being characterised by a structure and verbal forms which, in varying degrees, are ritualised and binding. This verbal production tends to comply with “rules” varying in strictness and in number which define both the content and the structure or verbal form of texts (e.g. use of *I* or *we*, etc).

The relationship between *discourse genre* and *text* is abstract-concrete (only texts are observable; the forms of discourse genre have to be “reconstructed” from them) or model-matrix/realisation-occurrence.

These forms assumed by communication as it is practised in a community of practice are identifiable as such by parameters such as the “place” where they are produced (congress, lecture, science section of a daily newspaper etc), the participants (who writes, listens, reads etc), the medium (oral, written etc)... Discourse genres are generally identified by a name, usually non-scientific in origin, forming part of the ordinary lexicon: conference, treatise, news item, anecdote, dispute, exhibition catalogue, prayer, conversation etc.

Discourse genres are thus the immediate form in which speakers can take hold of language: they are capable of identifying and also producing some of them, even without being taught.

Alongside discourse genres we encounter more abstract terms such as narration, description, order/instruction, exposition, explanation, argument etc. This classification has never really been able to describe text categories because it can easily be recognised that a specific text usually matches several types simultaneously. But this categorisation, which represents a lower level of analysis than that of genres, is nevertheless extremely useful for describing the latter.

Discourse genres can be described by means of linguistic categories (see 4.2.3.), because a discourse genre is a verbal object, albeit distinct from the sentence and the text. In some cases, they may also be described in terms of stable sentence forms (e.g. the form taken by directions for use: *take...put...assemble...*). It should lastly be noted that discourse genres are not universal forms: they are more often than not specific to communities, i.e. also to languages and cultures. Some genres have no equivalent from one language to another (for example, the traditional African *palaver* (French *palabres*) has no real equivalent in British English or the French of France) or they only coincide partially or superficially (*presentations* in English and French). While mathematics is universal in its concepts and procedures, this is not necessarily true of the way in which it is set out: mathematical discourse genres may differ from one language to another.

2.4. The diversity of scientific, artistic and technical discourse genres

In addition to the differences in discourse genres from one language to another, knowledge is expressed and disseminated in the form of different genres. In the case of published texts, for example, the following may be identified:

- genres internal to communities, where new knowledge is expounded and discussed;
- genres for transmitting knowledge outside scientific communities through education (textbooks, course books, summaries etc), with the necessary forms of didactic transposition;
- genres used for dissemination or popularisation: magazines aimed at the general public, encyclopaedias etc.

For example, the space science community disseminates a lot of information to the outside world. As in other fields, the production of discourse for the outside world depends on specific circumstances, such as:

- a discovery, i.e. a publication reporting on an advance in knowledge which is taken up by the media.
- an institutional event specific to the scientific community or institution: prize, congress, colloquy etc.
- a “common” event: science exhibition or disaster leading to the mobilisation of explanatory knowledge (earthquake, flood, volcanic eruption etc; in the case of astronomy: launch of a rocket or satellite, link-ups in space, eclipse, passing of a comet etc).

In addition to this considerable external dissemination of information, which is fairly common to all fields, the space science community of practice exhibits the following further characteristics:

- it continues to capture a wide audience (the conquest of space and the economic and industrial issues involved), concurrently with astrology, which is still active, although often as a recreational interest;
- it enjoys wide dissemination in the outside world, but its dissemination in education is still limited: there is little teaching of astronomy at secondary level and, in university physics courses, it is a specialisation.

The types of discourse which transpose this knowledge from the source community may be identified in terms of different types of publication, e.g.:

- “literature” for young people;
- magazines specialising in astronomy or high-brow generalist magazines aimed, for example, at a scientifically cultivated readership;
- the daily press, which reports on events in these fields (“discoveries” in knowledge of space, description of astronomical phenomena such as eclipses, the passing of comets etc);
- school textbooks: space science is part of the lower and upper secondary curriculum, although it may be considered as having only a small place;
- encyclopaedic works, including the “new” multimedia resources, which are particularly well-suited to the observation disciplines (in the visual sense);
- the texts produced by famous scientists (Hubert Reeves, Stephen Hawking etc) for a general audience.

Clearly, therefore, what we have here is not a single discourse genre (the discourse of astronomy, physics, art etc), but a multitude of discourse genres, many of which are already or can be involved in the teaching of subjects.

With a view to plurilingual and intercultural education, school's role is to widen the range of discourse genres to which learners have access, which we will call their discursive repertoire (which may include discourse genres in different languages). Building on their spontaneous notions and their experience of ordinary everyday communication, scientific subjects seek to offer them the opportunity to experience discourse genres which are not part of their repertoire, to understand their workings and to appropriate some of them (reception or production), thus creating the conditions for appropriation of the knowledge imparted by them and of the mode of construction of that knowledge as it is represented in the texts. The function performed by this increased range of discursive repertoires is to enable learners to discover scientific cultures in order to guide them towards these specific communities of practice, through mastery of the varied discourse genres associated with them.

2. General forms of classroom communication

Classes are also communities employing forms of communication which can be described in terms of texts and discourse genres, irrespective of the subjects taught. There are many different genres of classroom discourse: teachers' and learners' presentations, teacher-led or learner-led discussions and debates. Discussion may focus on problem exploring or problem solving, presentation may focus on information or persuasion. Such forms of classroom discourse can be seriously planned and carried out by

teacher and learners; they may “break out” spontaneously as well. In educational discourse the relationships are those between teacher and learners, or between learners. Teacher and learners position themselves and each other in their discourse, and in educational discourse the process of meaning making is a process of learning, of transmitting or constructing knowledge.

The following description of classroom discourse genres presents what may be considered to be basic formats of teaching/learning discourses, formats of discourse in which the (assumed) learning by the learners is organised. It is relatively independent of the subjects taught and topics addressed. It will not be entirely problem-free because it is not always easy to distinguish between formats. These classroom discourses are often fairly hybrid and quickly change from one format to another. They will be classified according to their organisational format and their function in the learning process. Two basic formats will be identified: teacher-learner interaction and learner-learner interaction.

2.1. Teacher-learner interaction

There are two formats of teacher-learner interaction: “monologic instruction” (where, in the terminology of E Roulet, only one speaker is involved) and “dialogic instruction” (teacher-led discourse, but jointly constructed with the class through interaction)⁵.

2.1.1. *Monologic instruction*

Monologic instruction appears in two slightly different formats. In the first, the teacher talks during the whole lesson: frontal education. There is no or hardly any learner’s contribution to the discourse. This instruction is about what is already known, about what is considered to be valid knowledge that has to be transmitted accurately by the teacher and/or the course book to the learners. The teacher may be modelling how to think, or how to solve a problem. The learners are supposed to listen, their experiences and knowledge are not important. Learning is above all being able to reproduce the knowledge transmitted by the teacher. The teacher talk is structured by a subject-specific list of topics and argumentation. Classroom discussion can be seen as a waste of time. In the second, the teacher is mixing his talk with questions to the learners. He asks questions to which he already knows the answers. He selects which learners are questioned. He does not accept possible learners’ initiatives to change the topic. The most important intention is to transmit information to the learners. His way of questioning often leads to a three-part exchange called the IRE sequence: question by the teacher; response by the learner; evaluation of the response by the teacher (according to Sinclair and Coulthard’s “classic” model⁶). Although, viewed superficially, this format of interaction could be perceived as a dialogue, it is in fact a monologue. The questioning mainly aims at continuing the line of argumentation and reasoning by the teacher, but often the questions appear to be mutually unrelated, at least in the perception of the learners. The questions demand small, reproductive answers, in one or two words by the learners. They become acculturated not only in the discourse community of the subject, but also in the discourse community of the school. They learn that usually only one answer or a limited range of answers is acceptable. The learners’ answers are most of the time only elliptical sentence fragments; they try to guess what the teacher has in mind. The teacher avoids controversial topics. He uses the “dialogue” to control the classroom situation.

Often teachers choose the frontal situation or the IRE format thinking that their learners might learn from an inspiring talk, or because it is a way to control the classroom. Sometimes they opt especially for the IRE format because they feel caught between contradictory demands: transmitting knowledge in an efficient way and at the same time challenging their learners to actively participate in the lesson. Another reason might be that teachers feel obliged to prepare learners for tests in which also just one answer is considered to be the only valid one.

⁵ The distinction between monologic and dialogic instruction is a distinction between two ‘archetypes’. In classroom reality those two types many times are to be seen in one and the same lesson. Teachers can switch, according to the situation. See also 2.3.

⁶ The IRE model (Initiation by the teacher – Response by the learners – Evaluation by the teacher) was presented by J. M. H. Sinclair & R. M. Coulthard (1975): *Towards an analysis of discourse: The English used by teachers and pupils*, Oxford University Press, Oxford.

2.1.2. Dialogic instruction

In dialogic instruction the objective of the lesson is not to transmit knowledge, but to “transform understandings, to negotiate on the meaning of the topics of conversation”.

Dialogic instruction is characterised by more conversational turns. Learners select themselves or others in speech turns, speech topics are chosen by all participants, the teacher primarily frames and facilitates the conversation. The dialogue stimulates teachers and learners alike to contribute their ideas to a discussion in which their understandings evolve, there is a more symmetrical or reciprocal division of roles: teacher and learners both learn and teach, e.g. explain, question, hypothesise.

There are fewer teacher questions and more learners’ question than in the IRE format and the questions are different. There are genuine questions or authentic questions, questions without fixed answers, as opposed to reproduction questions. The questions in dialogic instruction tend to diagnose learning problems, or to stimulate the learners’ thinking process. They try to provoke learner ideas, creating an ambiance in which knowledge is something everybody can create and possess; they stimulate learners’ ownership. There is a substantive engagement by teacher and learners.

The feedback by the teacher on questions and answers by the learners is not an evaluation in terms of “true” or “false” statements. The teacher evaluates the learner’s contribution by using it as a worthy contribution to the dialogue at hand. He does this by verbally noting the importance of a learner’s response in shaping a new understanding, by certifying the learner’s response and by incorporating the response in the discourse of the class. Thus the feedback by the teacher, and probably also by learners, shows a high level evaluation and uptake, which can stimulate an open learning climate. Linguistic characteristics in teachers’ and learners’ language indicate whether they employ reasoning and argumentation in their questioning and answering. Reasoning and argumentation require the use of co-ordinating conjunctions like “but”, “because”, “so”, and subordinating conjunctions like “when”, “although”, “if”... Teachers’ and learners’ thinking is thus made visible.

A hidden dimension in this practice is that knowledge is not given but (co-) constructed (collectively) by language use, by negotiating; that learning demands active participation by the learners, that their voices are important, as are their experiences, values and perspectives, including different social-cultural groups, origins, genders and languages.

2.2. Learner-learner interaction

Learner-learner interaction varies along two lines: the number of learners (small or larger groups) and the assignments set for the learners’ work. Learners’ activities can be tightly or weakly guided by the assignment, and tightly or weakly controlled by the teacher. But in any case learner-learner interaction develops different kinds of talk. Also the typology of learner-learner interaction is problematic, because of overlapping, hybridism, changing. Nevertheless we distinguish the following types:

- **Socio-cultural talk.** This discourse is distinguished from other ones because of the topic under discussion. Learner’s talk together about almost everything that has nothing to do with educational tasks: family, friends, weekends, etc. The objective of such talk is to establish or maintain social relationships. Sometimes such relationships are a basis for more education-related talk. There might be some learning that can be characterised as incidental, but it is not learning that is directly related to educational objectives.
- **Procedural talk:** learners talk about how to carry out the assignment set for their work. Sometimes there is some learning that might lead to procedural knowledge: how to do things, especially when they argue for possible actions, proposing solutions. They learn about setting up experiments, carrying out inquiries.
- **Instrumental talk:** learners’ talk is mainly directed towards fulfilling their task as efficiently as possible (usually as quickly as possible). The question in the assignment e.g. needs an answer. So e.g. learners note an answer, even if they doubt if it is the correct answer, because the teacher expects and the task requires an answer.
- **Disputational talk:** learners disagree, draw their own conclusions, make their own individual decisions. There is little or no co-operation. Tensions or even conflicts between learners appear to be counter-productive for their learning.

- **Cumulative talk:** learners build positively but uncritically on what the other one has said, there is no construction, only accumulation of information.
- **Pedagogical talk:** learners take over the role of the teacher, explaining the topic, the content and the task to each other. The “learner teacher” as well as the learners may learn from this talk. The learner teacher because he/she has to explain, to demonstrate, in short he/she is productively dealing with the content of the lessons: verbalisation can lead to elaboration of cognitive processes, to reflection, awareness, expansion of knowledge. The other learners may learn because of the individually directed explanation.
- **Exploratory talk:** learners discuss and argue about some school subject related topic, using or exploring subject specific concepts. They explain these to each other, supply information, identifying problems and applications. They discuss and evaluate information and interpretations, generate ideas, suggest hypotheses, develop criteria. They listen and try to understand by asking and answering questions. Possible tensions or even conflicts between learners appear to be productive for their learning.

A curriculum analysis of several subject areas in four European countries (England, Germany, Norway, Czech Republic; Vollmer 2007, Thürmann 2008, Vollmer et al. 2008) shows that there seems to be a limited set of *basic language or discourse functions* which are repeatedly mentioned and which seem to represent (or at least relate to) something like basic structures of content and procedural knowledge. These functions are conventionally stated, sometimes more, sometimes less explicitly; they are understood and shared by the respective discourse communities and constitute a link between the pedagogical approaches of dealing with text types and genres and the academic ways of thinking, writing and speaking. These functions reflect the logic of experience and knowledge construction and thus the basic patterns of cognition. At the same time they provide a framework for “translating” those cognitions into socio-semiotic reality, into language and discourse. In that sense discourse functions are both cognitive and linguistic in nature and come very close to the concept of thinking skills.

All these interaction activities, except in the case of monologic instruction, which is the teacher’s sole responsibility, bring into play linguistic resources which have to be mastered by learners whose first language is the language of schooling. They are not very different from ordinary exchanges, but they do, however, comprise a metalinguistic dimension (questioning about words and not about what they refer to) which is a specific feature of many discourse genres and which requires specific management in teaching (especially with young learners). The following points should be noted:

- management of interaction: speech initiative, management of speaking turns, interruptions, changing the subject, etc
- the form of closed questions (e.g. calling for a *yes/no* answer)
- the form of open questions (*who? how? where?* etc)
- the form of replies which do not necessarily have to follow the syntax of the written language (e.g. utterances without verbs)
- expression of the fact that one has understood or not
- interpretation of assessments of what has just been said (*true, easy, clear* etc)
- ways of reformulating, being more specific, asking someone to reformulate etc
- expression of certainty, doubt, restriction, hesitation etc
- [...]

However, the ability to classify, describe, deduce, explain, demonstrate etc uses linguistic resources with which learners may be familiar, but as it is not strictly linguistic in nature, but at once linguistic and cognitive (varying according to the epistemology of the subjects taught), it requires explicit teaching.

2.3. Formats of communication and learning

There is still discussion about the function of the different formats of classroom communication in learning. And, from this pedagogical standpoint, there are different national traditions. There may be a tendency to prefer lecture-type instruction, which should have the advantage of presenting knowledge in an organised and coherent manner, ensuring that it is intelligible to the people at whom it is aimed. But it is therefore

mainly the teacher who speaks, and there are “silent” classes where the learners’ main task is to understand and note. It is the lecture format which predominates, for example, in higher education⁷. This “frontal” teaching seeks to adapt the knowledge transmitted to the particular audience and allows for quality control: teacher’s flow, clarity of articulation, relevance of “illustrations”, clarity of the overall structure and its component parts, clear marking of links between sections, explanatory value of examples etc. This extensively monologic format for transmitting knowledge tends to be contrasted with formats of classroom communication which favour the (re)construction of knowledge by learners as the preferred means of appropriating knowledge. A perspective of this type emphasises the fact that learning is above all a social and cultural process and that it is therefore achieved, in the classroom, in and through interaction with other learners and with the teacher, where shared knowledge is jointly constructed. But this format does not facilitate automatic acquisition because not all classroom interaction is in itself conducive to the acquisition of scientific knowledge: it is not enough for learners to communicate verbally in “talkative” classes, because what is important is the quality of interaction, which lies in its ability to guide learners from one form of knowledge to another: from ordinary notions to scientifically proven knowledge, from an understanding of concepts to their controlled, reflective implementation in calculations, observations, analyses, technical systems, problem solving etc. Communication within a field of knowledge (scientific, artistic or technical) therefore involves teaching that does not put the emphasis solely on the transmission of knowledge and its applications and uses in given contexts, or on procedural competences, but also on its significance from an epistemological and social standpoint, particularly as regards its implications for the life of the community (e.g. nuclear power, sustainable development, pollution etc).

The formats of classroom communication therefore dictate the concrete strategies used for the teaching of subjects, as well as being “verbal applications” of those strategies.

3. Forms of communication in the teaching of scientific, artistic and technical subjects

The teaching of school subjects in which language is not the central focus of teaching is organised on the basis of the formats of communication described above, but it also brings into play or relies on other discourse genres. It may be viewed as the setting for a particularly complex confluence of discourse genres (scientific or not) which establish the classroom as a community of practice because, in principle, the following are shared there:

- a perception, more clearly defined in some cases than others, between learners (who are in the process of acquiring some of these) and teachers (whose perception of them is not always clearly defined), of the forms which texts should take in order to be regarded as of good pedagogical quality and as a potential learning space;
- ways of switching between discourse genres.

In addition to the ordinary formats (exchanges with learners or between them in practical activities, group work etc, see 2.1.2. and 2.2.), the following are directly present or used in transposed forms:

- discourse genres related to the creation and, above all, the disclosure of knowledge (see 1.4.), which appear mainly in textbooks or the teacher’s monologic presentation (exposition, description, explanation etc);
- “non-scientific” discourse genres (e.g. in history: asking learners to imagine letters from various participants in the fall of the Berlin Wall or the fall of Constantinople in 1453);
- oral or written discourse genres “invented” by school which are not used in social communication in the outside world.

The last-mentioned are particularly important in teaching because, unlike the others, their conventions for writing and presentation and for representation of knowledge cannot necessarily be identified by learners from their pre-existing repertoire of discourse genres. Moreover, they perform varied functions in teaching/learning: some prepare for socially relevant discourse genres: a pupil’s report to the class could be regarded as training for giving a presentation in a professional context; the literary or historical

⁷ But lectures are usually supplemented by practical sessions.

dissertation (as it is understood in the French education system) is similar to the corresponding scientific output (article, paper). Others form part of tasks which constitute teaching activities: report on experiments in physics as part of practical work, findings from observation and analysis of documents (in geology, geography, history etc). Lastly, others, which are mainly written and play an important role in knowledge assessment, are less clearly defined, such as the *essay* (in the British education system), the *rédaction* (in the French system), or the *tema* (in the Italian system) because they were created by school for the teaching of the language as a subject.

Such is the diversity of discourse genres in a given subject that it is not always possible to define the expected textual and scientific competences: it is possible, for example, to confine oneself to written textual forms that are unclearly defined and therefore difficult to describe. Learners cannot be referred to precise “models” for producing them, which tends to hinder the teaching of them and blur their assessment. It has already been stressed that:

the fact that awareness-raising activities in general, and those of a scientific nature in particular, may lead children to produce different texts from those they produce at other times in their school career, in or out of school, is accepted by most teachers, more explicitly in some cases than others. But the recognition of this fact is not necessarily accompanied by a very clear awareness of the differences exhibited by these texts in relation to so-called “free” texts or those generated by other school subjects, and of the role they may play in relation to the awareness-raising activity itself. [...] Hence, both in the classroom and in reports on activities carried out by teachers or by various observers, one often hears references to ‘awareness-raising texts’ or ‘scientific texts’, or, more cautiously, ‘science-oriented texts’, without having a clear idea of what these terms actually cover.⁸

For each subject it will be important to:

- *specify the nature of the linguistic quality of the monologic teaching genre:*
- *assign precise scientific goals to oral interaction in the classroom;*
- *catalogue the other discourse genres present in teaching;*
- *specify their uses (comprehension, production, rewriting etc);*
- *describe as clearly as possible the form of the oral and written texts expected from learners, insofar as they belong to a discourse genre which is itself clearly identified;*
- *differentiate texts used for the appropriation of knowledge from those used for assessment of the results of learning: they are not necessarily identical or drawn up in the same way;*
- *consider above all the relevance of these texts to the learning goals in the particular subject: what is the relevance to learning of writing and memorising “history summaries” (summaries of chapters in the textbook)?*

Clearly, then, defining the scientific knowledge and competences to be acquired means defining the interactions to be established in the classroom and defining the texts (in particular, written texts) to be produced as a means of appropriating knowledge. Is it a question of imparting information (how the human digestive system works, what led to the diversity of animal species, etc) in order to develop learners’ awareness of the world, or also enabling them to perceive the nature of the scientific approach and the knowledge-building process? Both these major goals can be pursued jointly, but they definitely involve the use of distinct discourse genres.

In any event, the “language issue” in the teaching of school subjects should not be considered, as is often the case, as being a kind of collective responsibility of all teachers, who must work together everywhere to ensure the proper use of the language of schooling. As we have shown, it is central to the transmission and acquisition of knowledge and, in this respect, constitutes a specific responsibility of subject teachers, and not an adjunct to the teaching of the language as a subject in its own right.

⁸ [Collective] (1983): *Eveil scientifique et modes de communication, Recherches pédagogiques* 117, Institut national de la recherche pédagogique (INRP), p. 77.

4. Discourse competences for learning in scientific, artistic and technical subjects

We will now endeavour to give concrete substance to this language teaching. Considering that subject teachers do not need to be linguists but that recourse to certain linguistic categories is necessary to identify these tasks, we cannot emphasise enough the importance of training/awareness-raising activities for this purpose and the participation of specialists in discourse analysis in developing the relevant programmes.

It is not the intention of this text to produce descriptors comparable to those of the *Common European Framework of Reference for Languages* (CEFR) or inventories similar to those of the *Reference Level Descriptions for languages* (RLD)⁹, as a “complement” to them. That is outside its scope because verbal communication in the teaching of subjects depends on the actual nature of each subject and the teaching methods adopted, and hence on educational cultures and traditions which are far from uniform. Its description depends also on the gradation of the knowledge offered over the course of the curriculum (by year, by stage of education etc), which varies greatly in Europe, as well as on the nature of the main language of schooling and its specific characteristics (phonetic, morphological, lexical, syntactic, textual). Consequently, we will not propose a set of common descriptors, but a shared approach (rather like a protocol), as already outlined in connection with several earlier points in this text, which should make it possible to reach agreement on the language dimensions of subject syllabuses.

4.1. Cognitive genesis: an intertextual path

The acquisition of scientific competences and knowledge may also be seen as a progression from mastery and use of some forms of discourse to others: the genre repertoire of learners develops through transformation of existing forms into other forms, along an intertextual path, in the same way (but this is only an analogy) as one moves from spontaneous, common-sense knowledge to verified, generalisable knowledge.

Learners’ spontaneous knowledge and perceptions (which have concrete dimensions and are derived from immediate experience) are the starting point for progressing to abstract categorisations and generalisations that are independent of the observation context. These initial perceptions and the words and textual forms used to express them will provide the teacher with bridges for moving towards conceptualisation of these immediate experiences, through a system of new concepts, terms, meanings and symbols.

Learners’ spontaneous activities and beliefs, triggered by their curiosity or their capacity for surprise, easily provide them with reporting material. However, in practical science-oriented activities (assignment, project, early learning activity in primary education), conceptualisation itself, as a form of problem solving involving the use of invariants (size, properties, relationships etc), will bring into play intermediate verbal outputs: notes, rough drafts, exchanges of opinions and theories between learners, and non-verbal traces (drawings, diagrams etc). At best, they will be able to take on a “mixed” form of discourse in which there will still be a close link and little difference between learners’ beliefs and knowledge-building processes (theory, experimental/empirical verification). It is a long way from a learner’s account of a spontaneous experiment to a scientific report by a learner on an experiment expressing general relationships independent of the subject and concrete conditions of observation. However, it is this path, which all learners must tread, which needs to be marked out by focusing particular attention on these mixed or unclearly defined textual forms, insofar as they are a medium for knowledge. Below is an attempted typology based on the productions of learners in primary education.

Knowledge building at school may also be seen as a complex intertextual process in which it is the role of teaching to serve as guide. This process has several main thrusts:

- *from collective knowledge building (in interaction with peers or the teacher) to individual appropriation of knowledge, hence with the ability to feed back and reproduce that knowledge in a coherent textual form;*
- *from oral forms (with frequent rephrasing) to written forms, from which the hesitations and*

⁹ www.coe.int/lang

successive approximations have been removed, via provisional, exploratory written forms (rough drafts, notes, outlines etc);

- *from reception/comprehension to production (model-based teaching);*
- *from “spontaneous”, improvised texts in ordinary communication to texts conforming to explicitly defined conventions based partly on the nature of each school subject, via a stage of reproduction/reprocessing/reformulation (see above: model-based teaching);*
- *from personal accounts of experience to texts (e.g. reports or problem-solving) of a scientific nature;*
- *from textual forms used for learning to those used to assess learners (mainly written forms).*

These should help give structure to scientific, artistic and technical syllabuses where their linguistic dimensions are concerned.

This description of teaching/learning processes as transformation of the corresponding knowledge and texts reminds us that, in plurilingual and intercultural education, the exposure of learners (in clearly identified teaching sequences) to a range of discourse genres and languages and experience of receiving, handling, reformulating and producing them is a precondition for learning. This experience of switching and mixing discourse genres is essential if learners are to adapt to the diversity of languages and cultures of contemporary European societies and the diversity of forms of knowledge in circulation, which requires great critical vigilance on the part of citizens.

4.2. The successive forms of language competences in school subjects

The gradual building of language competences facilitating the appropriation and use of knowledge requires learners to be given an awareness of discourse genres and the verbal means to increase their repertoire of discourse genres:

- textual forms of genres used in ordinary communication (conversation, personal account, personal opinion, expression of feelings)
- textual forms of intermediate and mediating “genres”, which are not necessarily present in actual social communication or are ambivalent (used in ordinary and scientific communication, but in different ways)
- textual forms corresponding to scientific genres (those of scientific communities), parascientific genres (those of university teaching) or wider dissemination genres, forms which will have been chosen as learning models and teaching goals.

4.2.1. Taking the I-here-now out of learners’ utterances

The first general form of transformation of learners’ discourses is the progression from the personal account, talking about oneself, to a more objective discursive regime which is independent of the immediate context. These linguistic forms do not necessarily give rise to complete texts, but they can be used in each utterance. They tend to give rise to utterances not centred on the individual (*I/you*) and the context (*here/now*) but possessing a form of generality which is independent of those parameters. There are some ordinary genres which have this appearance (proverbs, general truths, maxims etc), but they are still a long way from what is expected of a scientific utterance¹⁰. This may be characterised in the first instance as meeting requirements such as the production of utterances or texts that are *succinct, precise, explicit, complex, structured, objective, unemotional, unambiguous* etc. It is a form of utterance that can be achieved in texts belonging to different discourse genres and does not constitute one in its own right. In the school context, to achieve output of this kind, learners must master:

- the corresponding terminology (*precipitation vs. rain*) and its use as such: repetition of the same term should therefore not be regarded as a stylistic shortcoming but as a precondition for clarity and consistency;

¹⁰ The term *academic discourse* is also used, especially in the English-language literature, where *cognitive academic language proficiency* tends to be contrasted with basic *interpersonal communication skills*. See Cummins J. (1979): “Linguistic independence and the educational development of bilingual children”, *Review of Educational Research* 49, p. 222-251 and (1991) “Conversational and Academic Language Proficiency” in Hulstijn J & Matter J.F. (eds), *Reading in two languages. AILA-Review* 8, p. 75-89.

- personal pronouns (*The eagle is a bird of prey. It...*) or generic terms (*element, substance, problem etc*);
- all objective forms of quantification and location in time (beginning, interval, frequency, duration etc), i.e. which are not assessed or identified in relation to the person speaking (*It's too hot = for me*);
- links stressing enumerative, chronological, “logical” relationships etc, particularly in the form of co-ordinating and subordinating conjunctions in places where, in oral discourse, juxtaposition may be enough (*He was late. I left.*);
- ways of expressing certainty (present simple (*Water boils at 100 degrees*), doubt, possibility, a restriction etc);
- the use of conventional assessments (*significant results, interesting findings, plausible hypotheses etc*);
- [...]

This set of resources should enable learners to express observations and relationships otherwise than in a subjective manner. It is not really sufficient yet for the construction of texts as it is situated at the level of the attitude of the person “speaking” (who is not “speaking” in his or her own name), and does not constitute a text model corresponding to an identified discourse genre. Clearly, however, it constitutes material that can be used for structured, even short, texts oriented towards a conclusion, a finding, a deduction or a result.

4.2.2. Text sequences representing cognitive operations

At a subsequent stage, the teaching goal could be the ability to produce homogeneous (oral or written) texts representing in words a specific cognitive ability, such as comparing, deducing, demonstrating or defining. These textual elements do not transcribe actual intellectual operations (which are not observable), but report them.

Discourse functions?

These may be present in interactive or expository oral discourse insofar as they are not necessarily intended to take the form of texts belonging to identified discourse functions (especially in oral interaction between learners). These discursive representations of cognitive activities have been used for a long time (particularly under the influence of the work of M.A.K. Halliday and his notion of *function*) in textual linguistics or discourse analysis: they have been given many different names (there is no need to discuss them all here) such as *function, text type* (narration, description, instruction, argumentation etc), *discursive operations* (*Threshold Level, 1976*), *cognitive processes* (representing, interpreting, comparing, justifying etc), *language operations* etc). What these terms have in common is that they seek to link knowledge-building processes with a verbal/textual form.

Curriculum analysis of several subject areas in four European countries (the United Kingdom, Germany, Norway, the Czech Republic)¹¹ shows that there seems to be a limited set of *discourse functions* which are repeatedly mentioned and which seem to represent something like basic structures of content and procedural knowledge. These functions are conventionalised, sometimes more, sometimes less explicitly so; they are understood and shared by the respective discourse communities and constitute a link between the pedagogical approaches of dealing with text and genres and the academic ways of thinking, writing and speaking. These functions reflect the logic of experience and knowledge construction and thus the basic patterns of cognition. At the same time they provide a framework for “translating” those

¹¹ Thürmann E.: *Educational Standards and the language of schooling at the end of compulsory education. Analysis of curricular documents issued by the German Länder*. Strasbourg: Council of Europe. (Unpublished ms.);
 - Vollmer H. (dir.) (2007). *Language and Communication in the Teaching and Learning of Science in Secondary Schools*. Strasbourg: Council of Europe. (www.coe.int/lang → Resources/Publications → Languages of Schooling → Thematic Studies 2007 → 2 - Science);
 - Vollmer H., Thürmann E., Arnold C., Hammann M. & Ohm, U.: *Elements of a Framework for Describing the Language of Schooling in Subject-Specific Contexts: A German Perspective*. Strasbourg: Council of Europe (draft version, to be published in 2011)

cognitions into socio-semiotic reality, into language and discourse. In that sense discourse functions are both cognitive and linguistic in nature and come very close to the concept of thinking skills.

Inventories, typologies, a model

Establishing a comprehensive typology of these discourse functions is a complex task because their definition is totally dependent on the ordinary lexicon (e.g.: *résumer, contracter, réduire* in French). It is possible to agree more or less on deliberately loosely structured inventories such as:

- *presenting (showing, identifying, defining etc)*
- *describing or representing (enumerating, identifying the constituent elements etc)*
- *characterising (comparing, assessing, assigning a quality/quantity/property)*
- *situating an action or process in time and space*
- *representing an action or event in time*
- *doing, acting*
- *explaining, arguing*
- *summarising*
- *[...]*

It is also possible to construct more elaborate models consisting of macro-functions, e.g.

EXPLORING - NAMING - DESCRIBING – NARRATING – REPORTING – EXPLAINING – EVALUATING – ARGUING - REFLECTING - SIMULATING

which can be divided into lower-level functions, as follows:

LABELLING – DEFINING – POINTING (at, out) – SPECIFYING (details) – COMPARING – CONTRASTING – RELATING – JUDGING – APPRECIATING – POSITIONING, etc.¹²

Lastly, one can even produce a model (in this case based on B Mohan’s *knowledge framework*¹³) to develop a syllabus for English as a second language as the language of teaching¹⁴ on the basis of functions:

Theoretical/General		
Classification	Principles	Evaluation
Sample thinking skills:	Sample thinking skills:	Sample thinking skills:
Classifying Identifying Understanding Applying or developing concepts	Establishing hypotheses Interpreting data Drawing conclusions	Evaluating Ranking Judging Appreciating
Sample language:	Sample language:	Sample language:
Verb categories Verbs of possession: <i>have</i> comparison: <i>more than – taller than</i> Classification: <i>include, place under</i>	Cause/reason: <i>is due to</i> Condition & contrast: <i>if there is</i> Prediction: <i>probably</i> Generalization & explanation: <i>completely</i>	Describing emotions: <i>like, dislike, satisfactory</i> Evaluation adjectives: <i>good, right/wrong</i> Verbs of volition: <i>prefer, had rather</i>

¹² See Vollmer et al. 2008; see also Vollmer H. J. & Thürmann, E. (2010): „Zur Sprachlichkeit des Fachlernens: Modellierung eines Referenzrahmens für Deutsch als Zweitsprache“ dans Ahrenholz B. (ed.): *Fachunterricht und Deutsch als Zweitsprache*. Tübingen: Narr, p. 107-132

¹³ Mohan B. (1986): *Language and content*, Addison-Wesley, Reading, MA.

¹⁴ Beckett G., H. Gonzalez, V. & Schwartz H. (2004): “Content-based Writing Curriculum: A Language Socialization Model”, *NABE Journal of Research and Practice* 2:1, p. 161-75.

Sample thinking skills:	Sample thinking skills:	Sample thinking skills:
Observing Identifying Comparing Contrasting	Arranging events in order Following directions Predicting order	Selecting Generating solutions Solving problems Identifying issues
Sample language:	Sample language:	Sample language:
Stative verbs: <i>believe, feel</i> Relative clauses: <i>who, what, how</i> Prepositions of place: <i>between, under</i>	Logical & chronological connectors: <i>during, next, finally</i> Prepositions of space and time: <i>at, around, about, towards</i>	Modals: <i>can, will, must, should</i> Request/offer: <i>I can, I could, Could I</i> Preference: <i>prefer, had rather</i>
Description	Sequence	Choice
Practical/Specific		

But whatever the form adopted (inventory, hierarchical typology, model), determination and specification of the discourse functions to be placed at the centre of learning will depend on the language. They will therefore need to be established language by language on the basis of the ordinary lexicon available, care being taken to ensure that their names are directly accessible to learners and that their definition as textual forms and the nature of the cognitive tasks expected are clear.

Transversality

One important requirement in the specification of these discourse functions is especially that they should, as far as possible, be common to all the subjects taught (including the language of schooling taught as a subject), in order to guarantee the transversality that is essential in education. This is all the more necessary in that discourse genres can vary from one subject to another depending on the area of knowledge concerned (social science, experimental science, mathematics, literary criticism etc), even if their position in the discourse typology may lead them to adopt comparable forms (research discourse, doctoral thesis, encyclopaedia entry, school textbook etc). But, with the occasional exception, discourse functions are not discourse genres: they are components of them: as such, they are given variable linear orderings and formulations, and it is these which lend each discourse function its specific language identity. It is therefore these text sequences which may appear in isolation in oral interaction or in provisional, exploratory texts, which are the most visible area of convergence for teaching activities which take them as their object in different subjects. Significantly, it is precisely these discourse functions (referred to in this case as *cognitive/discursive operations*) which are taken as the basis for assessments of plurilingual competence:

[...] [the checks] could focus on the strategies deployed in exercising communication skills, either global (e.g. written reception) or metalinguistic (ability to interpret unknown terms in context, formulate a pattern from observation of a random text body), or on more limited shared elements, such as oral and written expression of discourse/cognitive operations (e.g. the ability to define, quantify, compare, etc.) common to the discourse genres concerned;¹⁵

The learning of some of these sequences in the context of classroom interaction or learning tasks brings more clearly into play the ability to construct coherent texts (see 4.2.1.), which involves planning, execution, checking and revision strategies etc. This learning should take learners from personal narration to varied forms of verbalisation of the cognitive activities that constitute *scientific literacy*.

It is impossible to describe here the language resources needed for “proper” performance of all the discourse functions mentioned. Reference can be made to the existing descriptions in each language or analysts of scientific discourse could be asked to produce such descriptions. Reference can always usefully be made to the *Threshold Levels* or to the *Reference Level Descriptions* for particular languages,

¹⁵ (2010): *Guide for the development and implementation of curricula for plurilingual and intercultural education*, Language Policy Division, Council of Europe, chapter 2.7. Our underlining.

which may include entries by discursive function. This approach is exemplified by two texts of the *Platform of Resources and References for Plurilingual and Intercultural Education*¹⁶:

- **History:** *An approach with points of reference* – Items for a description of linguistic competence in the language of schooling necessary for teaching/learning history (end of obligatory education)
- **Science:** *An approach with points of reference* - Items for a description of linguistic competence in the language of schooling necessary for teaching/learning science (end of obligatory education).

4.2.3. Forms of scientific discourse genres in the classroom

Subject teaching brings into play discourse genres which inform verbal exchanges in the classroom. Some are focused on transmission, such as the teacher's monologic discourse or the relevant textbook. At any rate, they do not belong to the discourse of the scientific community concerned but pertain to forms of dissemination/transposition of knowledge regarded as established.

The foreseeability of knowledge transmission discourses

What matters more than anything else, therefore, is their "legibility" to their recipients. It may be considered that this is culturally variable and also depends on learners' cognitive development. The quality criteria cannot, therefore, be defined a priori, but presuppose empirical analyses based on teachers' productions or the school textbook corpus. Layout and iconography are known to play a major role in this. What might be more important is their division into sections (the paragraph in written material) and their foreseeable organisation through use of recurrent patterns, such as:

- link with the previous paragraph
- theme/assertion/thesis/main information etc
- justification
- examples...

For example, this paragraph from a text aimed at a general readership follows an expected pattern¹⁷ and its links are very visible:

The text concerns the discovery of new foods in the 16th and 17th centuries

In some fields, such as that of fruit and vegetables [announcement of the paragraph structure], a full-scale revolution took place during this period [thesis]. First of all, a certain number of vegetables were brought in from Italy. Some of these were old acquaintances which had been considerably improved by that country's farmers [1st specification of the thesis; level 1 example: vegetables]: these included asparagus, artichoke, sorrel, beetroot, cardoon, cauliflower and peas [level 2 examples]. At the same time, new techniques were introduced in an attempt to improve fruits indigenous or long acclimatised to France [2nd specification of the thesis; level 1 example: fruit]: pears, apples, peaches, plums, melons and strawberries, which, by dint of patient selection, became very different from their rustic relatives [level 2 examples]. Lastly, efforts were made to acclimatise certain plants newly arrived from America [3rd specification of the thesis; level 2 example: vegetables], such as the Jerusalem artichoke, peppers and, especially, tomatoes and beans [level 2 examples].

The teacher's monologic discourse and the text of textbooks may be expected to exhibit organisational features of this kind, which, in theory, facilitate their reception by learners, without losing sight of the fact that exposure to texts structured in this way can help them in their own oral and written productions. As already stressed, it is essential that we base ourselves on the ideas which the recipients have of the simplicity of access to texts either through direct surveys among them or by analysing the characteristics of oral and written texts which they regard as "simple", in each language/educational/cultural context.

The characteristics of parascientific or (pre)scientific discourse genres in the classroom

In school teaching, the language tasks expected of learners rarely go so far as the production of texts proper, although this cannot be ruled out, particularly in upper secondary education. These are rarely texts of the kind actually used in scientific communities, but genres created for teaching which come close to

¹⁶ www.coe.int/lang → Platform of Resources and References → Box "Language(s) in other subjects"

¹⁷ François M. (ed.) (1972): *La France et les Français, [L'alimentation]*, Encyclopédie de la Pléiade, Gallimard, Paris.

them in some respects. They do not adopt their norms, but exhibit specific norms which define their proper form and quality, unlike isolated text sequences performing discursive functions. These scientific texts of school culture can be very varied within the same educational culture and between them: we would need to have an inventory of these textual forms in order to get a better grasp of their characteristics: report (on practical laboratory exercises), commentary on data (figures, non-verbal data, such as a photo of a Greek vase, map showing the distribution of a plant species etc), written solution to a problem (maths, physics etc), oral presentation (on a topic, a work etc), essay (discussing an opinion, an interpretation etc).

It was noted above that these discourse genres have no exact equivalents in social/scientific communication; this may make it problematical to specify their production norms and their assessment criteria, which may be based on perceptions which are considered to be shared but which remain unclearly defined and, especially, defined a contrario. This relative lack of definition of the textual products expected may function as a “hidden curriculum” and prove contrary to fairness.

The only solution is to describe these discourse genres as accurately as possible in order to render the teaching of them transparent. Obviously, they all share a certain form of distancing (see 4.2.1.) and some of their developments are similar or identical to the forms, already experimented with, which are given to discourse functions in brief, isolated text sequences (see 4.2.2.).

We will therefore confine ourselves to an indication of the nature of the “conventions” which lead texts belonging to the same discourse genre to resemble one another while always being unique.

It should first be noted that some discourse genres are subject to strict constraints and the corresponding texts vary only to a small extent. This applies to mathematical problem-solving genres. Other discourse genres present fewer, or less marked, similarities. The alternative forms, “equivalent” in a given respect to the corresponding texts, are diversified; they leave the writer greater latitude (the development of sentences or paragraphs becomes less foreseeable) or concern specific textual “loci”, such as the introduction of quotations in the text. Lastly, other school discourse genres are intended to produce texts which, to a great extent, are unforeseeable in terms of their organisation or the verbal material employed: they thus offer scope for learners’ verbal creativity.

In addition to these organisational forms which vary from one genre to another, it is generally agreed that the similarities of discourse which are perceptible from one text to another concern their linear structure or the way they are set out, and their linguistic forms in the strict sense.

Structural similarities may be observed in relation to fixed points such as the beginning and end of texts or textual patterns (more or less fixed succession of elements). For example, in the case of articles for specialist scientific journals, the following structure, explicitly defined by the drafting committees of international journals, is expected: problem area, literature existing on the subject and critical appraisal of it, hypotheses, experimental setup, results, criticism of the results, knowledge acquired (see 1.3.2.). Within these textual elements, whose boundaries can be highlighted (typographically, by means of connectors), discourse consists of an interweaving of elements of discursive functions (giving an example, disproving, commenting, interpreting, inferring, comparing etc) which are more or less fixed and foreseeable (see above).

Formal similarities concern the linguistic “colouring” shared by texts belonging to the same discourse genre. This is given to them in the first instance by a shared lexical core if the texts relate to the same objects of discourse, which is clearly the case with subject-specific discourses. Above and beyond this shared terminology, texts actualising a discourse genre may have recourse to certain linguistic resources, preferred in that they exclude others, which are however perfectly possible in other forms of communication. For example, to assess an element (fact, clue, tangible evidence etc) contributing to the development of historical knowledge, texts in specialist journals use adjectives such as: *significant, striking, disturbing, flimsy, interesting, revealing* etc, and seem to rule out words such as *extraordinary, mysterious* or *fantastic*. Discourse analyses show that the choices offered by the language system are therefore regulated by the discourse genres. They lead all the texts belonging to a discourse genre to have a linguistic “family resemblance”. The settled utterance choices which give them their specific nature concern:

- forms of presence of the speaker: *I, we, impersonal (It seems that...)*, passive form, combination of these possibilities (*It was shown above that...*)...;

- forms of actualisation of the recipient;
- forms of quantification;
- expression of certainty, probability, possibility, obligation;
- expression of value judgments (other than personal);
- verb tenses;
- modalities, in particular the uncertainty (possibility, probability etc), appreciative (subjectively framed assessment: *this point is important*), and deontic (*must, should*) modalities;
- the forms of chains of anaphoric references (*The resignation of... This event... It will be interpreted as...*);
- forms of deduction, demonstration, argument;
- the discursive tone (serious, personal touches etc);
- [...]

To define these choices, reference should be made to the grammars of each language, especially those which address the workings of a language in a form other than that of rules and constraints. As already noted, these essential analyses should be carried out jointly by linguists and subject specialists, teachers of language as a subject and teachers of other subjects.

5. Concluding remarks

This text will perhaps disappoint readers who were expecting to find handy competence scales broadly common to European education systems and school subjects. Reference instruments of this kind would perhaps need to be developed, although, as the experience of the CEFR has shown, there is a great risk with sets of descriptors of this kind that things will become fixed and standardised. In fact, this was not possible given the context in which this text was produced and, no doubt to a more radical degree, because of the differences between subjects, discourse genres and educational traditions and contexts. The result, therefore, is the outline of an approach and a description of a pedagogical attitude, which is not innovatory if one considers the contributions made to this text by subject teaching theory.

Neither will the reader find any methodological indications regarding specific classroom activities for familiarising learners with these forms of language and discourse required for scientific communication and leading them to identify and understand their value and how they work (syntactically, for example) and assimilate them through systematic reflexive activities. They would need to be built up on the basis of the “grammar teaching methods”¹⁸ developed in the teaching of language as a subject and foreign language teaching. But whatever the techniques adopted (depending on the educational context), they should be implemented from the standpoint that knowledge is not confined to a command of language, and the command of language expected in scientific, artistic and technical communication in the classroom can have a positive impact on the acquisition, use and processing of knowledge.

This focus on language, which is essential for structured subject teaching leading to scientific literacy, should not make us forget, because of the relatively technical issues involved, that school is responsible for providing all learners with solid experience of scientific knowledge: such knowledge is necessary for their understanding of the world and their personal and social life, where ignorance is always a major drawback. It is necessary for the exercise of citizenship in societies where science (but also pseudo-knowledge), the arts (but also the products of the culture industries) and technology (but also unnecessary technicality) are omnipresent and crucial for collective choices. Access to scientific culture and the diversity of knowledge therefore depends on an awareness of languages, discourse genres and texts, which should not be reserved for a few specialists but should be shared as widely as possible, so that all citizens may develop an awareness of them.

¹⁸ See, for example, Beacco J.-C. (2010): *La didactique de la grammaire dans l'enseignement du français et des langues*, coll. *Langues et didactique*, Didier, Paris.

HISTORY

Items for a description of linguistic competence in the language of schooling necessary for learning/teaching (end of obligatory education)

An approach with reference points

Jean-Claude Beacco

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This text presents a procedure for creating a curriculum for the teaching of history which explicitly takes into account the discursive and linguistic dimensions of this school subject. It proceeds through successive stages, for which there are corresponding inventories of references, from the level of educational goals in the teaching of history to the identification of linguistic elements which should be systematised in the classroom with a view to teaching the corresponding forms of discourse as well as possible. This procedure – presented for discussion – has been devised to be independent of the specific language in question. It may ultimately be adaptable to other disciplines.

Introduction

This module of the Platform proposes an approach for specifying the competences and knowledge relevant to communication in language and the mastery of the language(s) of schooling used as a vehicle for conveying this knowledge in subject teaching. This approach specifies the knowledge and competences so that they can be taught by a systematic, targeted method, integrated with the teaching of subject-related knowledge. It is illustrated specifically with reference to the teaching of “history”, a very significant subject, whether it goes by this name or by others like it, in the European educational area¹⁹.

It presents

- an overall approach
- open-ended reference points in the form of inventories/checklists: these are to be completed by the users, according to the languages in which teaching is conducted.

The purpose of these reference points is to help users in:

- identifying the linguistic activities present in the subject under consideration;
- specifying the forms of the language of learning/teaching which are especially helpful in mastering the varieties of discursive content attaching to the subject and the forms of communication necessary for imparting and acquiring subject-related knowledge and skills.

The overall scheme of the approach is as follows:

- (1) inventory and description of the educational values targeted by history teaching practices;
- (2) inventory and description of the social situations of communication involving history in the learners' social environment;
- (3) inventory and description of the expected historical knowledge;
- (4) inventory and description of the existing in-school communication situations for transmission of history.

The choices to be made among these possibilities lead to the definition of the purposes and objectives of education in history in compulsory schooling.

It is then possible to create:

- (5) inventories and descriptions of the linguistic, discursive and semiotic characteristics of relevance to the types of discourse involved in history teaching practices; these characteristics deserve to be taught in their own right in this subject area.

What is proposed here is a common procedure, relevant in theory whatever the language of instruction in question (whether the learners' first language or a language acquired to a standard of proficiency of at least CEFR level B2).

1. Values

All teaching pursues educational goals over and above the expertise and learning which are both its substance and its aspiration.

1.1. Educating social actors

The role of languages of education in schools is to structure and assist the training and education of social actors. The aims of this training/education are shared by the Member states of the Council of Europe as the basis for living in society in Europe.

Schooling is responsible for preparing future citizens and developing their potential by giving them the necessary tools for all aspects of life in society (personal relations, occupational activities, leisure

¹⁹ This text draws on the proposal for the Prague Conference (8-10 November 2007) drawn up by Jean-Claude Beacco (New Sorbonne University, Paris), Martin Sachse (State Institute for School Quality and Educational Research, Munich) and Arild Thorbjørnsen (Deputy Director General, Ministry of Education and Research, Oslo). It has benefited by several readings including those of Jean-Marie Gautherot, specialist in French as a Foreign Language and Maurizio Gusso, Italian specialist in the teaching of History (member of the CLIO 92 and LANDIS/EUROCLIO networks

activities, etc.) and by enabling them to understand the basic values of democratic life and make them part of their personal ethics.

The languages of Europe are therefore not only a raw material for building regional, ethnic and national cultural identities, but also a means of experiencing otherness. Plurilingual education seeks to enhance the value of individual language repertoires and to organise life-long training to ensure that they develop appropriately.

1.2. Values and history

The values whose transmission is the particular responsibility of history as a taught subject have been addressed by a great many Council of Europe initiatives, based on the idea of reconciliation and positive mutual influences among peoples. (Projects and programmes “*History in the new Europe*”, “*History teaching and the new initiative of the Secretary General*” and “*Learning and teaching about the history of Europe in the twentieth century*”). The teaching of history has led to very extensive recommendations on the principles, content and methods of history teaching, for example, Rec (1996) 1283 and Rec (2001)15.

On the basis of these values, the principal goals assigned to the teaching of history include:

- to play an essential role in educating and training responsible and active citizens and fostering respect for all kinds of differences on a basis of understanding of national identity and principles of tolerance;
- to be a decisive factor in reconciliation, recognition, understanding and mutual trust between peoples, especially by introducing multiperspectivity into historical research and accounts;
- to play a vital role in the promotion of fundamental values such as tolerance, mutual understanding, human rights and democracy;
- to be one of the fundamental components in the construction of a Europe based on a common historical and cultural heritage, enriched through diversity, even with its conflictual and sometimes dramatic aspects;
- to be part of an education policy that plays a direct role in young people’s development and progress, with a view to building tomorrow’s Europe with their participation, as well as the peaceful advancement of human societies in a global perspective and in a spirit of mutual understanding and trust;
- to allow the nurturing in pupils of the intellectual ability to analyse and interpret information critically and responsibly, through dialogue, through the findings of historical evidence and through open debate based on multiperspectivity, especially regarding controversial and sensitive issues;
- to enable European citizens to enhance their own individual and collective identity through knowledge of their common historical heritage in its local, regional, national, European and global dimensions;
- to be an instrument for the prevention of crimes against humanity²⁰.
- [...]

Civic and social goals of this kind can be called *extrinsic* in comparison with those related to the forms of historical discourse and the objectives which are in fact disciplinary (called *intrinsic*). It is important to maintain a balance between these two²¹

These specifications of values also include material for definitions of general abilities (“analyse and interpret information critically and responsibly, through dialogue, through the findings of historical evidence and through open debate based on multiperspectivity”). They offer a path to the specification of cognitive and linguistic competence.

²⁰ Rec (2001)15.

²¹ This point was made by Mayrizio Gusso

2. Social situations of communication where history is present

It behoves education to prepare learners to cope effectively with situations in which history is involved. History has a presence in numerous situations of life in society, being the human and social science subject most susceptible to ideologies, social representations and stereotypes and one of the “raw materials” for identity-building.

2.1. Checklist of social situations involving historical communication

By way of an indication, an inventory of the situations of social communication where history is utilised is set out below. Historical knowledge is present in *inter alia*:

- political agendas (parties, elected representatives, political leaders, etc.), where it is normally used for persuasive purposes (interpretation of the past), in particular to define national identity or the construction to be placed on historical events (slavery, colonialism, collaboration with totalitarian regimes, etc.);
- exchanges between citizens, particularly in terms of the “general knowledge” assumed to have been acquired;
- the family and neighbourhood context where personal accounts are passed on, mingled with “mainstream history”;
- the construction of collective memory: celebrations of “great men”, heritage sites, statues, battlefields, national holidays, etc.;
- the press and other media, in reviews of historical writings, accounts of archaeological discoveries, etc. or special features on a historical event as background to a current political event;
- the specialist press, such as history magazines, both general and specialist (the Middle Ages, history of religions, etc.);
- Film and theatre (fictional historical films/dramas as opposed to docu-dramas, historical epics), stories and dramas taken from history;
- television programmes, including historical documentaries;
- websites;
- historical re-enactments and performances;
- museums and exhibitions;
- Sites and monuments, and artistic productions to attract visitors and tourists;
- historiographic production for the general public or the “educated” public
- [...]

Some of these situations are intrinsic to social life, to politics or to active citizenship, others pertain to media use, access to knowledge and the formation of opinions. They involve different forms of communication: oral/aural, written and audiovisual reception, oral interaction, etc. This reference list may be supplemented and used as a guide to the identification of language skills forming part of history syllabi.

These social activities involving historical knowledge can in fact be described in terms of discourse types and linguistic capacities.

2.2. From social situations to types of discourse

For situations of “historical communication” it is possible to develop descriptors from an analysis of the characteristics of the type of discourse employed in the situation(s).

As an example, reference may be made to the goal of *learning to understand historical documentaries (television)*, which are a discourse type in the popularisation of history and mainly involving aural reception. ([CEFR](#): 4.4.2.3. : understanding TV programmes and films; understanding a documentary: B2)

History-related/cognitive skills include

Ability to:

- identify academic sources
- identify reasoning based on data/clues
- spot the devices used to give popular appeal: dramatisation, mystery, enigma, “experts”
- identify new knowledge
- place the occurrence under discussion in a broader context (chronological, cultural)
- evaluate representational forms chosen particularly for television
- identify simplifications, generalisations, lack of data, allusion to academic controversies
- understand whether a particular perspective is being conveyed
- [...]

Linguistic and semiotic skills include

Ability to:

- understand the voice-over commentary;
- understand interviews;
- read maps, diagrams, tables;
- interpret editing, framing and lighting;
- spot the definitions given in the voice-over;
- distinguish description from comment;
- distinguish objectified discourse from judgment (particularly aesthetic: beautiful, magnificent, etc.);

Once the social situations of communication have been characterised, it becomes possible to single out and focus on particular linguistic features in teaching dedicated to history.

3. Subject-related competences

A certain command of history as a form of knowledge is also an educational goal in itself, so a survey of the cognitive resources needed to learn/teach modes of in-school and social discourse is called for.

3.1. Checklist of components of epistemological competence in history

The expertise that has to be taught has been defined as “historical literacy”²².

In order to foster open-mindedness, tolerance, empathy and other virtues, it is important to develop “cognitive skills” or “expertise” in history, such as ability to handle and analyse different forms of information and documents, arrive at balanced, responsible conclusions, and see other points of view.

Historical proficiency²³ can be broken down into types of competence including being able to:

- formulate relevant questions about the available documents;
- examine potential sources of information and distinguish between primary and secondary sources;
- assess such sources in terms of perspective, bias, accuracy and reliability;
- recognise one’s own perspective, bias and prejudice and take account of them when interpreting the available evidence;
- use the sources available to identify relevant information to help students answer their questions;

²²Stobart M. (1997): “Towards a basic concept of historical literacy”, in Council of Europe: *History and its interpretations*, Council of Europe Publishing, Strasbourg, p. 64 ff.

²³ According to Stradling, R. (2001), *Teaching 20th-century European history*, Council of Europe Publishing, Strasbourg, pp. 97-98.

- structure this information on a particular event or situation as a sequence (what happened first and then subsequently, what was happening contemporaneously, etc.);
- contextualise the information by relating it to the information already available about the period, parallel events, etc.;
- scrutinise the available source material for reasons and rank them in terms of their significance;
- reach conclusions about what happened and why and to provide reasons for these conclusions;
- acquaint oneself with historiography as a particular form of the construction of knowledge²⁴;
- introduce multiperspectivity into historical research and narration;

In these inventories, the abilities that are actually within the learners' grasp need to be identified. There is also a need to bring out how they connect with each other so that the planning of a realistic path for their acquisition can be attempted, above all according to the cognitive development of learners at school.

3.2. Checklist of components of historical knowledge

This is the knowledge which it is hoped learners will “retain” from their history lessons and apply in social situations of communication. It consists of knowledge of different orders:

<i>general categories and general knowledge</i>	<ul style="list-style-type: none"> • chronology, temporality, period, long term; • event, trend, evolution; • structure, organisation; • continuity, change, break, revolution “progress”; • civilisation, culture; • causation, causes, multiple causation; • data, description, demonstration, comparison; • interpretation, subjectivity, anachronism... • [...]
<i>specific or local categories and knowledge, proximate in space and time</i>	<ul style="list-style-type: none"> • knowledge of general historical schemes and processes over the long term (for example: the expansion of agriculture in Europe (neolithisation), the birth of capitalism, the establishment of parliamentary democracy in Europe...) • understanding this type of process at the level of the major regions of Europe and the world, with their implications for more specific areas (nation-states, regions, towns, etc.) • understanding the events that have structured the active collective memory, in other words those whose consequences and interpretations are relevant to present-day life in society (knowledge of certain places, individuals and works significant for those stages in history, usually recent) • [...] •
<i>specific or local categories and</i>	These categories are the product of specific areas, periods or

²⁴ Stradling R. (2003) : *Multiperspectivity in history teaching: a guide for teachers*, Council of Europe.

<i>knowledge, remote in space and time</i>	cultures and often have currency in their original form and therefore in a foreign language (in English, for example, <i>ostracism</i> (Greece), <i>nome</i> (Egypt), <i>auto-da-fé</i> (Spain and Portugal), <i>aggiornamento</i> (Italy), <i>boyars</i> and <i>muzhik</i> (Russia)...
[...]	

The compilation of history teaching syllabi which comprise specifications in terms of knowledge can accommodate the traditional tendency to design syllabi focused on specific proximate categories (national history). The grid above is intended for scrutiny of the diverse nature of the knowledge meant to be taught. Its chief purpose is to emphasise that these various forms of historical knowledge presuppose different discursive forms in what is said by the teacher and the textbook:

- general knowledge should be dis-connected from its ordinary connotations and interpreted afresh in its historical perspective, also of a philosophical and anthropological nature;
- proximate knowledge can be debased, in which case its primary meaning must be restored;
- remote knowledge can give rise to interpretations distorted by ethnocentricity and vitiated by exoticism or by being construed anachronistically. Thus the teaching of such knowledge has to draw upon the approaches peculiar to intercultural education.

4. In-school communication situations relating to history teaching

In order to switch to the actual teaching, from the social forms of communication and from the objectives defined in terms of historical knowledge, these must be linked with the forms of communication that are used in history teaching.

Linguistic interactions in class have the function of transmitting values and guiding the learners in the formation of their attitudes, transmitting knowledge and directly or indirectly preparing them to handle the situations described in section 2 above.

It is important to characterise these interactions, since the effectiveness of the teaching in question depends on how the learners accept and participate in it.

4.1. Checklist of classroom situations of historical communication

History teaching practices are structured according to a finite repertoire of learning/teaching activities. Such forms of teaching methodology vary according to educational traditions and the methodological choices made in the syllabi which order the teaching.

It uses approaches such as:

- presentation by the teacher (including general narration, interpretations and comments, analysis of primary sources, explanation of terms and concepts, etc.) using visual aids (maps, diagrams, data tables, reproductions of evidence, etc.) (OP, AuR and WP²⁵ note-taking) for learners);
- teacher-learner interaction about the presentation and/or data (OI) or “pedagogical dialogue”: the teacher’s question, the learners’ answer, assessment of the learners’ answer by the teacher;
- learners read the textbook (WR);
- presentations by learners (OP) based on notes, PowerPoint, etc.;
- debates (adversarial/multiperspective, OI) organised by learners (on the basis of texts or notes: WP);
- finding information (WR and WP; note-taking);
- analysis and summary of text files (WR and WP);
- reviews of books, television programmes (WP or OP);
- reaction to a historical film watched as a class (OI);

²⁵ Coding of communication activities based on the CEFR: **R** = reception; **P** = production; **I** = interaction; **O** = oral; **W** = written.

- reading texts by historians (WR);
- activities run as projects (linking different competences, for example, making a promotional pamphlet or film for a monument): individual and/or group research;
- introduction to historical methodology: for example, gathering testimonies about the recent past, collation, analysis and commentaries, analysis of the street names of a town, etc. (WP), draft text for a guide explaining a painting for tourists;
- production of personal or imaginative texts (WP);
- global historical simulation;
- [...]

4.2. From classroom situations to discursive forms

These history teaching activities can be described in terms of linguistic capacities and types of discourse. For situations of “historical” communication, it is in fact possible (as in 2.2 above) to develop descriptors from the characteristics of the discursive style used in that situation.

An example is the objective: *Giving a (prepared) presentation to the class*, in which the type of discourse relates to oral production (see CEFR 4.4.1.1.: addressing audiences). This involves:

history-related/cognitive skills such as the ability to:

- Read and summarise relevant documentation;
- Locate the different sources of information;
- Adapt an existing historical discourse;
- Interpret primary data;
- Interpret quantitative data;
- Report the opinion of professional historians;
- Give and support one’s own point of view, explaining its source and nature;
- Highlight the gains and the problems;
- [...]

linguistic and semiotic skills such as the ability to:

- State a plan, a scheme of narration;
- “Give clear, systematically developed descriptions and presentations, with appropriate highlighting of significant points” (Descriptor B2 in the CEFR p. 58);
- Emphasise the stages of the presentation as it unfolds;
- Present and organise the linguistic commentary of tabulated data, a diagram, etc.;
- Make the presentation attractive: manage voice and intonation;
- React with restraint to objections or criticism from class or teacher;
- Answer questions afterwards;
- Assess one’s own performance;
- [...]

It will be noticed that in the example given the same descriptors can be used as those in the CEFR, devised for foreign languages, to the extent that it describes a group of discursive forms employed in history (addressing an audience). Yet not all are relevant, even in this case, as the CEFR takes no account of learners’ ages. Thus, the other descriptor B2 (CEFR p. 60): “Can depart spontaneously from a prepared text and follow up interesting points raised by members of the audience, often showing remarkable fluency and ease of expression” does not suit 15-16 year old learners, at an age when compulsory education often ends. Likewise, the level C1 and C2 descriptors can furnish material for descriptions but probably cannot be adopted as such.

Plurilingual education presupposes linkage of the classroom modes of communication to the social ones involving history, so as to make transfers of proficiencies between them. At least some of the classroom modes of communication should enable learners to handle social situations of communication with historical content:

- *either directly through the classroom use of these social forms*
- *or indirectly, with the same proficiencies as those inherent in the social forms being developed through the classroom forms.*

5. Specific linguistic and semiotic competences needed for history teaching

Working from

- social situations of history-related communication (2.1. Checklist)
- and the corresponding types of discourse (2.2.)
- the ingredients of epistemological competence in history (3.1. Checklist)
- and the components of historical knowledge (3.2. Checklist)
- in-school situations of communication with historical content (4.1. Checklist)
- and the corresponding types of discourse (4.2.),

it is possible to single out specific linguistic competences suited to history teaching aimed at imparting knowledge and expertise as well as instilling social communication skill. Quite plainly, for learners these cannot be restricted to command of specialised terminology or ability to piece together historical narrative, even where clear and “logical”, from data.

To describe these linguistic competences, we shall adopt a communication capability model arranged in four sets of components, the first three of which form what is strictly speaking linguistic communication competence:

- strategic component/competence (see 5.1.)
- discursive component/competence, mastering types of discourse) (5.2.)
- formal component/competence (5.3)
- intercultural competences, not peculiar to history teaching, will be dealt with in another module.

5.1. Strategic competence

General communicative ability includes a psycho-cognitive component termed *strategic* that controls observable linguistic behaviour in order to generate, produce and understand texts. “Strategies are a means the language user exploits to mobilise and balance his or her resources, to activate skills and procedures, in order to fulfil the demands of communication in context and successfully complete the task in question in the most comprehensive or most economical way feasible depending on his or her precise purpose.” ([CEFR](#) p. 57).

In the CEFR the strategies are situated at the same level as communicative activities (as oral/written interaction [OI/WI], oral/written production [OP/WP] and aural/written reception [AuR/WR]). This level of specification allows teachable actions to be defined in terms of planning, execution, evaluation and repair²⁶, which seem independent of the languages and discourses used. We shall proceed from these specifications to describe the communication proficiencies needed to teach/learn history.

²⁶ CEFR, 4.4.1.3. for OP/WP, 4.4.2.4. for OR/WR and 4.4.3.3. for OI/WI.

Oral and written production²⁷		
	General activities	Activities in the school setting of history teaching and learning
Planning	Locating resources Preparation and/or rehearsal Consideration of the recipient and audience Adaptation of message	Identifying the relevant information sources Producing successive tentative versions of the text to be produced. Verifying its length (if WP). Taking account of the audience's receptive capabilities, level of knowledge and status, etc., Transposing, paraphrasing, summarising, mentioning, quoting and commenting on source texts
Execution	Building on prior knowledge Trial (experimentation)	Reliance on existing texts of the same kind as the one contemplated Making successive provisional versions of the text to be produced.
Evaluation	Checking of results	Testing through listeners' reactions (if OP) the intelligibility to an outsider not directly addressed (if WP)
Repair	self-correction	Improving self-correction through an external evaluation

Aural and written reception²⁸		
	General activities	Activities in the school setting of history teaching and learning
Planning	Framing (selecting mental set, activating schemata, setting up expectations)	Identifying type of discourse and its potential contents
Execution	Identifying cues and making inferences	Working out the meaning of technical terms or historical deductions from language knowledge and historical knowledge
Evaluation	Hypothesis testing: matching cues to schemata	Matching up the interpretative hypotheses and developing critical sense
Repair	Revising hypotheses if required	Reconsidering one's position about a theory, explanation, validity of data and their interpretation

It is plain that the specifications of the CEFR relate more to reading as comprehension than as interpretation or critical response. For languages of instruction, the comprehension strategies need to be re-interpreted as a function of the knowledge in the discipline (in this case, critical comprehension).

Spoken and written interaction²⁹		
	General activities	Activities in the school setting of history teaching and learning
Planning	Framing the issue (establishing a line of approach) Judging what can be presupposed Planning moves	No relevant descriptors in the CEFR, since the interactions between teacher and learner or among learners occur in the language of schooling. But it is necessary to

²⁷ According to CEFR. p. 53.

²⁸ According to CEFR. p. 65.

²⁹ According to CEFR. p. 73.

		understand what is expected of the classroom interactions whose aim is to provide insight into the knowledge presented and which are not ordinary social interactions. It is thus important to know their implications for imparting knowledge.
Execution	Taking the floor Co-operating (interpersonal) Dealing with the unexpected Asking for help	These specifications are altogether relevant in the context of debates, discussions and arguments staged in class about historical questions
Evaluation	Monitoring (schema, praxeogram) Monitoring (effect, success)	No particular specificity to the history-related verbal styles in or out of class
Repair	Asking for clarification Giving clarification Communication repair	Relevant as regards terminology, foreign borrowings, knowledge and patterns of historical reasoning and explanation...

These descriptors of strategies, as may be seen, need specifying if possible, where types of communication with “historical” content are concerned. This reference grid should be considered provisional. From a pedagogical standpoint, the descriptors of planning, which relate to the learners’ preparation of the statements (oral or written) should no doubt be more developed than those concerning monitoring or correction (save in the case of OP or WP).

These strategic abilities are valid for all subjects taught, so a comparison with the terms in which they are specified for, say, the natural sciences is called for.

5.2. Discursive competence

The concept *type of discourse* (or *discursive form*) has been used to denote the forms taken by communication as practiced in a given social situation and communication community. The types of discourse are specific discursive forms identified as such by a standard name and certain characteristics (physical location, type of participants, medium, etc.) of the situations where they occur: lecture, news item, anecdote, dispute, myth or prayer, etc.

The texts that pertain to a given type tend to follow the conventions typifying these discourses; the conventions concern not only contents but also structure and/or verbal productions. A text is more or less consistent with the discursive form whose specific outcome it is. The types of discourse themselves are more or less strained and formalised (sermon vs casual conversation).

The concept of discourse type is less abstract than that of textual type (narrative, descriptive, imperative, expository, persuasive, etc.). Typologies of this kind have never really been adequate for describing classes of texts since it is readily acknowledged that most actual texts correspond simultaneously to several types. This typology may nevertheless be used to denote the style (or discursive regime) adopted by certain segments of texts: for example, in the “film/book/record/review” discourse type in written media, there is often a segment at the beginning which has a descriptive or narrative tone (film); the texts then continue with a segment with an evaluative purpose. Insofar as the production of complete texts in a specific genre is expected from learners at the end of secondary education, this categorisation by text types (often called *discursive, cognitive operations...*) may help in identifying some limited language activities to be conducted at an earlier stage³⁰.

One aim of plurilingual and intercultural education, hence of languages of learning/teaching, is to broaden learners’ discourse repertoires (in some/all of the languages of their language repertoires) in relation to

³⁰ In this respect, see Beacco, J-C., Coste, D., van de Ven, P-H., Vollmer, H. (2010): “*Language and school subjects - Linguistic dimensions of knowledge building in school curricula*”, Council of Europe, Strasbourg

their initial experience/proficiency in types of discourse and to give them the opportunity for new experiences (through texts and documents) of the diversity of cultures and of otherness..

History syllabi may also be specified according to discourse type:

- types seen as already entering into the learners' repertoires (textbook, documentary, historical film, tourist leaflets, etc.)
- types present in the learners' social environment (periodicals: general-interest press, history monthlies; websites, political speeches, etc.)
- types to which a certain form of exposure is sought by history teaching.

For the purpose of choosing the types of discourse with which learners are to be familiarised, attention needs to be paid first to the academic status of history narratives. They are very diverse in nature because of the role assigned to them in diverse texts in the public domain which have some connection with history. For example, with respect simply to written narratives, it may be deemed important for learners to be brought into contact with:

- academic discourse types written by specialists for specialists (articles, communications, monographs, theses and the like);
- types produced by specialists, presenting new knowledge meant for and made accessible to the ("educated") general public;
- types used in popularisation in book form by professional historians, knowledgeable amateurs and authors specialised in historical dissemination;
- journalistic discourse types of the press specialising in history;
- journalistic discourse types of the ordinary daily press relating to history (reviews of published books, accounts of "discoveries" and exhibitions, interviews with historians, etc.);
- educational discourse in the form of history textbooks, summaries for school students;
- the encyclopaedic discourses of dictionaries, encyclopaedias, treatises, etc.;
- the direct testimonies recorded for example in as memoirs, autobiographies, recollections and personal diaries;
- fictional or "literary" works of a historical nature: novels, stage plays, films, TV series, serials, comics, etc.;

The choice of the discourse types which it is considered learners should experience depends on the general choices already described (values, social situations of communication, historical knowledge, etc.) but may be fine-tuned in the light of descriptors relating to:

- the nature of the instructional activities which are to draw upon these texts (WR, OI...)
- the expected degree of proficiency for each (see sections 3 and 4)
- the proximity or familiarity of the types compared to those already experienced by the learners
- the interest (or motivation) which these discourse types may arouse

Characteristics peculiar to the types may also be used as a basis:

- length of the texts pertaining to them
- their predictability (as to layout, form of paragraphs and phraseology)
- presence of explicit headings and subheadings, summaries, etc.
- presence of graphics, illustrations, maps, diagrams, etc.

These inventories are apt to guide choices in compiling teaching syllabi which differ but are based on similar categorisations of discursive forms.

5.3. Formal competence

Lexical/terminological competence has already been partly covered in section 3.2. The attention paid to proficiency in spelling, morphology and syntax, although it may take up a lot of room in the teaching activities, should not mean that the activities relating to discursive competence are minimised.

5.3.1. Pragmatic and cognitive categories

The conventions of form recurring in types of discourse (ie the linguistic and structural deliveries of the texts) may be described by means of categories unconnected with the syntax of the sentence.

These may be categories like some speech acts known as *cognitive operations*. This analytical category (see 5.2) applied to texts (also or alternatively called *cognitive process*) is to be understood as the discursive representation (in the sense of enactment) of the cognitive processes brought into play for the development/exposition of knowledge.

These include cognitive operations such as:

<i>analyse</i>	<i>illustrate/exemplify</i>
<i>argue</i>	<i>infer</i>
<i>calculate</i>	<i>interpret</i>
<i>quote</i>	<i>judge/evaluate/assess</i>
<i>classify</i>	<i>correlate/contrast/match</i>
<i>compare</i>	<i>name</i>
<i>describe/represent</i>	<i>specify</i>
<i>deduce</i>	<i>prove</i>
<i>define</i>	<i>recount</i>
<i>discriminate</i>	<i>report a discourse</i>
<i>enumerate</i>	<i>summarise</i>
<i>explain</i>	[...]

To describe academic discourse in history, pride of place may be given to cognitive/discursive operations/processes such as:

- *describe/recount*
- *represent* (textual or factual data)
- *interpret* (data)
- in particular by *matching* (data and interpretations) and *contrasting* (data and interpretations)
- *deduce* (interpretations/conclusions from data)
- *justify* (the deductions)
- *classify*
- *define*
- [...]

For each of these operations it is possible to identify the linguistic resources needed for their enactment, with likely variation between discourse types. It may be assumed that the “words” needed to express these cognitive operations have equivalents in all languages and that an attempt could be made to compile transposable inventories (for different languages and different subjects).

To compile such inventories of forms required to express the discursive/cognitive operations occurring in given types of discourse, one ought to use the *Descriptions of language-specific reference levels in the CEFR*³¹

[The following examples are translated from French]

For example, for *define* there would be descriptors such as:

In one or more specified types, the learner is capable of:

- recognising (W or O) (minimum level)
- and/or producing (W or O) (intermediate level)

³¹ Available, or being produced, for English, German, Spanish, French, Greek, Portuguese...

- improvising/creating/proposing (OI/WI) (advanced level)

a definition appropriate to the types in question by using some of the following linguistic resources:

- through a series of examples
- through one or more comparisons
- through contrast
- by paraphrasing
- through hypernyms/hyponyms
- by giving a translation
- through etymology
- through internal characteristics
- by relating the term to concepts or a theory...
- [...]

Such inventories make it possible to move from specification by strategic/discursive competence to definition of the requisite linguistic forms.

5.3.2. *Linguistic categories*

Discourse types can be described by using speech acts and/or discursive/cognitive operations since a specific discursive form is a verbal object albeit distinct from utterance, text, speech act, type of text, etc. Their verbal conventions may be apprehended

- as relatively stable types of utterances, in the case of highly restrictive types or set phrases, ...
- as the relatively stable or predictable general scheme or elements of their structure, which may be broken down into stabilised successions of speech acts or discursive/cognitive operations (for example, the sequence: represent, interpret, match...)
- as the preferential forms, in a given type, with which to deliver them. This conformity determines the appropriateness of the utterances (and not their accuracy or grammatical correctness), that is their compliance with common “rules” on the acceptable makeup of discourse types.

These conventions may be described on the basis of various general linguistic categories (= independent of individual languages), such as:

- forms of actualisation of the speaker (for example, in English: *I/me, we, one*, impersonal, passive, reflexive, etc.);
- forms of actualisation of the person addressed;
- presence/distribution and expected forms (in a given type) of assertive, appreciative, ethical and other formulations;
- presence/absence/distribution and forms of meta-discursive indications (statement of text plan, etc.);
- standard form of certain paragraphs;
- discursive tone (serious, humorous, personal touches, etc.).
- [...]

All descriptive categories used when analysing a discourse may serve as the starting-point for descriptors of formal mastery, especially with respect to reception or production. It nonetheless has to be taken into account that:

- texts of the same discourse type comply **to varying degrees** with the (often unstated) model underlying it;
- discourse types themselves may be conventional to varying degrees either as a whole or in some of their constituent parts (for example, the beginnings of scientific articles may be quite conventional/predictable while those of newspaper articles are fairly unpredictable).

This specification of forms should be underpinned by the expected language skills in other subjects taught and in language as a subject.

For example, to *state a plan* (in OP) there would be descriptors such as:

In one or more given types, the learner is able to

- recognise (W or O) (minimum level)
- produce (W or O) (intermediate level)
- improvise/create/propose (OI/WI) (advanced level)

a statement of plan appropriate to the types under consideration (here, presentation to the class), by activating some of the following linguistic resources:

[Highlight the structure of the forthcoming discourse]

[statement of the general schema]

- I am about to speak of/examine/deal with the question/the issue...
- I shall talk about...

[each point introduced by means of cohesive devices, but without using a predictable sequence (such as *firstly, secondly, thirdly*)... which is readily considered “clumsy” in English]

- first of all, first, to begin with, etc.
- next, then, as the second point
- the following point
- ...
- to conclude, the final aspect, etc.

[announcement of the end]

- lastly, to conclude, to finish, in conclusion

Inventories of this type may be common to different languages and to different disciplines in some respects, but they necessarily comprise language-specific elements owing to their morphological and syntactic diversity and the diversity of discursive forms.

6. Thresholds

Users are invited to determine from the categories set out above which thresholds of knowledge/language skills as regards history-related discourse types the students should possess, according to:

- expected proficiencies (OI, OP...)
- types of discourse to be mastered (for reception or production)
- discursive/cognitive operations which they must be able to recognise or deliver
- forms for delivering the above, which they must know how to handle correctly and suitably.

Empirical analyses of correct applications of these forms in productions (examination papers, for example) by learners who have taken courses of this kind or in other types of discourse to which they are exposed (textbook) should make it possible to estimate whether the results are actually achieved, hence to judge realistically whether they are within the learners' grasp.

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LITERATURE

Items for a description of linguistic competence in the language of schooling necessary for learning/teaching (end of compulsory education)

An approach with reference points

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In consultation with

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This text presents a procedure for creating a curriculum for the teaching of literature which explicitly takes into account the discursive and linguistic dimensions of this subject area. It proceeds through successive stages, for which there are corresponding inventories of references, from the level of educational goals in the teaching of literature to the identification of linguistic elements which it is particularly important to systematise in the classroom in order to manage the corresponding forms of discourse. This procedure – presented for discussion – has been devised to be independent of the specific language in question.

The texts in this part of the platform – on history, sciences and literature – all contribute to the identification of the linguistic dimensions of knowledge building in school curricula. They aim at offering assistance for coherent curriculum development and express shared values. For this reason, the texts provided follow a common pattern. Part 0.,1 and 1.1. are nearly identical in wording, other parts have been adapted to the theme of literature education (part 4, 5 and 6).³²

³² Jean-Claude Beacco designed the first study on history from which the present study benefited to a large extent (Beacco 2009). It is also linked to discussions in the group of experts who worked on the language as subject, namely Laila Aase, Mike Fleming, Tina Samihaian (see Pieper (ed.) 2007; Aase et al. 2009) and besides to an ongoing exchange with Helmut Johannes Vollmer who did the study on sciences (Vollmer 2009). For a general approach to the “linguistic dimension of knowledge building in school curricula” see Beacco et al. 2010.

Introduction

This module proposes an approach for specifying the competences and knowledge relevant to communication in language and the mastery of the language(s) of schooling used as a vehicle for conveying this knowledge. This approach specifies the knowledge and competences so that they can be taught by a systematic, targeted method, integrated with the teaching of subject-related knowledge. In the following text is illustrated specifically with reference to the teaching of literature, a very significant subject in the European educational area which often forms part of language as a subject, but is also taught as a subject of its own.

The text presents

- an overall approach for the description and categorisation of literature education and the competences needed for successful learning/teaching
- open-ended reference points (in the form of inventories) which are to be completed by the users, according to the specifics of the respective educational system and the languages in which teaching is conducted.

The purpose of these reference points is to help users in:

- identifying the linguistic and cognitive activities present in the subject under consideration;
- specifying the forms of the language of teaching/learning which are especially helpful in mastering the varieties of discursive content attached to the subject and the forms of communication necessary for imparting and acquiring subject-related knowledge and skills.

The overall scheme of the approach is as follows:

- (1) inventory and description of the educational values targeted by literature teaching practices;
- (2) inventory and description of the social situations of communication involving literature in the learners' social environment;
- (3) inventory and description of the expected literary knowledge (including attitudes);
- (4) inventory and description of the existing in-school communication situations for the acquisition and construction of basic knowledge and procedures in literature.

The choices to be made among these possibilities lead to the definition of the purposes and objectives of education in literature within compulsory schooling.

Based on steps (1) to (4) it is then possible to create:

- (5) inventories and descriptions of the specific linguistic, discursive and semiotic characteristics of relevance for the types of discourse involved in literature teaching and learning practices; these characteristics deserve to be taught in their own right in this subject area.

The text is part of a set of modules (including history, sciences and the mathematics) which propose a common procedure, relevant in theory and helpful for curriculum planning, whatever the language of instruction in question is, whether the learners' first language or a language acquired to a standard of proficiency of at least level B2, according to the Common European Framework of Reference for Languages (CEFR).

1. Educational Values

All teaching pursues educational goals over and above the expertise and learning which are both its substance and its aspiration.

1.1. Educating social actors

The role of languages of education in schools is to structure and assist the education and training of social actors. The aims of this education and training are shared by the Member States of the Council of Europe as the basis for living in society in Europe.

Schooling is responsible for preparing future citizens and developing their potential by giving them the necessary tools for all aspects of life in society (personal relations, occupational activities, public and

political activities, leisure activities, etc.) and by enabling them to understand the basic values of democratic life and make them part of their personal ethics.

The languages of Europe are therefore not only a “raw material” for building regional, ethnic and national cultural identities, but also a means of acquiring relevant knowledge in a number of different areas, of exchanging about this knowledge and how to make use of it as well as of experiencing otherness. Plurilingual education seeks to enhance the value of individual language repertoires and to organise life-long continuation and training to ensure that they develop appropriately. Literature as embedded in plurilingual education has a strong potential of moving beyond the actual: the explorative and creative dimension of language and literature point to the possibility of vision and change.

1.2. Values and literature education

The values connected to the teaching of literature extend from acknowledging the contribution of reading literature to personal development and identity formation and appreciating literary praxis as a form of participation in cultural life, to preserving and forming the cultural memory, national and transnational heritage(s). In recent years, recognizing diversity among literatures as a meaningful contribution to learning in heterogeneous societies and to intercultural understanding has become more relevant. Thus, the public aspect of literary education is underlined.

The issue of literary education has been addressed in particular by two recent recommendations of the Council of Europe: It is stressed that knowledge of language includes the knowledge of great works of literature and that literature education should form part of the curriculum “at all levels of the education system” (Recommendation 1833, Parliament Assembly of the Council of Europe, 2008). A move beyond national conceptions of literature education is aimed at in favour of a “transversal approach to Europe’s heritage, highlighting the common link of respect for cultural diversity” and as a contribution to education in European citizenship (ibid.).

Besides, literature education forms part of a wider concept of cultural and intercultural education through the arts with a rich potential for personal development and mutual understanding. Self-expression *through* and experience *of* the arts is explicitly valued (cf. Recommendation 1884, Parliament Assembly of the Council of Europe, 2009).

It should be noted that the notion of literature has changed over time and nowadays does not only refer to highly valued, canonical and/or national literary texts (cf. Eagleton 2008). It may well include other media (multi-modal texts like films in particular), sometimes even pragmatic texts. This is reflected in many European curricula which often address learning with various media within the same domain as literature. Thus, literature education is open towards media education in a more general sense as well as towards reading education in a narrower sense (Pieper (ed.) (2007)). The conception of literature and the design of the domain or even subject in the curriculum naturally affect the goals assigned to its teaching. It is particularly noteworthy that goals in the field of literature education embrace personal and subjective areas such as the development of a positive attitude towards literature, based on experiences of emotional involvement, pleasure, creativity, intellectual stimulation and enrichment, as well as the public sphere: literary discourse incorporates a cultural, often ethical and political dimension which is enacted in various social contexts including the classroom. In most cases, curricula in literature stress reception and communication about literature more than production. However, the concept of cultural education points to a creative dimension which includes the latter also.

Besides, in the field of compulsory schooling it is worth reflecting upon the relationship between an academic discourse on literature which is oriented towards a discipline – philology, literary studies, literary theory, cultural studies – and a less professional discourse which takes into account the various ways in which literature is part of life and society and is valued as such.

Within the history of literature education the teaching of literature and its context have shaped both praxis and knowledge. This process has been influenced by expectations and literary praxis of society in general

and the academy.³³ It can be argued that it lead to a knowledge in its own right – which of course has changed in history.³⁴ The rather general goals laid out below are primarily concerned with the civic and social as well as personal goals. Objectives which are closer to the logic of the academic disciplines are especially valuable in higher education (upper secondary and beyond).

The principle goals assigned to the teaching of literature may include:³⁵

- to enable students to read and appreciate literature as a rich cultural source for understanding and exploring human existence in history and in the present, a source which exceeds one's own living sphere and offers intercultural and transcultural insights and which contributes to the formation of cultural memory
- to enable students to conceive of literature (including theatre, film and other media) as one of the fundamental components in the construction of a Europe based on a common cultural heritage, enriched through diversity and cultures of the world
- to allow for in-depth-understanding of fundamental anthropological as well as ethical and political issues across cultures and thus play a vital role in the promotion of fundamental values such as mutual understanding (empathy), tolerance, human rights and democracy;
- to make a vital contribution to educating responsible and active citizens and fostering respect for all kinds of differences on a basis of understanding culture(s) and literature(s) as a vital dimension of social existence in Europe and beyond
- - to allow the nurturing in learners of the intellectual ability to analyse, interpret and evaluate texts critically and responsibly, through dialogue and through open debate based on multiperspectivity;
- - to support learners to recognise and understand different views and interpretations of one and the same text or issue and their relative legitimacy, especially by accepting multiperspectivity in literary discourse
- - to allow for experiences of pleasure and deep engagement and the development of a positive, appreciative attitude towards as well as knowledge of literature
- - to allow for experiences of literature as a (lifelong) means of identity-formation and self-development
- - to support learners to master a variety of genres in reception as well as production and in different media
- - to support learners to explore language as a means of imaginative and artistic expression both in *reception* and *production*, e.g. via reading and literary praxis, via creative writing, reciting and composing poetry, enacting theatre performances.
- [...]

2. Social and private situations of communication where literature plays a role

It is the obligation of education to entitle learners to enriching experiences with literature.³⁶ As mentioned above (1.2) the concept 'literature' has changed in history and nowadays does not only refer to a well-defined body of texts, e.g. in the sense of a canon, but may well include other media and texts which are not as highly valued. A wider notion of literature which takes into account its popular forms including those in other media the media makes room for the acknowledgement of more social situations of

³³ Given the diversity of the academic disciplines concerned with literature and the potential of learning with literature at school, it has to be considered that the way from disciplinary knowledge – not a clear cut body in itself – to literary knowledge as an outcome of compulsory education is not straightforward (Kämper-van den Boogaart 2008).

³⁴ This point was made by Bernard Schneuwly in a keynote at the Symposium Deutschdidaktik in Bremen in September 2010: "Savoirs/Scire: Gegenstand und Perspektive der Didaktik. Bemerkungen aus der Sicht der französischen Sprach- und Literaturdidaktik. See Aeby-Daghé/Schneuwly 2011 (forthcoming).

³⁵ Some of the goals laid out for history might well be taken into account for literature as well, especially where literature is considered as a cultural source which is embedded in a historical context and at the same time an expression of history.

³⁶ This is true for all learners and crucial especially for those who do not experience a regular and lively literary praxis at home and thus lack familiarity with literature

communication where literature plays a role. These are situations and activities in realms both private and public. In Western societies the concept of an intimate reading experience, even secluded from everyday life and seen as a merely private experience, has been strong since the rise of civic society. Accordingly, the CEFR links literature to private and personal³⁷ situations. Intimate and engaged encounters with literature are certainly important and appreciated by habitual readers. Still, literature was and is also part of public life. Learner-oriented thinking on literature-education might well benefit from a closer look at those forms of literary discourse which can be found outside the private realm or the academy. Among the social situations are also those situations where people choose literature as a means of expression, where they write, recite and perform.

2.1. Situations in society which involve literature communication

An inventory of the situations of social communication where literature is present is set out in the table below. Its basis is a broad notion of literature. Situations of literature communication in classrooms are dealt with in part 4.

Informal social settings: family, peers, friends reading together (e.g. parents and children), reading by oneself

Media reception in social settings:

communicating reading experiences, experiences with films etc; listening to lyrics; exchanging opinions on literature of different kinds, discussing prominent themes

playing with language (riddles, rhyme, jokes; lexical creativity [e. g. invent words]; register and style; dialect and standard, minority and majority language), singing lyrics

The general press and other media, including the web:

reviews of literature, commercials of publishing houses, interviews with writers, reports on festivals and prizes, documentation of laudations; television or radio programmes on literature, on cultures and sub-cultures; theatre productions on television etc., authors' blogs;

interactive formats: customer's review, recommendation, commentary

The specialist press, which includes literature magazines (general and specialist)

Places for the construction of collective memory: celebrations of "great authors/authoresses", exhibitions

Public encounters with literature: recitals / lectures by authors and other performers, libraries and book shops, book clubs, reading circles

Artistic productions: cinema, theatre, opera...

Places to write and perform, public or semi-public: Theatre workshops, drama groups, poetry slams, creative writing workshops, writing competitions...

[..]

There are of course also:

Private situations of reading literature individually.

To some extent these private situations can be considered social as well: they can for example be embedded in family life. On an abstract level they form part of the process of socialisation which is by definition a process in which the individual and the social merge; e.g. individuals engage in reading as part of their ongoing engagement with themselves, others and their social existence which affects identity formation.

The situations mentioned involve different forms of communication: oral, written and audiovisual reception, oral and written interaction, oral and written production. The list may be supplemented and used as a

³⁷ See chapter 4, table 5.

guide to the identification of language skills forming part of literature syllabi. The social activities involving literary knowledge can be described in terms of discourse types and linguistic capacities.

Besides, in the history of literature education goals and discourse genres have been developed which are situated more specifically in education and classroom contexts. These are dealt with in part 3. These educational goals and practices form a dynamic body in the history of institutional learning. Their link to situations outside the classroom varies and changes in time.

2.2. From situations in society to types of discourse

For situations of literature communication it is possible to develop descriptors from an analysis of the characteristics of the types of discourse employed in those situations.

One example is analysed in more detail. First the cognitive skills underlying the discourse are spelt out, followed by the linguistic and semiotic skills which cover the language-driven activities. The operations are differentiated here for heuristic reasons. Linguistic activities are certainly linked to cognitive skills.

On the level of production and interaction the linguistic and semiotic skills will be observable. They are of particular relevance in educational contexts as it is via articulation (and often via verbal articulation) that knowledge and understanding are assessed.

Producing a review of a book for a website³⁸

The literature related cognitive skills include the ability to ...

- develop a thorough understanding of the book: e.g. decode, extract propositions, make inferences, make use of prior knowledge and relate to information given, realise intra-/intertextual correspondences, establish a coherent situational model of the text³⁹
- clarify one's personal interest in and the appeal of the book
- identify relevant aspects of the story, plot or content, of style and genre and work out the relationship between aesthetic devices and effect
- place the book in a broader context: author/ess, literary history, literary works which cover similar issues or/and have the same genre...
- consult further sources if necessary (read existing reviews; study articles on contextual issues)
- develop an interpretation of the text which draws conclusions as to meanings on the basis of the operations mentioned⁴⁰
- evaluate the book with respect to form and content
- form an opinion
- identify the possible audience of the review
- Identify the genre-features of a review
- decide on the relevant and attractive issues to be presented in the review

The last three items of this list have a preparatory/planning function for text-production which is focussed upon below:

³⁸ The CEFR does not cover this genre, but provides scales for reports and essays which are partly applicable (4.4.1.2).

³⁹ Here, all aspects of the reading-process as reconstructed by research in the field of reading psychology are to be considered (Christmann 2010). Some operations are especially relevant for reading literature, such as the realisation of intra- and intertextual correspondences (Kämper-van den Boogaart/Pieper 2008).

⁴⁰ The difference between developing a thorough understanding and an interpretation is not always clear-cut. It could be argued, for example, that intertextuality comes in only when interpretation is asked for as a second step. On the other hand, in the case of satire a situational model which misses out on this point would not be adequate to the text.

Linguistic and semiotic skills⁴¹ include the ability to

- produce a text along the characteristics of the genre: provision of a catching introduction, presentation of the book (summarising relevant aspects of story, style and genre; sketching an interpretation), evaluation and contextualisation, possibly expression of subjective conceptions of the text
- make use of a register and style which suits genre, addressees (audience) and place of publication: more academic for a professional journal, closer to everyday-language (BICS) for a bookseller's customers-platform
- present arguments in a conceivable order, highlight important aspects
- monitor the writing process, analyse the provisional product with regard to addressees, content, style
- edit the provisional product

Note that the differences in addressees and place of publication will affect the genre characteristics applicable: a customer's review does not have to meet the expectation of contextualisation and interpretation which forms part of professional expectations towards reviews. But the articulation of subjective impressions might be expected to a greater extent.

However, the example should show the complexity of literary discourse which often combines reception, production and even interaction.

Linguistic skills to be mastered in this example are linked to mastering the writing process.

An interesting second example which focuses on oral production is: *taking part in an informal discussion on a recent film in the cinema*. This is a common discourse type in literary life, mainly involving oral, visual, possibly written reception and oral interaction.

Once the situations of literary communication in society have been characterised and the types of discourse they (primarily) involve have been identified and exemplified, it becomes possible to single out and focus on particular aspects of knowledge and linguistic features in the teaching and learning literature in school itself. The relationship between literary discourse and knowledge and competences within the educational frame of reference is, however, not one of mere correspondence. Some aspects will reflect the constitutive function of literary education.

3. Subject-related knowledge and competences

A certain command of literature is an educational goal in itself. Therefore, specifications of literary competences as well as of literary knowledge are called for.

3.1. Components of knowledge in literature

Despite the different approaches to and conceptions of literature and the related knowledge there are constituents which regularly form part of literary studies and literature education. A comparison of curricula concerning literature shows a certain consensus with regard to elements of knowledge (cf. Pieper (ed.) 2007). The following components are often considered as the core of knowledge:

- genres: epic, poetry, drama and further differentiations
- fiction and non-fiction
- literature, text, media
- author, narrator, character
- rhetorics and stylistics: e.g. image, symbol, metaphor; irony; syntactic figures
- literary history: continuity, change, break, epochs

⁴¹ By distinguishing between literature related cognitive skills and linguistic and semiotic skills priority is given to a distinction between cognitive operations never mind their linguistic representations and linguistic and semiotic representation. This does not mean, however, that the latter are performed without cognition.

Another element concerns what historically has been covered by the issue of the canon (cf. Fleming (2007) in: Pieper (ed.)):

- knowledge of a range of texts which are exemplary with regard to genre, epoch, style (national and world literature).

In addition, especially towards upper secondary and with regard to its propaedeutic function for university and academic study concepts which are closer to literary theory might be brought in:

- interpretation and polyvalence
- intertextuality, intermediality
- text, culture and interculturality.

With regard to the social situations pointed out in 2.1 knowledge connected to the perspective of cultural sociology and system theory should also be acknowledged:

- the literary field
- roles in the literary system: author, publisher, critic, other mediators.

It forms part of the logic and structure of academic literary discourses that the components mentioned can be conceptualised in different ways – depending on the standpoint taken. For example: from the perspective of cultural sociology the notion of interpretation can be developed in view of different actors (the literary critic, the local theatre...), from the perspective of hermeneutics the same notion can be developed in view of a dialogue between reader and text. Also literary history and epochs are dependent on questions like: Is literature conceived of as autonomous or is it seen in interdependence with its socio-political context?

The components can be considered as general categories and general knowledge comparable to what has been termed as such in the studies on history (Beacco 2009) and science (Vollmer 2009). Their specification involves processes of clarifying perspectives and choices. In educational contexts this process will be directed by educational aims, conceptions of feasibility, teaching traditions and various social actors. This “transposition didactique” (Chevallard 1991) thus forms a bridge between the complexity and diversity within disciplines on the one hand and goals in the field of knowledge and competences in literature education on the other hand. It needs to be subject to responsible observation and research.

Empirical research on students' performances in literature shows that aspects of literary knowledge might well be reproduced without being made functional for an interpretation or that they are applied schematically and even hinder comprehension and interpretation (Winkler 2007; Köster 2003). Findings of this kind are especially relevant in compulsory schooling where literary knowledge is often linked to dealing with texts and media (cf. Pieper (ed.) 2007) while in upper secondary schooling it is also valued beyond its application in text-reception as part of the canonical knowledge in the field. Due to the obstacles mentioned declarative knowledge as a constituent of literature education in compulsory education needs special attention: How can elements of knowledge be conceptualised and taught in such a way that they are helpful for the achievement of the goals of literary education?

3.2. Textual demands

Given that literature education deals with reading texts of very different character and complexity and given that everyday situations involve a variety of texts it is necessary to assess textual demands. An awareness for these should guide curriculum decisions on text choice. Also, their analysis in view of learning should be part of planning procedures of teachers.⁴² The following aspects concentrate on literature in the sense of written texts which are still more prominent in educational settings than other media. The list covers some major aspects.

Aspects of text-complexity in literature

- Vocabulary: specific and unfamiliar/outdated or common and current

⁴² A system which assesses text-complexity in view of corresponding levels of expertise with learners is currently developed in the project LIFT-2: Literature Framework for Teachers in Secondary Education (EU-Comenius Program): <http://www.rug.nl/uocg/internationalisering/literatureframework/index> (26/07/2011).

- Syntax: length of sentences and complexity
- Text length (in prose), density (in poetry)
- Text genre: meeting or varying the familiar/the pattern
- Arrangement of plot and storyline: action/suspense easy conceivable or not; several lines or straight forward arrangements; number of characters; chronology and its explicitness
- Perspectives: clear and few, unclear and many
- Aesthetic structures/tropes: indirectness, imagery (metaphor/symbolic language), irony
- Layers of meaning
- Demands on prior knowledge and interests

Taking into account the goals of literature education (1.2), the situations in society involving literature communication (2.1) and the subject knowledge (3.1) as well as textual demands (3.2) that might occur the corresponding literary competences need to be clarified.

3.3. Components of literary competence

Taking into account the traditional core of literature as well as the manifold forms of literary praxis, a broad notion of literary competence is called for. Reading competence is certainly relevant; also, the specific elements of literary discourse, its role in socialisation and praxis have to be considered.

With regard to reading, students should be able to understand, use, reflect upon and engage with the text (cf. PISA 2009, 34). The aspects of reading which PISA distinguishes as “mental strategies, approaches or purposes that readers use to negotiate their way into, around and between texts” (ibid.) are all relevant to reading literature:

- “retrieving information
- forming a broad understanding
- developing an interpretation
- reflecting on and evaluating the content of a text
- reflecting on and evaluating the form of a text.” (PISA 2009, 34)

It forms part of reading competence to arrange the reading process effectively via strategies. The strategies are linked to the reader’s purposes and to phases of the process: prior reading, while reading (perhaps several times), after reading.

Knowledge of strategies will include strategies useful to activate prior knowledge and expectations, e.g. considering the title of the text, briefly surveying the text, asking questions etc.. This phase – “prior reading” – corresponds to “planning” as part of the strategic competence in the CEFR.

During and after reading, those strategies should be available which help to structure and to pinpoint the essential parts of the text (e.g. mark key words, formulate captions for passages) or which help to elaborate upon the text in order to integrate new knowledge (e.g. answer questions formulated in the beginning, compare preliminary results of the reading process to expectations), other strategies to secure knowledge or intensify it (summarise main points). This phase corresponds to “execution” as part of the strategic competence in the CEFR. Here, epistemic writing, writing which helps to develop thoughts and to gain new insights, can come in.

Special attention needs to be paid to generating a mental model and developing it further/revise it – if necessary in the course of reading. This can also be helpful for narratives where a scenery needs to be imagined. The construction of meaning and a cognitive and affective response to the literary text in particular is often highly dependent on imagination.

Specific to literature is the importance of a motivation to engage in literature that goes together with a certain form of expertise and that is founded in gratifying experiences. It often has a habitual dimension (Bourdieu) which makes it a demanding goal for teaching. In general, literary competence can be defined as the ability to master the rules of literary communication. This includes attitudes and motivation, e. g. the

readiness to read a text several times and to accept the contract of conceiving a text as fictional (Kämper-van den Boogaart/Pieper 2008).

It is then possible to spell out further elements of receptive and productive competences such as:

- to trace the interplay of form and content
- to trace intratextual structures
- to trace intermedial and intercultural relations
- to process/interpret metaphoric and symbolic language
- to identify layers of meaning
- to write about/talk about a literary text and argue an interpretation
- to take part in literary conversations/discussions.

4. In-school communication situations relating to literature teaching and learning

In order to switch to the actual teaching, from the social forms of communication and from the objectives defined in terms of literary knowledge, these must be linked with the forms of communication that are used in literature teaching.

Linguistic interactions in class have the function of transmitting values and guiding the learners in the formation of their attitudes, transmitting knowledge and directly or indirectly preparing them to handle the situations described in section 2 above.

It is important to characterise these interactions, since the effectiveness of the teaching in question depends on how the learners accept and participate in it.

4.1. Checklist of classroom activities in literature education (for subject teaching/learning in general)

Literature teaching practices are structured according to a finite repertoire of teaching/learning activities. Such forms of teaching methodology vary according to educational traditions and the methodological choices made in the syllabi which order the teaching. It is possible to distinguish between five major groups of activities:

- 1) activation, acquisition, structuring and storing of literary knowledge and world knowledge
- 2) presenting and describing text/media, arranging text reception (including free reading times), responding to/elaborating upon text
- 3) negotiating and discussing meaning(s)
- 4) evaluation of/reflection on text, new knowledge (change of perceptions) and the ways by which it was gained
- 5) creative/expressive literary praxis.

The following activities can be regularly found in classrooms:

- Presentation by the teacher (including information about authors, genres, contexts, general narration, comments, explanation of terms and concepts, etc.) using visual aids (OP, AuR and WP⁴³ note-taking) for learners);
- Teacher-learner interaction about the presentation (OI);
- Learner-learner interaction (group work/pair work)
- Learners' text-reception/finding information
- Learners' treating of (textbook) tasks
- Agents summarise information/results of.../new knowledge
- Teacher-learner interaction about reading impressions after reading a book (e.g. at home)

⁴³ Coding of communication activities based on the CEFR: **R** = reception; **P** = production; **I** = interaction; **O** = oral; **W** = written; AuR = aural reception.

- Learners read the textbook (WR);
- Presentations by learners (OP) based on notes, PowerPoint, etc.;
- Literary dialogue where interpretations are shared and discussed (OI), chaired by learners or the teacher;
- Debates (adversarial/multiperspective, OI) organised by learners (on the basis of texts or notes: WP);
- Finding information (WR and WP; note-taking);
- Analysis and summary of text files (WR and WP);
- Reviews of books, television programmes (WP or OP);
- Reaction to a film watched as a class (OI);
- Reading texts by critics (WR);
- Activities run as projects (linking different competences, for example, developing a guided tour to an author's house); individual and/or group research;
- Production of personal or imaginative texts (WP);
- Production of analytical/interpretative essays (WP), production of reviews (WP);
- [...]

What usually might be produced in writing is likely to be produced in various medial formats nowadays, e.g. in the form of (hyper-)text to be presented on the web.

4.2 From classroom situations to discursive forms

These literature teaching activities can be described in terms of linguistic capacities and types of discourse. For situations of literature communication, it is in fact possible to develop descriptors from the characteristics of the discursive style used in that situation.

An example is the objective: *taking part in a literary dialogue/discussion on a novel in class*, in which the type of discourse relates to oral production. This involves:

Literature related cognitive skills such as the ability to:

- Read the text in question prior to the event;
- Identify relevant aspects of the literary text;
- Clarify personal reactions and form an opinion on characters, plot, narrative style etc.;
- Give and support one's own point of view, explaining it by referring to the text and one's interpretation;
- Listen to contributions of others and react, possibly change/adapt his/her own opinion/interpretation
- [...]

Linguistic and semiotic skills such as the ability to:

- Express and describe reading experiences including what he/she likes/dislikes
- Express an opinion and give reasons, explain it by referring to the text in question/possibly its context and by highlighting important points
- Develop an argument by taking into account the standpoints of others
- Ask questions to peers in case contributions are not clear to him/her
- Formulate a standpoint by relating to the text and to contributions presented in the discussion
- Offer alternative phrasings if he/she feels not understood/misunderstood
- Explicitly deal with the pros and cons of opinions/arguments presented in class and draw conclusions

- [...]

The example can be linked to descriptors of the CEFR which were originally developed for foreign languages and which would have to be modified: B1, B2 and C1 in “addressing audiences” could form a starting point (CEFR, p. 60). An adaptation should take into account that contributions in the format of a literary dialogue or discussion can and should also be shaped by imaginative, even personal response. Depending on the age and cognitive development of the learners, demands as to abstraction and structure need to be reconsidered. Also, engaging in the exchange with others is central to the format at stake: the argument needs to be developed on the spot.

Plurilingual education presupposes linkage of the classroom modes of communication to the social ones involving literature, so as to make transfers of proficiencies between them. At least some of the classroom modes of communication should enable learners to handle social situations of communication with literary content:

- *either directly through the classroom use of these social forms*
- *or indirectly, with the same proficiencies as those inherent in the social forms being developed through the classroom forms.*

5. Specific linguistic and semiotic competences needed for literature education

So far we have identified and partly described (by way of example/illustration)

- situations in society of literary communication (2.1.)
- and the corresponding types of discourse (2.2.)
- and the components of literary knowledge (3.1.)
- the ingredients of literary competence (3.2.)
- in-school situations of communication with literary discourse as goal/content (4.1. checklist)
- and the corresponding types of discourse in literature lessons in school (example(s) in 4.2.).

Based on these different steps (and their underlying principles) it is now possible to single out and generalise specific linguistic competences suited for literature teaching and learning, aimed at imparting knowledge and expertise as well as instilling social communication skills.

To describe these linguistic competences, we shall adopt a communication capability model arranged in four sets of components, the first three of which form what is strictly speaking linguistic communication competence (see Beacco 2009):

- strategic component/competence (see 5.1.)
- discursive component/competence, mastering types of discourse (5.2.)
- formal component/competence (5.3)
- intercultural competences, not peculiar to literature teaching, will be dealt with in another module.

5.1 Strategic competence

General communicative ability includes a psycho-cognitive component termed *strategic* that controls observable linguistic behaviour in order to generate, produce and understand texts: ‘Strategies are a means the language user exploits to mobilise and balance his or her resources, to activate skills and procedures, in order to fulfil the demands of communication in context and successfully complete the task in question in the most comprehensive or most economical way feasible depending on his or her precise purpose.’ (CEFR p. 57) The strategic competence is – apart from where the field of reading is concerned - in fact not subject specific and is presented in more detail in the study on teaching and learning history (see Beacco 2009, 13-15).

5.2 Discursive competence

Discursive competence with regard to literature education has three major dimensions: one refers to the textual genres which are treated in class, texts that are read, genres that form part of receptive activities. The second dimension, often less present and certainly less explicit in curricula, refers to the literary

genres students produce themselves, e.g. when engaged in creative writing. The third dimension refers to specific genres of communication about literature outside and inside school. The concept *type of discourse* (or *discursive form*) is useful for all, as it has been used to denote the forms taken by communication as practiced in a given social situation and communication community. The types of discourse are specific discursive forms identified as such by a standard name and certain characteristics (physical location, type of participants, medium, etc.) of the situations where they occur: lecture, news item, observation, dispute, myth or prayer, etc. (see Beacco 2009 for a more extensive account on the concept).

One aim of plurilingual and intercultural education, hence of languages of teaching/learning, is to broaden learners' discourse repertoires (in some/all of the languages of their language repertoires) in relation to their initial experience/proficiency in types of discourse and to give them the opportunity for new experiences (through texts and documents including non-verbal forms of representation) of the diversity of disciplines, academic cultures and of otherness.

A specific aim of literature and language education is to provide occasions for reflecting on discourse types, their usage and dynamics.

Literature syllabi may also be specified according to discourse type:

- types seen as already entering into the learners' repertoires (novels/stories/poetry for children and young readers, various kinds of films (drama/comedy...), theatre etc.)
- types present in the learners' social environment (various books available at home, periodicals: general-interest press, ...; websites, customers' reviews, professional reviews, interviews with authors/authoresses; literary praxis: lectures in the library, poetry slams)
- types to which a certain form of exposure is sought by literature teaching: historic genres, canonical literature, literary criticism, encyclopaedic entries in the specialised discourse of the academy etc..
- types which learners should master as form of their literary praxis within and outside the classroom: literary dialogue/discussion, essay, summary...

The choice of the discourse types which it is considered learners should experience depends on the general choices already described (values, social situations of communication, literary knowledge, etc.) and may be fine-tuned in the light of descriptors relating to:

- the nature of the instructional activities which are to draw upon these texts (WR, OI...)
- the expected degree of proficiency for each (see sections 3 and 4)
- the proximity or familiarity of the types compared to those already experienced by the learners
- the interest (or motivation) which these discourse types may arouse
- the linguistic complexity of the texts chosen (3.2).

A specific demand when developing discursive competence in literature education is to make students aware of shifts between BICS and CALP: in a first encounter with a literary text it might be accepted to use an informal register and an intimate personal response might well be appropriate. However, when learners are expected to write a summary or an essay they usually need to choose a language that allows for abstractness and distance. Also, dealing with literature might well ask for choosing a language different from the language of the literary text treated (see 5.3.2).

5.3. Formal competence

5.3.1 .Pragmatic and cognitive categories

The conventions of form recurring in types of discourse (i.e. the linguistic and structural deliveries of the texts) may thus be described by means of categories unconnected with the syntax of the sentence.

These may be categories like speech acts/language functions or, on a higher, more abstract level, *discourse functions*. These analytical categories applied to texts (and also or alternatively to the *cognitive processes*) are to be understood as the discursive representation of both the cognitive processes and their

linguistic realisation (in the sense of enactment) brought into play for the development/exposition of knowledge.

These discourse functions mark cognitive operations *and* their verbal performance at the same time; they are at the interface between cognition and verbalisation, they include operators such as:

<i>Analyse</i>	<i>distinguish</i>	<i>name</i>
<i>argue</i>	<i>enumerate</i>	<i>outline/sketch</i>
<i>assess</i>	<i>explain</i>	<i>prove</i>
<i>classify</i>	<i>illustrate/exemplify</i>	<i>recount/narrate</i>
<i>compare</i>	<i>infer</i>	<i>report (on) a discourse</i>
<i>describe/represent</i>	<i>interpret</i>	<i>summarise</i>
<i>deduce</i>	<i>judge/evaluate/assess</i>	<i>specify [...]</i> ⁴⁴
<i>define</i>	<i>correlate/contrast/match</i>	

To describe educational and pre-academic discourse in literature, pride of place may be given to cognitive/discursive operations/processes such as:

- *describe*
- *recount/narrate*
- *explain*
- *analyse*
- *interpret*, in particular by *matching* (textual clues and interpretations) *comparing* (texts with related or contrasting texts/genres)
- *argue*
- *evaluate*
- *summarise*
- [...]

For each of these operations it is possible to identify the linguistic resources needed for their enactment, with likely variation between discourse types. It may be assumed that “words” referring to cognitive operations have equivalents in all languages and that an attempt could be made to compile transposable inventories (for different languages and different subjects).

To compile such inventories of forms required to express the discursive operations occurring in given types of discourse, one ought to use the CEFR *Reference Level Descriptions* for specific languages⁴⁵

5.3.2. Linguistic categories

Discourse types can be described by using speech acts and/or cognitive operations since a specific discursive form is a verbal object albeit distinct from utterance, text, speech act, type of text, etc. Their verbal conventions may be apprehended

- as relatively stable types of utterances, in the case of highly restrictive types, set phrases, etc..
- as the relatively stable or predictable general scheme or elements of their structure, which may be broken down into stabilised successions of speech acts or cognitive operations (for example, the series: represent, interpret, match...)

⁴⁴ See the extended list in Vollmer et al. 2008 which was arrived from the analysis of modern science curricula (and other subjects) for grade level 9/10 in Germany. See also the set of Macro-functions derived from this analysis (Vollmer 2009).

⁴⁵ Available, or being produced, for English, German, Spanish, French, Greek, Portuguese...

- as the preferential forms, in a given type, with which to deliver them. This conformity determines the appropriateness of the utterances (and not their accuracy or grammatical correctness), that is their compliance with common “rules” on the acceptable makeup of discourse types.

These conventions may be described on the basis of various general linguistic categories (= independent of individual languages), such as:

- forms of actualisation of the speaker (for example, in English: *I/me, we, one*, impersonal, passive, reflexive, etc.);
- forms of actualisation of the person addressed;
- presence/distribution and expected forms (in a given type) of assertive, appreciative, ethical and other formulations;
- presence/absence/distribution and forms of meta-discursive indications (statement of text plan, etc.);
- standard form of certain paragraphs;
- discursive tone (serious, humorous, personal touches, etc.).
- [...]

All descriptive categories used when analysing a discourse may serve as the starting-point for descriptors of formal mastery, especially with respect to reception or production. It nonetheless has to be taken into account that:

- texts of the same discourse type comply **to varying degrees** with the (often unstated) model underlying it;
- discourse types themselves may be conventional to varying degrees either as a whole or in some of their constituent parts (for example, the beginnings of scientific articles may be quite conventional/predictable while those of newspaper articles are fairly unpredictable).

This specification of forms should be underpinned by the expected language skills in other subjects taught and in language as a subject (Beacco 2009, see the example “to state a plan”).

5.3.3. Executing discursive competence: write a review

To perform the task of writing a review learners execute the operations describe, recount, evaluate. The task can be classified as complex in that it combines demands in reading and writing and often less demanding linguistic activities (narrate/describe) with more complex ones (evaluate/argue):

to describe

- with regard to genre: relate to/distinguish from common genres, use more or less academic terminology
- with regard to context: author, year, translator, similar works, publisher
- addressees: young or adult readers, female or male, people with specific interests
- design
- protagonists
- prominent themes/motifs
- language

to recount

- choose aspects of the story: who? what? where? (taking into account the addressees)
- recount (parts of) the story, possibly leaving out the end
- use present tense

to evaluate

- articulate an opinion (different levels of differentiation; depending on purpose)

- argue with reference to the book, to discourse outside the book (other texts, criteria like genre, epoch, literary market)
- articulate subjective experience and explain/make it plausible
- possibly articulate a recommendation

It is obvious that writers/learners need a linguistic repertoire which can form the basis of their choice. Their choice will depend – among other things – on the appropriate register for the context. Also, they need expertise in mastering the writing process including its phases planning, executing and revising.

6. Thresholds

Users are invited to determine from the categories set out above which thresholds of knowledge/language skills as regards literature-related discourse types the students should possess, according to:

- expected proficiencies (OI, OP...)
- types of discourse to be mastered (for reception or production)
- cognitive operations or speech acts which they must be able to recognise or deliver
- forms for delivering the above, which they must know how to handle correctly and suitably.

Empirical analyses of correct applications of these forms in productions (examination papers, for example) by learners who have taken courses of this kind or in other types of discourse to which they are exposed (textbook) should make it possible to estimate whether the results are actually achieved, hence to judge realistically whether they are within the learners' grasp.

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MATHEMATICS

Items for a description of linguistic competence in the language of schooling necessary for learning/teaching (end of compulsory education)

An approach with reference points

Helmut Linneweber-Lammerskitten

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This text presents a procedure to help in creating a curriculum for the teaching and learning of mathematics which explicitly takes into account the discursive and linguistic dimensions of this subject area. It mainly transfers and adapts the ideas and procedures developed for history in Beacco (2010), science in Vollmer (2010) and literature in Pieper (2011). It proceeds through successive stages, for which there are corresponding inventories of references, from the level of educational goals in the teaching and learning of mathematics to the identification of linguistic elements which it is particularly important to systematise in the classroom in order to manage the corresponding forms of discourse.

The texts in this part of the platform – on history, sciences, literature and mathematics – all contribute to the identification of the linguistic dimensions of knowledge building in school curricula. They aim at offering assistance for coherent curriculum development and express shared values. For this reason, the texts provided follow a common pattern: some parts are nearly identical in wording, other parts have been adapted to the peculiarities of mathematics education.

Introduction

Though it is widely accepted among mathematicians that mathematics itself can be seen as a universal language for all sciences, language awareness is often missing among mathematicians at universities and mathematics teachers at school. There is still a widespread prejudice that natural language and linguistic competences are less important, if not irrelevant, for the understanding and practicing of mathematics and that therefore language or even linguistic competence should not form part of a curriculum of the subject mathematics at school.

With the publication of the OECD/PISA concept of mathematical literacy and the development of educational standards and competency models in several European countries things begin to change: Though the term “literacy” in the PISA 2003 study is used only as a metaphor, it nevertheless imports some linguistic connotations and the concept of mathematical literacy itself goes far beyond operating and calculating with numbers. In the recent formulation of educational standards (in several European countries), which refer to competency models, linguistic aspects - especially those concerning argumentation and explanation - are seen as integrated parts of mathematical competence as a whole. Following this line of thinking, language awareness and the integration of linguistic aspects in teaching and learning mathematics should be part of any mathematics curriculum.

This paper presents

- an overall approach for the description and categorisation of the language competences needed for successful learning/teaching in mathematics education
- open-ended reference points (in the form of inventories/checklists) which are to be completed by users, according to the specifics of the respective educational system and the languages in which teaching is conducted.

The purpose of these reference points is to help users in:

- identifying the linguistic activities present in the subject under consideration;
- specifying the forms of the language of teaching/learning required in mastering the varieties of discursive content attached to the subject and the forms of communication necessary for imparting and acquiring subject-related knowledge and skills.

The overall scheme of the approach is as follows:

- (1) inventory and description of the educational values targeted by mathematics teaching practices;
- (2) inventory and description of the social situations of communication involving mathematics in the learners’ social environment;
- (3) inventory and description of some basic /the expected mathematical knowledge structures;
- (4) inventory and description of the existing in-school communication situations for the acquisition and construction of basic knowledge and procedures in mathematics.

Based on steps (1) to (4) it is then possible to create:

- (5) inventories and descriptions of the specific linguistic, discursive and semiotic characteristics of relevance for the types of discourse involved in mathematics teaching and learning practices; these characteristics deserve to be taught in their own right in this subject area.

In other words, what is proposed here is a common procedure, whatever the language of instruction in question is, whether it be the learners’ first language or an additional language acquired to a standard of proficiency of at least level B2, according to the CEFR (*Common European Framework of Reference for Languages* – Council of Europe 2001).

1. Educational values and mathematics education (inventory and description of the educational values targeted by mathematics teaching practices)

All teaching pursues educational goals over and above the expertise and learning which are both its substance and its aspiration. The overall objectives and values of education – and hence of mathematics teaching and learning - are twofold: they concern the personal welfare of the individual and the public welfare of society, as well as rights and duties on both sides. Learners are entitled to acquire certain competences, skills, knowledge and experiences as prerequisites for a successful future life in different respects, such as:

- for developing their own identity (personal domain)
- for participation in society as social agents and democratic citizens (public domain)
- for finding their place on the job market (occupational domain)
- for their future learning⁴⁶ (educational domain)
- ...

Society in turn puts requirements on learners: they are expected to use the opportunities for learning offered to them and to take efforts to acquire the necessary competences for their future, especially for their future role as democratic citizens. The values of individual and public welfare and the rights and duties combined with these constitute a basis of legitimation for education and educational objectives and goals.

Mathematics education is expected to contribute to these objectives and can do so in many different ways and on different levels. On a general and abstract level it can help students to acquire:

- mathematical competence in the sense of mathematical literacy (OECD 2003), which presupposes numerous subordinated competencies, as well as skills, declarative and procedural knowledge, abilities, emotions, volitions and so on
- key competences which are not specifically mathematical in character⁴⁷, but can be supported or frustrated by mathematical education
- mathematical experiences that can probably only be made in an artificial environment of a mathematics classroom
- ...

The role of languages of education in schools is to structure and assist the training and education of social actors and the development of the individual to their full potential as individuals. The aims of this training/education are shared by the Member States of the Council of Europe as the basis for living in society in Europe.

1.1. Mathematical Literacy

A specification of the general objectives and values with respect to mathematics education can be found in the PISA 2003 assessment framework (OECD 2003). In this document the aim of the OECD/PISA study is determined as the development of "indicators that show how effectively countries have prepared their 15-years-olds to become active, reflective and intelligent citizens from the perspective of their uses of mathematics." (p. 55). The developed assessments focus on the extent to which students can use the mathematics they have learned. Thus the assessment is twofold: it measures the performance of the students but also – and even in the first place - the effectiveness of the educational system. The underlying notion of mathematical competence is that of "mathematical literacy" which is defined as "an individual's capacity to identify and understand the role that mathematics plays in the world, to make well-founded judgements and to use and engage with mathematics in ways that meet the needs of that individual's life as a constructive, concerned and reflective citizen." (p. 24). Though this definition is

⁴⁶ Cf. Vollmer 2009 p. 4; CEFR, p. 45.

⁴⁷ Cf. the publications of the DeSeCo-project ("DeSeCo" stands for Defining and Selecting Competencies) e.g. DeSeCo 2005.

focussed on the student's future role as citizen, it is meant in a broader sense which is made clear by terminological explications (p. 25). Taking these explications into account the principal goals assigned to the teaching of mathematics are the following ones:

Mathematics education should enable the students:

- to put mathematical knowledge to "functional use in a multitude of different situations in varied, reflective and insight-based ways" (p. 25)
- to identify and understand the role that mathematics plays in the "natural, social and cultural setting in which the individual lives" (p. 25)
- to make "well-founded judgements" by using mathematics (p. 24)
- to use mathematics in ways that meet the needs of that individual's "private life, occupational life, and social life with peers and relatives, as well as life as citizen of a community". (p. 25)
- to engage with mathematics through "communicating, relating to, assessing and even appreciating and enjoying mathematics. (p. 25)
- ...

1.2. Key competences

Mathematics education should also contribute to the development of key competencies which are not specifically mathematical in character. The DeSeCo project names the following - classified in three broad categories and substantiated by the needs of the individual (DeSeCo 2005 p. 10ff):

Using Tools Interactively

The ability to use language, symbols and texts interactively	The need to keep up to date with technologies
The ability to use knowledge and information interactively	The need to adapt tools to own purposes
The ability to use technology interactively	The need to conduct active dialogue with the world

Interacting in Heterogeneous Groups

The ability to relate well to others	The need to deal with diversity in pluralistic societies
The ability to co-operate, work in teams	The importance of empathy
The ability to manage and resolve conflicts	The importance of social capital

Acting Autonomously

The ability to act within the big picture	The need to realise one's identity and set goals, in a complex world
The ability to form and conduct life plans and personal projects	The need to exercise rights and take responsibility
The ability to defend and assert rights, interests, limits and needs	The need to understand one's environment and its functioning

1.3. Mathematical experiences

Mathematics as a subject should not only be directed to the development of future competences but should also provide mathematical experiences that can probably only be made in the artificial environment of a mathematics classroom⁴⁸. Among these are:

- to perceive and understand the appearances of the world (nature, society, culture) we are

⁴⁸ The first three are due to the German mathematics educator Heinrich Winter (Winter 1995) and reformulated in the German National Educational Standards for Mathematics of the German Kultusministerkonferenz - i.e. German Standing Conference of the Ministers of Education and Cultural Affairs of the Länder (KMK 2004 p. 6). The fourth one is mentioned in (NCTM 2000 p. 4).

concerned with or should be concerned with in a specifically mathematical way.

- to understand mathematical objects and states of affairs represented in language, symbols, pictures and formulas as intellectual creations, as a deductively ordered world of its own kind.
- to acquire by analysis of tasks problem-solving (heuristic) skills which go beyond mathematics.
- to identify mathematics as a part of cultural heritage, as one of the greatest cultural and intellectual achievements of humankind
- to experience success by doing mathematics
- to experience that mathematics can be interesting and delightful
- ...

1.4. Linguistic and communicative impact

Even a short reflection on the linguistic and communicative impact of the values, the rights and duties, and the contribution of mathematics as a subject to the general objectives of education (mathematical literacy / competence, key competence, mathematical experiences) should make it clear that their realisation is dependent on linguistic and communicative categories presupposed in these values, rights and duties and general objectives.

That communication, language and language awareness do play a decisive role is most evident with the values of participation in society and of future learning, but can also be recognised as a prerequisite for finding a place on the job market and for the development of personal identity. On the highly abstract level, on which mathematical literacy / competence is formulated, expressions like “knowledge”, “identify and understand”, “well-founded judgements” and “communicating” already indicate that mathematical competence presupposes and comprises abilities, skills, capacities and competencies in the field of mathematics as well as in the field of subject based language and communication. The key competencies formulated above are also explicitly directed to interaction, language, texts, knowledge, information, communication, working in groups etc. The notion of experience, finally, outlined in the last section encompasses experiences in a narrow sense and their cognitive and verbal reflection.

2. Social and private situations of communication where mathematics plays a role (inventory and description of the social situations of communication involving mathematics in the learners’ social environment)

2.1. Situations and contexts where mathematics plays a role

Knowledge of mathematics and its application is needed or at least helpful in many and quite different situations. This is why the PISA 2003 framework stresses the importance of students being able to apply mathematics (and not just have some mathematical knowledge) and that they are able to do so in a variety of situations. Thus most of the test items are located in typical problem-solving situations taken from different domains: “An important aspect of mathematical literacy is engagement with mathematics; using and doing mathematics in a variety of situations. It has been recognised that in dealing with issues that lend themselves to a mathematical treatment, the choice of mathematical methods and representations is often dependent on the situations in which the problems are presented.” (OECD 2003, p. 32).

The PISA 2003 framework classifies the situations and contexts⁴⁹ of the test items according to the following two dimensions which focus on the distance of the problem to the student on the one hand and to mathematics on the other hand.

⁴⁹ The context (of an item) is explained as “its specific setting within a situation. It includes all the detailed elements used to formulate the problem.” (OECD 2003, p. 32)

2.1.1. *Situation and context considered in terms of the distance between the problem and the student*

The problem that is to be solved by applying mathematics may be situated very close to or further away from the student's personal life. Thus, oriented at the domain categories of the CEFR⁵⁰: personal, public, occupational and educational (CEFR p. 45ff.), the following four types are distinguished (OECD 2003, p. 32):

- Personal: the student's personal life;
- Educational/occupational: school life, work life and leisure
- Public: local community and society as encountered in daily life;
- Scientific: scientific, also hypothetical scenarios and potential situations⁵¹

Since these different types of situations/domains are also determined by different linguistic components (register, technical terms, typical pattern, style, types of discourse etc.) the PISA test items in mathematics generally make higher demands to the linguistic competencies of the students than conventional "word problems" (i.e. mathematical problems where significant background information is presented as text). One and the same activity e.g. the activity of selling and buying, can be situated in a personal situation type (selling a bicycle), in an occupational situation type (selling a car as a professional car seller), in a public situation (selling of community property) or in a scientific situation (solving a microeconomic problem). Each of these situation types is determined by genuine linguistic and communicative requirements and conventions and therefore makes different demands with respect to the linguistic-communicative components of mathematical competence.

2.1.2. *Situation and context considered in terms of the distance between the problem and the mathematics involved*

The problem and the means to solve it may be situated entirely in the "mathematical world" or at some distance to it, either closer or more distant. The distinction explicitly made in PISA 2003 is rather raw ("intra-/extra-mathematical")

- intra-mathematical: if it refers only to mathematical objects, symbols or structures, and makes no reference to matters outside the mathematical world
- extra-mathematical: if the problem contexts must be translated into a mathematical form

One could arrive at more subtle distinctions in the first category by asking from which kind of mathematics (financial mathematics, mathematics for psychologists, pure mathematics, etc.) the problem comes from, and what kind of mathematical means would be necessary to solve the problem. Since mathematics over the centuries has been used as an ancillary science by other sciences, differing conceptions have been generated with their own registers and linguistic and communicative conventions. With respect to the second category one could ask from which extra-mathematical sphere the problem arises and whether the problem can be solved entirely by mathematical means or whether other disciplines or considerations (philosophy, ethics, politics, world knowledge, personal experience etc.) are needed in addition.

2.2. **A focus on the communicative aspect of situations and contexts where mathematics plays a role**

The classification of situations in terms of the distance between the problem and the student / the mathematics involved in the PISA 2003 framework is motivated by the differing social and private situations of communication in the real world. Mathematical items of the PISA tests, however, only contain descriptions of such situations. Solving mathematical word problems in a paper and pencil test thus differs substantially from solving these problems in a real communication situation.

⁵⁰ Council of Europe, Strasbourg (2001): *Common European Framework of Reference for Languages: Learning, teaching, assessment* (CEFR). (Cambridge University Press).

⁵¹ "The use of mathematics to explain hypothetical scenarios and explore potential systems or situations, even if these are unlikely to be carried out in reality, is one of its most powerful features. Such a problem would be classified as belonging to the 'Scientific' situation-type." (OECD 2003, p. 33)

But, nevertheless, since these items are constructed as indicators for the ability of the students to use mathematics in real situations, we can refer to these items as describing typical examples for social and private situations of communication where mathematics plays a role. Thus the distinction between personal, educational/ occupational, public and scientific can be made in two directions: (i) directed to the situation where the problem is located and/or (ii) directed to the situation / the discourse community where the problem is posed or (re-)formulated and solved.

The role that mathematics can play in situations of communication is of course not confined to problem solving. In fact, in most cases mathematics can only give a contribution to such a solution, or it can give support to a better understanding, e.g. by sketching a geometric arrangement, by visualising a connection, by drawing a diagram with some spreadsheet software etc. Properties of all kinds are measured and expressed by numbers whenever it seems possible in scientific as well as in everyday contexts. Connections of different sorts can be interpreted as mathematical functions and thus give rise to a functional understanding of the world.

Since mathematics is used in science, technology and day-to-day life as an ancillary science and a means of understanding, there is also a need to learn more in mathematics and mathematics related subjects like ICT for occupational, educational or personal reasons. Hence there are private or social and formal or informal situations, far away from obligatory school, where the learning of mathematics is the focal point. Other persons with advanced mathematical competencies, though not mathematics teachers, are expected to give support in situations where the learning of mathematics is at stake – e.g. parents are expected to give support to their children, peers to peers, colleagues to colleagues, partners to partners. Thus there are teaching or support situations as a complement to the learning situations.

Among the various situations of communication in which mathematics is or could be used are the following:

Personal situations: situations within Informal social settings: family, peers, friends

discussing, posing and solving problems by means of mathematics

- that are close to the informal social setting: e.g. talking about mobile contracts and taking a decision between two offers.
- that are further away from the informal social setting: e.g. discussing a newspaper article about competing financial strategies proposed by political parties
- ...

trying to understand and to explain a development, a functional connection, a geometric arrangement etc.

- which are close to the informal social setting: e.g. sketching the floor plan for arranging a flat.
- which are further away from the informal social setting: using mathematical operations in order to reconstruct the possible meaning of a newspaper article where absolute and relative numerical data are mixed.
- ...

learning, teaching, explaining, exercising mathematics

- where the subject is close to the informal social setting: e.g. learning how to change a recipe for a cake.
- where the subject is further away from the informal social setting: e.g. parents helping their children to understand a mathematical problem, notion, operation
- ...

Occupational situations: situations within formal social settings: colleagues, superiors, customers,

solving problems in a team by means of mathematics

- that are close to / further away from the occupational sphere: e.g. building or constructing a house, an engine, a machine; making a budget plan
- ...

trying to understand and to explain a development, a functional connection, a geometric arrangement etc.

- which are close to / further away from the occupational sphere: e.g. interpreting a development or a state of affairs based on a statistical data analysis
- ...

learning, teaching, explaining, exercising mathematics

- where the subject is close to/ further away from the occupational sphere: e.g. attending an upgrade training course, where mathematical methods are prominent.
- ...

Public situations: situations within formal social settings: offices, business partners, customers

discussing, posing and solving problems by means of mathematics

- that are close to / further away from the formal social setting: e.g. creating a business plan
- ...

trying to understand and to explain a development, a functional connection, a geometric arrangement etc.

- which are close to / further away from the formal social setting: e.g. comparing different offers
- ...

learning, teaching, explaining, exercising mathematics

- where the subject is close to / further away from the formal social setting: e.g. explaining a calculation / a special algorithm in financial mathematics to a customer
- ...

Scientific situations: situations within formal social settings: mathematicians, other scientists, mathematics educators,

discussing, posing and solving problems by using mathematics

- in pure or applied mathematics,
- in other sciences e.g. physics,
- in technology e.g. ICT, engineering
- ...

trying to understand and to explain a development, a functional connection, a geometric arrangement etc.

- e.g. explaining the differences in educational systems by means of probabilistic test theory
- ...

learning, teaching, explaining, exercising mathematics

- e.g. attending a scientific congress in the field of mathematics
- ...

Corresponding to these distinctions of social situations where mathematics plays a role, one can easily construct an inventory of private situations, which are in spite of their privacy determined by the registers of the different domains (personal, educational / occupational, public, scientific, ...)

The situations mentioned involve different forms of communication: oral, written and audiovisual reception, oral and written interaction, oral and written production. The list may be supplemented and used as a guide to the identification of language skills forming part of mathematics syllabi. The social activities

involving mathematical knowledge and competencies can be described in terms of discourse types and linguistic capacities.

Like in other school subjects, goals and types of discourse have been developed in the history of mathematics education which are situated more specifically in education and classroom contexts. These are dealt with in part 3. These educational goals and practices form a dynamic body in the history of institutional learning. Also, their link to situations outside the classroom varies and changes over time.

2.3. From social situations to types of discourse

For situations of mathematics communication it is possible to develop descriptors based on an analysis of the characteristics of the types of discourse employed in those situations. One example is analysed in more detail. First the cognitive skills underlying the discourse are spelt out, followed by the linguistic and semiotic skills which cover the language-driven activities. The example concerns the social situation, in which mathematics is used as a contribution to solve a real-world problem. The description of activities in “mathematical processes” is taken from the preprint version of the PISA 2012 framework (OECD 2010 p. 14ff.)

The mathematics-related cognitive skills include the ability to ...

- formulate situations mathematically⁵²:
 - Identifying the mathematical aspects of a problem situated in a real-world context and identifying the significant variables
 - Recognising mathematical structure (including regularities, relationships, and patterns) in problems or situations
 - Simplifying a situation or problem in order to make it amenable to mathematical analysis
 - Identifying constraints and assumptions behind any mathematical modelling and simplifications gleaned from the context
 - Representing a situation mathematically, using appropriate variables, symbols, diagrams, and standard models
 - Representing a problem in a different way, including organising it according to mathematical concepts and making appropriate assumptions
 - Understanding and explaining the relationships between the context-specific language of a problem and the symbolic and formal language needed to represent it mathematically
 - Translating a problem into mathematical language or a representation, i.e., to a standard mathematical model
 - Recognising aspects of a problem that correspond with known problems or mathematical concepts, facts, or procedures
 - Using technology (such as a spreadsheet or the list facility on a graphing calculator) to portray a mathematical relationship inherent in a contextualised problem
 - ...
- employ mathematical concepts, facts, procedures, and reasoning⁵³
 - Devising and implementing strategies for finding mathematical solutions
 - Using mathematical tools, including technology, to help find or approximate solutions
 - Applying mathematical facts, rules, algorithms, and structures when finding solutions
 - Manipulating numbers, graphical and statistical data and information, algebraic expressions and equations, and geometric representations
 - Making mathematical diagrams, graphs, and constructions and extracting mathematical information from them
 - Using and switching between different representations in the process of finding solutions

⁵² cf. OECD 2010 p. 14f.

⁵³ cf. OECD 2010 p.16

- Making generalisations based on the results of applying mathematical procedures to find solutions
 - Reflecting on mathematical arguments and explaining and justifying mathematical results
 - ...
- interpret, apply and evaluate mathematical outcomes⁵⁴
- Interpreting a mathematical result back into the real-world context
 - Evaluating the reasonableness of a mathematical solution in the context of a real-world problem
 - Understanding how the real world impacts the outcomes and calculations of a mathematical procedure or model in order to make contextual judgments about how the results should be adjusted or applied
 - Explaining why a mathematical result or conclusion does, or does not, make sense given the context of a problem
 - Understanding the extent and limits of mathematical concepts and mathematical solutions
 - Critiquing and identifying the limits of the model used to solve a problem
 - ...

The activities described above concern private as well as social situations of problem solving. In the first case “thinking aloud” would exhibit the close connection between cognitive and linguistic activities (cf. Section 5). In the second case communicative activities accrue for which B1-B2 competencies described under the “heading goal-oriented cooperation” in the CEFR (CEFR, p. 79) are relevant, if they are reformulated as plurilingual competencies.

Linguistic and communicative skills include the following abilities ...

- Can understand detailed instructions reliably. B2
- Can help along the progress of the work by inviting others to join in, say what they think, etc. B2
- Can outline an issue or a problem clearly, speculating about causes or consequences, and weighing advantages and disadvantages of different approaches. B2
- Can follow what is said, though he/she may occasionally have to ask for repetition or clarification if the other people’s talk is rapid or extended. B1
- Can explain why something is a problem, discuss what to do next, compare and contrast alternatives. B1
- Can give brief comments on the views of others. B1
- Can generally follow what is said and, when necessary, can repeat back part of what someone has said to confirm mutual understanding. B1
- Can make his/her opinions and reactions understood as regards possible solutions or the question of what to do next, giving brief reasons and explanations.
- Can invite others to give their views on how to proceed.
- ...

3. Mathematical competencies (inventory and description of some basic /the expected mathematical knowledge structures)

The values, the rights and duties and the objectives related to mathematics education have been exposed in the first section, and the private and social situations where mathematics plays a role have been expounded on in the second section. The mathematical competencies, abilities, skills, etc. that are valued as important for the personal welfare of the individual and for the public welfare of society are systematically organised into competency models, which describe the relevant dimensions of

⁵⁴ cf. OECD 2010 p.17

mathematical competence and their relations to each other, among others: areas (contents), aspects (processes), levels, the developmental trajectories of competencies etc.

3.1. An example of a mathematical competency model

The mathematical competency models used as a basis for National educational standards in European countries differ in terminology and also in their conception due to historical, political and organisational reasons. The categorisation used in the following text is taken from the mathematical competency model of the Swiss National educational standards.

Content dimension:

- Number & Variable
- Shape & Space
- Functions & Relations
- Size & Measurement
- Data Analysis & Probability
- ...

Process dimension:

- Knowing, Recognising & Describing
- Operating & Calculating
- Using Instruments & Tools
- Presenting & communicating
- Mathematising & Modelling
- Arguing & Justifying
- Interpreting & Reflecting on Results
- Experimenting & Exploring
- ...

Combining the two dimensions one arrives at a grid with 40 cells each containing a description of one or more competencies. On a more abstract level it is sufficient to cluster the competences belonging to the same process dimension:

Among the mathematical competencies that are valued as important for each child at the end of obligatory school are the following:

Knowing, Recognising & Describing

- understanding, using and explaining technical terms
- relating technical terms to mathematical objects, properties and relations and vice versa
- identifying forms and pattern
- naming and describing mathematical rules and laws in their own language
- capturing mathematical states of affairs and describing them
- ...

Operating & Calculating

- Carrying out calculations, transformations and constructions in written "standard form", with notes or orally, with or without (technical) instruments
- ...

Using Instruments & Tools

- Using electronic instruments (calculator, Computer), works of reference, construction instruments (compass, set square)
- ...

Presenting & communicating

- Understanding calculations, transformations, constructions, argumentations of other students
- Presenting own calculations, transformations, constructions, argumentations in a way that is comprehensible and traceable by others and appropriate with respect to the mathematical object
- ...

Mathematising & Modelling

- Describing, interpreting and modulating (problem) situations (of daily life) in order to solve them by mathematical means
- ...

Arguing & Justifying

- Forming assertions and giving reasons for them
- Making thoughts and ways of calculating transparent and justifying them
- Giving illustrative explanations for mathematical phenomena and laws
- understanding and reproducing proofs and counterexamples
- ...

Interpreting & Reflecting on Results

- Checking results for truth and for adequacy with the original problem
- Reflecting whether a result or an approach can be used for future problem solving
- ...

Experimenting & Exploring

- Exploring mathematical situations and searching for mathematical laws
- Expressing conjectures and trying to support or falsify them by thought experiments
- ...

3.2. Linguistic and communicative competences as components of mathematical competence at different stages.

The educational values targeted by mathematics teaching practices can only be realised if linguistic and communicative competence is also targeted at the same time, since

Linguistic and communicative competencies are preconditions for learning:

- Students can only successfully participate in learning mathematics if they have the linguistic prerequisites to understand questions, problems, argumentations, etc. and are able to give answers, to interact with others, etc.

Linguistic and communicative competencies are constitutive parts of educational standards in mathematics:

- Students can only reach the educational standards in mathematics at the end of compulsory school if they are able to name, describe, define, explain, argue etc.

Linguistic and communicative competencies are preconditions for making experiences, for mathematical literacy, for key competences:

- All these presuppose a certain degree of reflection, which can only be realised on a higher level of language competence

4. In-school communication situations relating to mathematics teaching and learning

We now have to switch the focus from communication in society and from the objectives defined in terms of mathematical knowledge and procedural competence to the *types of teaching and learning in school*.

The latter have to be informed by the former: the forms of communication that are used in mathematics education must be linked to those present outside school. Yet, school-based education also follows its own rules and conventions.

In general, we can distinguish between several different phases or types of learning activities in the classroom, and this is also true for mathematical education. Each of them involves different cognitive-linguistic demands and challenges.

4.1. Checklist of classroom activities in mathematics education (for subject teaching / learning in general)

The forms of teaching and learning mathematics vary according to educational traditions and the methodological choices made in the syllabi or by individual teachers, all of which structure the processes of teaching and learning. Most of the forms used in mathematics classrooms are also used in other subjects such as history, science or literature⁵⁵, but there are also others that are more peculiar for mathematics - especially a combination of oral and written interaction “OWI” using mathematical symbols, sketches, grids etc. – cf. CEFR (Council of Europe 2001, p. 82 4.4.3.3 and p. 90 4.4.5.3). Among the different forms of teaching and learning mathematics are:

Presentation by the teacher (teacher-learner interaction as monologic instruction) using visual aids (maps, diagrams, data tables, graphs, computer animations, applets dynamic geometry software etc.) (AuR, WR and WP note-taking)	teacher-learner interaction as monologic instruction / frontal education
Teacher-learner interaction as dialogic instruction (OI)	teacher-learner interaction as dialogic instruction / pedagogical dialogue / IRE model ⁵⁶
Learners presenting the results of their homework using visual aids (OWP), comparing the results (AuR, WR), asking and answering questions using visual aids (OWI)	learner-learner interaction as monologic instruction / presentations by students
Learners explaining a mathematical conception, an assertion, a rule, a procedure, a proof etc. to others (OWI)	learner-learner interaction as dialogic instruction / instruction by peers
Learners read the textbook (WR) and solve problems (WP) or work individually within a learning environment (WR) and (WP)	Individual work (problem solving)
Learners working on mathematical exercises individually (WP)	Individual work (practising)
Learners exploring individually a mathematical state of affairs or testing conjectures systematically (WR, WP)	Individual work (exploring)
Gathering information (WR and WP: note-taking);	Individual work (gathering information)
Activities run as projects (linking different competences) of individual research; e.g. inventing new mathematical problems (WP) departing from solved problems (WR)	Individual work (working on an individual project / creative work)
Learners writing a study diary (WP)	Individual work (metacognition)
Learners interact with fellow pupils in group work (WR, WP, OI, OWI) solving a problem or working together with a learning environment	Group work (problem solving)

⁵⁵ Cf. Beacco, Coste, van de Ven, Vollmer (2010, p. 12-14). The Coding of communication activities is based on the CEFR: R = reception; P = production; I = interaction; M = mediation; O = oral; W = written.

⁵⁶ The IRE model (Initiation by the teacher – Response by the learners – Evaluation by the teacher) was presented by Sinclair & Coulthard (1975).

Learners exploring individually a mathematical state of affairs or testing conjectures systematically (OWI , WP)	Group work (exploring)
Searching information: planning the search (OI), gathering information (WR and WP; note-taking); sharing the results (OWI)	Group work (planning the search for information), individual work (gathering information)
Presentations of the results of group work by learners (OP) based on notes, using PowerPoint (O&WP), Blackboard (O&WP), etc.; answering questions (OWI)	Group work (preparing a presentation), individual work (presenting)
Activities run as projects (linking different competences) as group research (OWI, O&WP);	Group work (working on a common project)
Teamwork: Developing new mathematical problems (OI, WP);	Group work (creative work)
Controlling and reflecting results (WR, OI)	Group work (reflective work)
[...]	

All of these forms of activities which can be found in mathematics classrooms – though perhaps some of them are more common than others - have been established as instruments to support the development of mathematical competence. The indicated type of communicative language activities is to be understood as part of the mathematical competence that has to be developed. In this sense classroom activities can be understood as an anticipation of real life activities in the future that can be tried out without severe consequences, if they go wrong. On the other hand a certain degree of linguistic and communicative competence is a prerequisite for the participation in these activities and thus for learning - just in the same sense as a certain degree of mathematical content knowledge and competence is a prerequisite for successful learning in mathematics. Students can only successfully participate in such learning situations if they get the necessary scaffolding comprising mathematical content, as well as linguistic and communicative knowledge and competencies.

4.2. From classroom situations to discursive forms

These types of mathematics teaching and learning activities can be described in terms of linguistic capacities and types of discourse and it is possible to develop descriptors from the characteristics of the discursive style used in those situations.

Example: Giving a (prepared) presentation to the class using auxiliary means (data projector, blackboard, flipchart, overhead projector, etc.) to visualise a mathematical derivation, construction, procedure, calculation etc.

Presentations using auxiliary means for visualising a line of thought are typical for mathematics. They constitute a type of discourse that relates to oral production (see CEFR, 4.4.1.1.: addressing audiences) based on notes, slides or a whole manuscript in written form, but also to written interaction (see CEFR, 4.4.3.2 and 4.4.3.2). This involves among others the ability to:

- State a plan, a scheme of presentation;
- “Give clear, systematically developed descriptions and presentations, with appropriate highlighting of significant points and relevant supporting detail.” (Overall OP: descriptor B2 in the CEFR, p. 58);
- “Give clear, systematically developed descriptions and presentations on a wide range of subjects related to his/her field of interest, expanding and supporting ideas with subsidiary points and relevant examples.” (Overall OP: descriptor B2 in the CEFR, p. 58);
- Emphasise the stages of the presentation as it unfolds;
- Present and organise the linguistic commentary of tabulated data, a diagram, etc.;
- “Convey information and ideas on abstract as well as concrete topics, check information and ask about or explain problems with reasonable precision.” (Overall WI: descriptor B1 in the CEFR, p. 83);
- Make the presentation attractive: manage voice and intonation;

- React with restraint to objections or criticism from class or teacher;
- “Can depart spontaneously from a prepared text and follow up interesting points raised by members of the audience (...).” (Addressing audiences OP: descriptor B2 in the CEFR, p. 58)
- Answer questions concerning the findings and/or the procedures applied afterwards;
- Assess one’s own performance (without or with the help of others);
- [...]

It will be noticed that in the example presented above descriptors of the CEFR, devised for foreign languages, can be used or easily adapted for the description of discourse types in mathematics classrooms, but of course not all of the descriptors are relevant. Likewise, the level C1 and C2 descriptors can sometimes furnish material for descriptions but probably cannot be adopted on the whole.

Plurilingual education presupposes linkage of the classroom modes of communication to the social ones involving science, so as to make transfers of proficiencies between them. At least some of the classroom modes of communication should enable learners to handle social situations of communication with mathematical content:

- *either directly through the classroom use of these social forms*
- *or indirectly, with the same proficiencies as those inherent in the social forms being developed through the classroom forms.*

5. Specific linguistic and semiotic competences needed for mathematics education

So far we have identified and exemplified

- social situations and contexts where mathematics plays a role (2.1. checklist)
- the communicational aspects of such situations and contexts (2.2.)
- an example (problem solving according to PISA 2010) of the corresponding types of discourse (2.3 checklist)
- an example of a mathematical competency model (3.1. checklist)
- linguistic and communicative competences as components of mathematical competences at different stages (3.2. checklist)
- Classroom activities in mathematics education (4.1. checklist)
- the corresponding types of discourse in mathematics lessons in school (example in 4.2.).

Based on these different steps (and their underlying principles) it is now possible to single out and generalise specific linguistic competences suited for mathematics teaching and learning, aimed at imparting knowledge and expertise as well as instilling social communication skills. As already demonstrated, for learners these cannot be restricted to command of specialised terminology or the ability to piece together elements of mathematical knowledge, even where these may be clear and logically derived from data. The necessary linguistic competences involved in mathematics education also involve complex thinking and discourse skills and ways of relating the two via lexical, grammatical and textual choices.

To describe these linguistic and communicative competences in more general terms, we shall adopt a subject-based model of *capability* and *communication*, arranged in four sets of components, the first three of which form what is strictly speaking linguistic communication competence:

- strategic component/competence (see 5.1.)
- discursive component/competence, mastering types of discourse) (5.2.)
- formal component/competence (5.3)
- interdisciplinary/cross-curricular competences, not peculiar to mathematics teaching: these will have to be dealt with in another module.

5.1. Strategic competence⁵⁷

General communicative ability includes a psycho-cognitive component termed *strategic* that controls observable linguistic behaviour in order to generate, produce and understand texts. “Strategies are a means the language user exploits to mobilise and balance his or her resources, to activate skills and procedures, in order to fulfil the demands of communication in context and successfully complete the task in question in the most comprehensive or most economical way feasible depending on his or her precise purpose.” (CEFR, p. 57).

In the CEFR the strategies are situated at the same level as communicative activities (as oral/written interaction [OI/WI], oral/written production [OP/WP] and aural/written reception [AuR/WR]). This level of specification allows teachable actions to be defined in terms of planning, execution, evaluation and repair⁵⁸, which seem independent of the languages and discourses used. We shall proceed from these specifications to describe the communication proficiencies needed to teach/learn mathematics.

Oral and written production⁵⁹

	General activities	Activities in the school setting of mathematics teaching and learning
Planning	Locating resources Preparation and/or rehearsal Consideration of the recipient and audience Adaptation of message	Identifying the relevant information sources Producing successive tentative versions of the text to be produced. Verifying its length (if WP). Taking account of the audience’s receptive capabilities, level of knowledge and status, etc., Transposing, paraphrasing, summarising, mentioning, quoting and commenting on source texts
Execution	Building on prior knowledge Trial (experimentation)	Reliance on existing texts of the same kind as the one contemplated Making successive provisional versions of the text to be produced.
Evaluation	Checking of results	Testing through listeners’ reactions (if OP) the intelligibility to an outsider not directly addressed (if WP)
Repair	self-correction	Improving self-correction through an external evaluation

Aural and written reception⁶⁰

	General activities	Activities in the school setting of mathematics teaching and learning
Planning	Framing (selecting mental set, activating schemata, setting up expectations)	Identifying type of discourse and its potential contents
Execution	Identifying cues and making inferences	Working out the meaning of technical terms or mathematical deductions from language knowledge and knowledge in

⁵⁷ This paragraph is taken with minor adaptations from Beacco (2011) and Vollmer (2011).

⁵⁸ CEFR, 4.4.1.3. for OP/WP, 4.4.2.4. for OR/WR and 4.4.3.3. for OI/WI.

⁵⁹ According to the CEFR, p. 53.

⁶⁰ According to the CEFR, p. 65.

		mathematics
Evaluation	Hypothesis testing: matching cues to schemata	Matching up the interpretative hypotheses and developing critical sense
Repair	Revising hypotheses if required	Reconsidering one's position about a theory, explanation, validity of data and their interpretation

It is obvious that the specifications of the CEFR relate more to reading as comprehension than as interpretation or critical response. For languages of instruction, the comprehension strategies need to be re-interpreted as a function of the knowledge in the discipline (in this case, critical comprehension).

Spoken and written interaction

	General activities	Activities in the school setting of mathematics teaching and learning
Planning	Framing the issue (establishing a line of approach) Judging what can be presupposed Planning moves	No relevant descriptors in the CEFR, since the interactions between teacher and learner or among learners occur in the language of schooling. But it is necessary to understand what is expected of the classroom interactions whose aim is to provide insight into the knowledge presented and which are not ordinary social interactions. It is thus important to know their implications for imparting knowledge.
Execution	Taking the floor Co-operating (interpersonal) Dealing with the unexpected Asking for help	These specifications are altogether relevant in the context of debates, discussions and arguments staged in class about mathematical questions
Evaluation	Monitoring (schema, praxeogram) Monitoring (effect, success)	No particular specificity to the mathematics-related verbal styles in or out of class
Repair	Asking for clarification Giving clarification Communication repair	Relevant as regards terminology, foreign borrowings, knowledge and patterns of scientific reasoning and explanation...

These descriptors of strategies, as may be seen, need specifying if possible, as far as types of communication with “mathematical” content are concerned. This reference grid should therefore be considered provisional. From a pedagogical standpoint, the descriptors of planning, which relate to the learners’ preparation of the statements (oral or written) should no doubt be more developed than those concerning monitoring or correction (except in the case of OP or WP).

These strategic abilities are valid for all subjects taught, so a comparison with the terms in which they are specified for history, science or art (e.g.) is called for.

5.2. Discursive competence

The concept *type of discourse* (or *discursive form*) has been used to denote the forms taken by communication as practiced in a given social situation and communication community. The types of discourse are specific discursive forms identified as such by a standard name and certain characteristics (physical location, type of participants, medium, etc.) of the situations where they occur: lecture, news item, observation, dispute, myth or prayer, etc.

The texts that pertain to a given type tend to follow the conventions typifying these discourses; the conventions concern not only contents but also the structure and/or verbal forms of realisation/productions. A text is more or less consistent with the discursive form whose specific outcome

it is. The types of discourse themselves are more or less strained and formalised (lecture *versus* casual conversation).

The concept of discourse type is less abstract than that of textual type (narrative, descriptive, imperative, expository, persuasive, etc.). Typologies of this kind have never really been adequate for describing classes of texts since it is readily acknowledged that *most actual texts correspond simultaneously to several types*. This typology may nevertheless be used to denote the style (or discursive regime) adopted by certain segments of texts: for example, in the “film/book/record/review” discourse type in written media, there is often a segment at the beginning which has a descriptive or narrative tone (film); the texts then continue with a segment with an evaluative purpose, before summarising and highlighting the main points.

One aim of plurilingual and intercultural education, hence of languages in teaching/learning, is to broaden learners’ discourse repertoires (in some/all of the languages of their language repertoires) in relation to their initial experience/proficiency in types of discourse and to give them the opportunity for new experiences (through texts and documents including non-verbal forms of representation) of the diversity of disciplines, academic cultures and of otherness.

As in every other subject, mathematics syllabi may be specified according to discourse type:

- types seen as already entering into the learners’ repertoires (textbooks; learning environments; internet sites offered for students by students, teachers or institutions; social networks, wikis, internet groups; scientific documentaries; illustrations and animations of (abstract) relationships and functions, info brochures; discursive forms in other subjects, in which mathematical procedures or ways of presentation are used; mathematical games, puzzles, riddles, etc.)
- types present in the learners’ social environment (periodicals: general-interest press, science-based journals; websites, applets, dynamic geometry software, computer algebra systems, instruction manuals where mathematics is used; expert debates, moderated public and/or political discussions, etc.)
- types to which a certain form of exposure is sought by mathematics teaching.

For the purpose of choosing the types of discourse with which learners are to be familiarised, attention needs to be paid first to the academic status of statements of “facts” and of popularised reports concerning science and mathematics. These are very diverse in nature because of the role assigned to them in diverse texts in the public domain, which have some connection with mathematics and the natural sciences. For example, with respect to written scientific reports, it may be deemed important for learners to be brought into contact with:

- academic/disciplinary discourse types written by specialists for specialists (articles, communications, monographs, theses and the like) in mathematics or other sciences and disciplines where mathematics plays a role;
- types produced by specialists, presenting new knowledge meant for and made accessible to the (“educated”) general public;
- types used in popularisation in book form or as TV features by professional scientists, knowledgeable amateurs and authors specialised in scientific dissemination;
- journalistic discourse types of the press specialising in issues of mathematics and natural sciences;
- journalistic discourse types of the ordinary daily press relating to scientific and mathematical questions, procedures and debates (reviews of published books, accounts of “discoveries”, interviews with mathematicians, scientists, with interested laymen, etc.);
- educational discourse in the form of textbooks in mathematics or other subjects where mathematics is used, other summaries for school learners, multi-media presentations on film or video;
- educational discourse in the form of popularised mathematics textbooks, auxiliary learning material and games;
- the encyclopaedic discourses of formularies, dictionaries, encyclopaedias, Wikipedia / the internet in general, etc.;

- the direct testimonies recorded for example in autobiographies, recollections and personal diaries, statements of representatives of interest groups, etc.;
- fictional or “literary” works of a scientific or mathematical nature: novels, films, TV series, etc.;

The choice of the discourse types which it is considered learners should experience and partly even produce (either by way of simulation or by way of (local) participation), depends on the general choices already described above (values, social situations of communication, mathematical and scientific knowledge, status of knowing, controversies involved, etc.) but may be fine-tuned in the light of descriptors relating to:

- the nature of the instructional / learning activities, which are to draw upon these texts (WR, OI...)
- the expected degree of competence or proficiency for each (see sections 3 and 4)
- the proximity or familiarity of the types compared to those already experienced by the learners
- the interest (or motivation), which these discourse types may arouse
- the necessity of dealing with certain discourse types due to their importance and impact outside school.

Characteristics peculiar to the discourse types may also be used as a basis for decision-making on the following levels:

- length of the texts pertaining to them
- predictability (as to layout, form of paragraphs and phraseology)
- complexity (number of items linked, nominalisations, hypertactic constructions)
- use of explicit headings and subheadings, summaries, etc.
- use of graphics, illustrations, maps, diagrams, etc.

These inventories lend themselves as a basis for decision-making about the discourse types suitable for mathematics education in school and as a checklist for evaluating the traditional materials and discourse types used so far in different parts of Europe. The inventories are helpful and appropriate to guide choices in planning curricula and compiling teaching programmes, which may differ, yet which are based on similar categorisations of discursive forms.

5.3. Formal competence

In addition to lexical/terminological and discursive competences a more formal competence of handling the macro and micro structures of the discourse types plays a decisive role: this involves the capability of linguistic expression of cognitive processes underlying the analysis (comprehension) and the construction (production) of concrete discursive forms (or texts).

5.3.1. Pragmatic and cognitive categories

The conventions of form recurring in types of discourse (i.e. the linguistic and structural deliveries of the texts) may thus be described by means of categories unconnected with the syntax of the sentence.

These may be categories like speech acts/language functions or, on a higher, more abstract level, *discourse functions*. These analytical categories applied to texts (and also or alternatively to the *cognitive processes*) are to be understood as the discursive representation of both the cognitive processes and their linguistic realisation (in the sense of enactment) brought into play for the development/exposition of knowledge.

These discourse functions mark cognitive operations *and* their verbal performance at the same time; they are at the interface between cognition and verbalisation, they include operators (or terms) such as⁶¹:

⁶¹ See the extended list in Vollmer et al. 2008 which was arrived from the analysis of modern science curricula (and other subjects) for grade level 9/10 in Germany. See also the set of Macro-functions derived from this analysis (Vollmer 2009, updated Vollmer 2011).

<i>analyse</i>	<i>define</i>	<i>correlate/contrast/match</i>
<i>argue</i>	<i>distinguish</i>	<i>name</i>
<i>assess</i>	<i>enumerate</i>	<i>outline/sketch</i>
<i>calculate</i>	<i>explain</i>	<i>prove</i>
<i>classify</i>	<i>illustrate/exemplify</i>	<i>recount</i>
<i>compare</i>	<i>infer</i>	<i>report (on) a discourse</i>
<i>describe/represent</i>	<i>interpret</i>	<i>summarise</i>
<i>deduce</i>	<i>judge/evaluate/assess</i>	<i>specify [...]</i>

Among these many discourse functions, there are some which are more basic or comprehensive and relatively distinct from one another in terms of cognitive operations and discursive forms involved (they might be called *macro functions*), while others may appear under several macro functions and serve a number of them, not just one (these might be called meso and micro functions – for our purposes we just refer to them as *micro functions*).

Among the macro functions, there are at least the following ones:

1. Exploring/processing/documenting
2. Naming/defining
3. Describing
4. Reporting
5. Explaining
6. Evaluating
7. Arguing
8. Exchanging / negotiating
9. Narrating
10. Creating
11. Reflecting (e.g. about learning paths + results)
12. Acting (symbolically or by way of simulation)

Each macro function is served by a great number of micro functions. Among the many micro functions, we could list the following ones:

Asking questions	Labelling	Presenting	Hypothesizing
Questioning	Collecting	Sequencing	Predicting
Guessing	Selecting	Relating	...
Identifying	Reporting	Structuring	
Classifying	Summarizing	Contrasting	

These micro functions operate on a lower level than the macro discourse functions, but they also describe and specify both cognitive *and* verbal activities at the same time.

As to mathematics education, to describe academic discourse in this subject area all of the macro functions mentioned above would play an important role, whereas a specific subgroup of cognitive/discursive operations/processes on the micro level would be prominent in this context such as:

- *reporting / recounting* (on a solution of a problem, an exploration)
- *classifying* (mathematical objects, properties, relations, procedures)
- *defining / determining* (a mathematical term, a mathematical state of affairs)
- *representing* (mathematical objects, relations or data)
- *interpreting* (a mathematical state of affairs, the results of a calculation)
- *matching and/or contrasting* (problem situation and the solution found)

- *deducing* (conclusions from data)
- *justifying* (steps in a solution, the chosen approach / procedures, decisions)
- *embedding* (an observation / a finding into a larger structure)
- *reflecting or weighing* (learning paths, arguments for and against a decision)
- [...]

For each of these operations it is possible to identify the linguistic resources needed for their enactment, with likely variation between discourse types. It may be assumed that the above “words” (verbs, verbal operators) referring to cognitive operations have equivalents in all languages and that an attempt could be made to compile transposable inventories (for different languages and different subjects).

To compile such inventories of forms required to express the cognitive-discursive operations occurring in given types of discourse, one ought to use again the *Descriptions of language-specific reference levels in the CEFR*⁶²

5.3.2. Linguistic categories for the description of discourse types

Discourse types can be described by using speech acts and/or cognitive operations or, as suggested here, by using *discourse functions* which link cognition and verbalisation, since a specific discursive form is a verbal object, yet governed by cognition underlying it. Discourse functions (on the macro as well as on the micro level) are distinct from utterance, text, speech act, type of text, etc.; their verbal conventions may be apprehended

- as relatively stable types of utterances, in the case of highly restrictive types, set phrases, etc.
- as the relatively stable or predictable general scheme or elements of their structure, which may be broken down into stabilised successions of speech acts or cognitive operations (for example, the series: represent, interpret, match...)
- as the preferential forms, in a given type, with which to deliver them. This conformity determines the appropriateness of the utterances (and not their accuracy or grammatical correctness), that is their compliance with common “rules” on the acceptable makeup of discourse types.

These conventions may be described on the basis of various general linguistic categories (= independent of individual languages), such as:

- forms of actualisation of the speaker (for example, in English: I/me, we, one, impersonal, passive, reflexive, etc.);
- forms of actualisation of the person addressed;
- presence/distribution and expected forms (in a given type) of assertive, appreciative, ethical and other formulations;
- presence/absence/distribution and forms of meta-discursive indications (statement of text plan, relating to known rules, assumption of prior knowledge, etc.);
- standard form of certain paragraphs;
- discursive tone (serious, humorous, personal touches, etc.).
- [...]

All descriptive categories used when analysing a discourse may serve as a starting-point for descriptors of formal mastery, especially with respect to reception or production. Nonetheless it has to be taken into account that:

- *texts of the same discourse type comply to varying degrees with the (often unstated) model underlying it;*
- *discourse types themselves may be conventional to varying degrees either as a whole or in some of their constituent parts (for example, the beginnings of scientific articles may be quite conventional/predictable while those of newspaper articles are fairly unpredictable).*

⁶² Available, or being produced, for English, German, Spanish, French, Greek, Portuguese...

This specification of forms should be underpinned by the expected language skills in other subjects taught and in language as a subject.

5.3.3. *Executing discursive competence: two examples*

First example: to state a plan (in OP) – with descriptors such as:

The learner is able to produce (W or O) a statement of plan appropriate to the types under consideration (here, presentation to the class), by activating some of the following linguistic resources:

[Highlight the structure of the forthcoming discourse]

[statement of the general schema]

- I am about to speak of/examine/deal with the question/the issue of...
- I shall talk about...
- My topic is...

[each point introduced by means of cohesive devices]

- first of all, first, to begin with, etc.
- next, then, as the second point
- the following point
- ...
- a final aspect is..., etc.

[announcement of the end]

- lastly, to conclude, to finish, in conclusion

Second example: reporting about a mathematical exploration/experiment (W) – with descriptors such as:

The learner is able to describe (W)

- the aims of the exploration/experiment,
- the means chosen,
- the observations made
- the results obtained and
- what could be expected as a generalisation

by activating some of the following linguistic resources:

[Highlight the structure of the forthcoming discourse: Introduction]

- In the following, I will write/report about...
- The report is about...
- My topic is about...

[statement of the general goal of the mathematical exploration/experiment]

- The purpose of the exploration/experiment was... to find out whether/in how far/...how much...
- The exploration/experiment was to examine/to deal with the question/the issues) of...
- In the exploration/experiment I looked at...
- We were asked to explore... /observe... /find out...

[name necessary subtopics like: choosing the appropriate means, carrying out the exploration / performing the experiment, observing and documenting regularities and irregularities; each point introduced by means of paragraphs with cohesive devices]

- first of all, first, to begin with, etc. was set up...
- next, then... sth. was started/initiated...

- the next step was
- An observation sheet had been prepared for...
- It could be observed that...

[announcement of the results of the exploration/experiment, possible conjectures, the necessity of proving and/or of the end (of the report)]

- As a result (we can say/we have...)/ It showed that.../
- The exploration/experiment showed that...
- As to the goal of the exploration/experiment, ...
- As a possible generalisation it could be expected that ..., but ... / A possible conjecture could be ...
- Could we prove that ... / It seems to be certain, that ..., but can we prove it?
- Finally,..., etc.
- To conclude, to finish, in conclusion...

Inventories of this type may be common to different languages and to different disciplines in some respects, but they necessarily comprise language-specific realisations owing to their morphological and syntactic structures and the diversity of discursive forms in the classrooms, in a country, in a discipline.

6. Summary and Perspectives: Thresholds and stages of development

Users are invited to determine from the categories set out above which thresholds of knowledge and language skills (concerning mathematics-related discourse types) the learners should possess, according to:

- expected proficiencies (OI, OP...)
- types of discourse to be mastered (for reception or production)
- cognitive operations or discourse functions which they must be able to recognise or deliver
- forms for delivering the above, which they must know how to handle correctly and suitably.

Empirical analyses of correct applications of these forms in productions (examination papers, for example) by learners who have taken courses of this kind or in other types of discourse to which they are exposed (textbook) should make it possible to estimate whether the results are actually achieved, hence to judge realistically whether they are within the learners' grasp.

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SCIENCES

*Items for a description of linguistic competence in the language of schooling necessary for learning/teaching sciences
(at the end of compulsory education)*

An approach with reference points

Helmut Johannes Vollmer

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Items for a description of linguistic competence in the language of schooling necessary for teaching and learning science (at the end of compulsory education) - An approach with reference points

This text presents a procedure to help in creating a curriculum for the teaching of science (biology, chemistry and physics) which explicitly takes into account the discursive and linguistic dimensions of this subject area. It proceeds through successive stages, for which there are corresponding inventories of references, from the level of educational goals in the teaching of science to the identification of linguistic elements which it is particularly important to systematise in the classroom in order to manage the corresponding forms of discourse.

Introduction

In recent years there has been an increasing awareness of the role of language competences for science education in school as a prerequisite for learners to benefit fully from the curriculum and to participate in situations with a science dimension outside of school. Learning science does not only involve new concepts, explanations and arguments, but also new ways of making meaning and of interacting with others using these concepts, explanations and arguments. Learning science thus involves a new way of perceiving, analysing and communicating.

Science has developed specific types of discourse (genres) suited for specific purposes. While textbooks largely contain *consensual* science (providing an overview of certain topics), the experimental report usually presents a new claim backed up by empirical evidence. Scientific texts might include facts, hypotheses, claims, evidence, arguments, conclusions etc. In order to interpret a scientific text in adequate terms, the reader needs to be able to identify a hypothesis as a hypothesis, facts as facts, evidence as evidence etc. This interpretation is guided by awareness of the author's intention and the purpose of the text, awareness of the audience for which it is/was written and the conventions at work in the discourse community. All of these aspects influence the types of discourse under consideration, and how they are produced and understood.

It should be stressed from the beginning, however, that science education in school has developed forms of discourse of its own, for speaking and writing and especially for classroom interaction, which relate to the social situations outside school, but which are not identical with them. The discursive forms which are school-based are only valid within the confines of that institutional setting, yet they prepare the learner for active participation as a future citizen.

In order to develop appropriate curricula for science education, it is therefore necessary to identify and name the language competences involved in science teaching and learning with precision and clarity, both the discourse related to science education as well as the use of science in society. In particular, they have to be explicit with respect to the language needed (a) for acquiring knowledge, (b) for interacting and negotiating in the classroom, (c) for evaluating outcomes as well as procedures of gaining new knowledge and (d) for critical reflection on scientific issues and the way scientific knowledge is used in private life, in the work place and in society as a whole.

This paper proposes an approach for specifying the language competences in such a way that they can be taught by a systematic method, integrated with the teaching of subject-based knowledge. This is illustrated here with reference to the teaching of the "sciences" irrespective of whether this term is used or individual subject labels like biology, chemistry or physics⁶³.

The paper presents

- an overall approach for the description and categorisation of the competences needed for successful learning/teaching in science education
- open-ended reference points (in the form of inventories/checklists) which are to be completed by users, according to the specifics of the respective educational system and the languages in which teaching is conducted.

The purpose of these reference points is to help users in:

- identifying the linguistic activities present in the subject under consideration;
- specifying the forms of the language of learning/teaching required in mastering the varieties of discursive content attached to the subject and the forms of communication necessary for imparting and acquiring subject-related knowledge and skills.

⁶³ This text draws on earlier work prepared for the Prague Conference (8-10 November 2007) of the Council of Europe, written up by Helmut Vollmer (University of Osnabrueck, Germany), Stein Dankert Kolstø (University of Bergen, Norway), Jenny Lewis (University of Nottingham, GB) and Tatiana Holasová (Research Institute of Education, Czech Republic); see Vollmer 2007b.

The overall scheme of the approach is as follows:

- (1) inventory and description of the educational values targeted by science teaching practices;
- (2) inventory and description of the social situations of communication involving science in the learners' social environment;
- (3) inventory and description of some basic /the expected scientific knowledge structures;
- (4) inventory and description of the existing in-school communication situations for the acquisition and construction of basic knowledge and procedures in science.

The choices to be made among these possibilities lead to the definition of the purposes and objectives of education in science within compulsory schooling.

Based on steps (1) to (4) it is then possible to create:

- (5) inventories and descriptions of the specific linguistic, discursive and semiotic characteristics of relevance for the types of discourse involved in science teaching and learning practices; these characteristics deserve to be taught in their own right in this subject area.

In other words, what is proposed here is a common procedure, whatever the language of instruction in question is, whether the learners' first language or an additional language acquired to a standard of proficiency of at least level B2, according to the Common European Framework of Reference for Languages (CEFR).

1. Educational Values and Science Education

All teaching pursues educational goals over and above the expertise and learning which are both its substance and its aspiration.

The role of languages of education in schools is to structure and assist the training and education of social actors and the development of the individual to their full potential as individuals. The aims of this training/education are shared by the Member States of the Council of Europe as the basis for living in society in Europe.

Schooling is responsible for preparing future citizens and developing their potential by giving them the necessary tools for all aspects of life in society (personal relations, occupational activities, leisure activities, etc.) and by enabling them to understand the basic values of human rights, democracy and the rule of law and make them part of their personal ethics.

The languages of Europe are inter alia a means of acquiring knowledge, of engaging in exchanges about this knowledge and how to make use of it with others who may have different understandings of these issues.

As a consequence, the goals of science education include not only the mastery of the *basic structure* and of specific *items of knowledge* within science, but also a more general goal of *understanding science*, and of developing a framework for understanding the specific questions addressed and the answers given by the natural sciences and their related disciplines; everyone should understand the contributions and limitations of the sciences to knowing the world. This is epitomised in the notion of the *development of a scientific mind of enquiry* as a general characterisation of the intended outcome of science education in school.

This goal for science education involves first the development of 'investigative skills': e.g. planning an investigation, proceeding accordingly, collecting data and interpreting these – including the handling of various kinds of nonverbal or semiotic forms of information like graphs, statistics, formula etc.. Second, it involves the development of evaluative as well as reflective competences in a critical analysis of ideas, procedures and evidence in science as well as applications and uses of science in its social context. This implies comprehension and discussion of the following questions:

- how are scientific knowledge and insights gained, how are "discoveries" made;
- how are scientific ideas agreed and disseminated;
- how do scientific controversies arise;

- how can scientific work be affected by the social, historical, moral or spiritual context in which it takes place;
- how do these contexts influence whether ideas or findings are accepted?

Where there is agreement that science education should not limit itself to the reconstruction or transfer of knowledge, but should equally consider the power and limitations of science in addressing societal issues, including uncertainties and ethical problems in scientific knowledge and its application, the following may be included in science education:

- use of contemporary scientific and technological developments and their benefits and risks;
- consideration of how and why decisions about science and technology are made, including those that raise ethical issues, and about the social, economic and environmental effects of such decisions;
- (un)certainities in scientific knowledge and ideas, how these change over time, and the role of the scientific community in validating these changes

The specifications of values also include material for definitions of more general abilities, for example: to analyse and interpret information critically and responsibly, through dialogue, through the findings of scientific evidence and through open debate based on mutual respect and rational argumentation. They offer a path to the specification of cognitive and linguistic competence, as outlined below.

In more general terms, the principal goals assigned to science education thus include:

- to make a contribution to educating responsible and active citizens and fostering respect for all kinds of differences in evaluation on a basis of understanding scientific issues and possibilities of solving them;
- to make a contribution to educating responsible and active citizens and fostering respect for all kinds of differences in evaluation on a basis of understanding scientific issues and possibilities of solving them;
- to play a role in the promotion of fundamental values such as rational exchange of positions and opinions, tolerance, human rights and democracy;
- to be a fundamental component in the construction of a Europe based on a common cultural heritage, with a humanistic and a scientific orientation, working towards the development of a knowledge society in which conflictual factors are accepted;
- to be an instrument for the prevention of crimes against humanity and securing the quality of human existence.
- to be part of an education policy that has a direct effect on the personal, professional and social experience and decision-making of the learners, with a critical and enlightened view on building tomorrow's Europe together, by participating in solving local as well as global issues and leading a satisfying private life, with a spirit of mutual understanding and trust;
- to allow the nurturing in learners of the intellectual ability to analyse and interpret information critically and responsibly, through dialogue, through the findings of empirical evidence and through open debate based on multiperspectivity, especially regarding controversial and sensitive issues;
- [...]

In sum, science education is based on socio-critical values raising question of relevance, of contextualisation and possibly of reduction of the science content (concentration on key concepts, on core content(s), on exemplary procedures, embedding science teaching into the learner's own experience and relevance for everyday life) vis-à-vis the limited time given and the need to include dealing with socio-scientific issues (personal and societal issues with a science dimension) in the classroom. Only this will prepare learners for the application of scientific knowledge and for scientific reasoning outside school, in life, participating actively as citizens in this area.⁶⁴

⁶⁴ See particularly the contribution of Kolstø 2007b. These broad and critical teaching goals will require science teachers to provide differentiated tasks which allow students to work at their own level, at their own pace, in their

2. Science education and citizenship

It is the obligation of education to develop in learners a scientific mind and outlook on life and to prepare them to cope effectively with situations and social activities in which science is involved, being a subject area with highly significant relevance to human engineering, to technological innovation, to health and security and to ideologies of man-made progress concerning productivity, efficiency, quality of everyday life as well as increasing mastery of the environment.

Science education relates to situations in the private as well as in the public domain. There are immediate insights and applications of science possible in everyday life and there are global issues at stake like climate change, sustainability and biodiversity or local issues ranging from energy supply to food additives. Such issues call for personal or political decisions, but also have a *science dimension* that needs to be considered. In democracies it is important that citizens engage in debate and decision-making processes, and that schools prepare future citizens for such participation.

The science dimension of such issues leads to the need for *scientific literacy* :

Scientific literacy is the capacity to use scientific knowledge, to identify scientific questions and to draw evidence-based conclusions in order to understand and help make decisions about the natural world and the changes made to it through human activity (OECD 2007).

In addition to this focus on understanding and decision-making, science education for citizenship involves preparing students for active, informed, critical and responsible participation in issues and situations where scientific insights the quality of this participation.

Science education for citizenship thus aims to empower learners to be willing and able to engage with socio-scientific issues by enabling them to read and listen to scientific information and arguments with understanding, examining and evaluating this information and the argumentation critically, and to contribute to discussions and decisions in a competent, informed manner.

This empowerment is founded on a broad knowledge base:

- a thorough understanding of the main explanatory stories in science (e.g. particle model of matter or germ theory of diseases)
- insights into the nature of science, including social processes in science whereby the reliability of claims from the frontier of science is discussed and evaluated
- insights into the contextual dependencies of science, especially science–society interactions, including science policy issues, ethical aspects of science, the role of funding in research and issues of dissemination of selective research results.

and four competences, all involving communication and language – the ability to:

- 1) bring out and formulate one's own conceptions, representations and existing knowledge
- 2) retrieve, read and interpret scientific information,
- 3) examine, discuss and negotiate information and arguments critically,
- 4) make deliberate/considerate decisions and communicate/disseminate their own points of view.

2.1. Contexts requiring scientific literacy competences

In order to define the nature of these competences, it is necessary to consider contexts in which they might be used.

preferred learning style. Such a teaching approach should challenge the most able learners while also supporting the less able ones: in order to do this, science teaching would have to be (more) student-centred, partly even individualised, actively engaging students in the development (construction) of their own knowledge by starting from their preconceptions; the teaching would have to bring out these representations and the knowledge that learners already have if one wants their later construction of knowledge to be sound and solid (cf. Giordan 2007 or DeVecchi/Giordan 2002 for science education in France). (This might be dealt with in more detail in another module).

Retrieve and interpret information

Citizens increasingly search for authentic scientific information on such matters as children's illnesses. Information and viewpoints are to be found in the media, newspapers, TV, radio, the Internet or libraries, where citizens access texts written in scientific genres e.g. expositions of findings, reports of experiments, and executive summaries. They also get information through professional consultancy, e.g. from their medical doctor and from energy-saving advisors. Understanding, relating and interpreting this information from the manifold sources is at the basis of all communicative competence in this respect.

Examination of information and arguments

Examination of information and arguments involves, first, analysing the reasoning e.g. through discussing the assumed or constructed meaning with peers or professionals. Secondly, the trustworthiness of the author, institution or source of the information/viewpoints needs to be examined, e.g. through inspecting competence, affiliation, merits, possible vested interests, ideological orientation etc. Thirdly, the scientific reliability of claims and arguments needs to be examined, e.g. through comparing views of different experts, inspecting evidence and references provided, and comparing them with consensual science.

Decision-making and dissemination of viewpoints

Based on the processes of acquiring information and examining views and arguments critically, citizens might contribute to debate through posing questions, giving observations, sharing and exchanging arguments and viewpoints with others. A range of platforms and channels are available for this, for example entering into discussion with friends and colleagues or engaging with the agendas of NGOs. This may be oral or written communication of views e.g. through letters to newspapers, blogs or private websites or by contributing to texts produced by NGOs in the form of brochures, web-articles, press releases, etc.).

Examples of contexts in which these competences operate include:

- Political agendas where scientific knowledge or assumptions are used for persuasive purposes to define e.g. 'progress' or 'security' and justify actions to be taken e.g. dealing with atomic power or pandemic threats, reduction of CO2 emissions etc.;
- Exchanges between citizens which pre-suppose "general knowledge" of a scientific nature;
- Family and neighbourhood contexts where personal knowledge and evaluations are passed on or mixed with "expert" knowledge and opinions;
- Accounts in the media of technological breakthroughs, celebrations of "great scientists", expansion of knowledge about the universe, etc. or of actual or potential misuses of scientific discoveries
- Reading both general and specialist science press and didactic publications etc.);
- Watching different kinds of entertainment both fictional and documentary – films, television programmes, theatre - with a scientific content e.g. re-enactment of scientific discoveries
- Using sources of reference such as websites ;
- Visiting museums, exhibitions and similar sites on natural science and technology;

Some of these situations are intrinsic to social life, to politics and to active citizenship, others pertain to media use, accessibility to knowledge and the formation of opinions or even interest/lobby groups. They involve different forms of communication: oral/aural, written and audiovisual reception, oral interaction, etc. This reference list may be supplemented and used as a guide to the identification of language skills and capacities which should be part of a science syllabus.

2.2. From social situations to types of discourse

For situations of "scientific communication" it is possible to develop descriptors from an analysis of the characteristics of the types of discourse employed in those situations.

For example, *learning to understand scientific documentaries (on television)* involves a discourse type in the popularisation of scientific knowledge and problem definition, based on aural and visual reception (cf.

[Common European Framework of References for Languages](#): “4.4.2.3.: understanding TV programmes and films; understanding a documentary”: B2).

At this point, we distinguish between *cognitive skills* underlying discourse and *linguistic/semiotic skills* which are visible on the surface level. In section 5 – we will demonstrate how cognition and verbalisation are closely linked to one another.

Science-related cognitive skills include the ability to

- identify types of sources used/academic sources
- identify reasoning, based on data/clues
- notice the strategies/devices applied to give popular appeal: e.g. dramatisation, “experts” versus laymen, activating elements/substances etc.
- identify and distinguish already known and new knowledge
- place the presentation into a broader context (larger issues, concepts, structures)
- evaluate representational forms chosen specific to the media in question
- identify simplifications, generalisations, lack of data, allusion to academic controversies, unbalanced solutions etc.
- understand whether a particular bias is being conveyed
- ...

Linguistic and semiotic skills include the ability to

- understand the goals and commentaries of the moderator;
- understand interviews and explanations;
- read maps, diagrams, tables;
- interpret editing, framing and emphasis;
- notice the definitions given directly or in the voice-over;
- distinguish description from comment;
- distinguish objectified discourse from judgement (particularly unrealistic, moral etc.);
- ...

Once the social situations of communication have been characterised and the types of discourse they (primarily) involve have been identified and exemplified, it becomes possible to single out and focus on particular perspectives and linguistic features in the teaching and learning of science in school itself.

3. Subject-related competences

A certain command of science as a form of knowledge is an educational goal in itself. Therefore, a list of specifications of scientific knowledge is called for (section 3.1), while a survey of the cognitive resources (e.g. thinking skills) needed to learn/teach modes of in-school and social discourse has to be developed as well (section 3.2).

3.1. Checklist of components of scientific knowledge structures

These are the basic knowledge structures which it is hoped learners will acquire from their science lessons and be able to apply it in social situations of communication. It consists of knowledge of different types and orders:

Three levels of scientific knowledge can be identified: *general* categories and knowledge like ‘elements’ or ‘concepts’, *specific* categories and knowledge relating to structures and relationships and *specific knowledge linked to developments* and their dynamics.⁶⁵

⁶⁵ See the formulation of standards of education in Germany for biology, chemistry and physics (Vollmer 2007a).

<i>general categories and general knowledge: concepts, elements, principles</i>	<ul style="list-style-type: none"> • biological, chemical, physical phenomena • basic concepts and notions • principles and facts • elements, matter • data, description, demonstration • rules, regularities • [...]
<i>specific categories and knowledge: relationships, structures</i>	<ul style="list-style-type: none"> • structure, organisation; • interpretation and comparison; • (types of) relationships, • causation, causes, interaction • system(s), features and functions • [...]
<i>specific categories and knowledge: developments</i>	<ul style="list-style-type: none"> • Chronology, temporality, • event, trend, evolution; • continuity, change, break, “progress”; • laws of conservation and transformation • knowledge of general scientific schemes and processes over the long term (for example: evolution, mutation, “survival of the fittest”...) • understanding these processes, the built-in mechanisms and the influence of mankind on these developments etc. • understanding the events and driving forces that have structured the present situation • [...]

The three subjects of biology, chemistry and physics share many basic concepts and ideas, but also differ in some of their guiding principles and in their terminology.

The compilation of science teaching syllabi which comprise specifications in terms of knowledge can accommodate the traditional tendency to design syllabi focused on specific *areas* of knowledge, while outlining at the same time specific *structures* of knowledge plus understanding the *development* of knowledge over time. The grid above is intended for scrutiny of the diverse nature of the knowledge meant to be taught. Its chief purpose is to emphasise that these various forms of scientific knowledge presuppose different types of discourse (or discursive forms) in what is said by the teacher and the textbook or other types of material:

- basic scientific knowledge should be disconnected from its ordinary connotations and interpreted afresh in its experiential and historical perspective, also of a philosophical nature;
- structural knowledge can be defined in different ways/debased, in which case its primary meaning must be restored;
- knowledge about the dynamics of scientific development can give rise to different interpretations and basic beliefs about the nature of the cosmos, the world, the universe and what holds it together. Thus the teaching of such knowledge has to draw upon historical comparison.

3.2 Checklist of components of methodological competences in science

The expertise and strategies that have to be taught to learners for successful application of their knowledge, have already been defined as “scientific literacy” (see above). In order to foster sound judgement, critical analysis and evaluation as well as open-mindedness and other virtues, it is important to develop “cognitive skills” or “procedural expertise” in science, such as ability to handle and analyse different forms of information and documents, arrive at balanced, responsible conclusions, and see other points of view or interpretations of the same data set(s). Scientific literacy thus consists of several

components of knowing how to proceed in relation to given tasks and goals which could be summarised under the heading of “scientific proficiency”. This procedural capacity can be broken down into a number of relevant competences, including being able to:

- formulate relevant questions about the available documents/data source;
- examine potential sources of information and distinguish between primary and secondary sources;
- assess such sources in terms of validity, possible bias, accuracy and reliability;
- use the sources available to identify relevant information to answer certain questions;
- analyse and structure this information on a particular topic/issue and relate it to existing/prior knowledge;
- contextualise the information by relating it to information already available about the period, the actor, the transmitter of knowledge;
- scrutinise the available source materials for rational justification and rank them in terms of their significance;
- Acknowledge that scientific inquiry and findings are not value-free;

When related to the above mentioned three types of knowledge, the respective inventories for epistemological or procedural competence could look like this:

Relating to certain *items/objects of knowledge*

- Identify an element/a topic/ a concept (e.g. by marking, highlighting, copying etc)
- Name the term(s) for ...(as an act of memory)
- Write the captions of (e.g. a diagram)
- Label the components of a graph (with or without choices given)
- Describe (orally or in a written form) ...
- Summarise ...
- Explain

In connection with *knowledge structures, systems and functions to be understood and reconstructed, here are a few examples of possible descriptors:*

Name	different flowers/flowering plants, distinguish their organs/parts ...
Describe	the functions of the organs contributing to digestion
describe (by exemplifying and illustrating)	the make-up of a sense organ
Explain	the adaptation of mosquitoes to the living conditions of their environment

For initiating or checking the understanding of the notion of *development* in scientific thinking possible descriptors could be:

Describe	In simple terms the process of mitosis and explain its meaning
Describe	the development of plants
Identify and name	fossils as proof for evolution
Describe	the restructuring of the landscape by human beings through an example

In principle, all types of descriptors involving cognitive-linguistic operations for demonstrating areas and degrees of acquiring and understanding scientific concepts and findings on the basis of individual work and individual responses serve the function of becoming aware of the new knowledge gained, its relationship to prior knowledge, the questions still open and the aspects not yet fully understood. Therefore, a large number of discourse activities and formats as well as descriptions relating to them and guiding them are possible.

By way of a summary, we can state that methodological competence consists of knowledge *and* skills necessary for the acquisition of the different types of subject knowledge. This can be expressed in the following summarising table⁶⁶:

Practical an enquiry skills includes to be able to:

- plan to test a scientific idea and test it, answer a question or solve a problem;
- collect data from primary or secondary sources, including using ICT sources and tools;
- work accurately and safely, individually and with others, when collecting first hand data;
- evaluate methods of collection of data and consider their validity and reliability as evidence;

Students are to learn

- how scientific data can be collected and analysed;
- how interpretation of data, using creative thought, provides evidence to test ideas and develop theories;
- how explanations of many phenomena can be developed using scientific theories, models and ideas;
- how questions can be identified that science cannot currently answer, and others that science cannot or does not want to address

It is only when these procedural dimensions are addressed in science education, that learners are empowered to become active for themselves, responsible for their own learning, and critical thinkers rather than uncritical consumers, acting on the results and applications of their scientific knowledge and participating in relevant debates i.e. follow, but also influence, either individually or collectively, such debates as critical citizens.

In these inventories, we have not yet identified the level of abilities that are actually within the learners' grasp at different stages in time and how to build on them. In other words, we still need to clarify how these capacities can be developed over time and how they connect with each other so that the planning of a realistic path for their acquisition can be attempted, above all according to the cognitive development of learners at school.

4. In-school communication situations relating to science teaching and learning

We now have to switch from communication in society and from the objectives defined in terms of scientific knowledge and procedural competence to the *types of teaching and learning in school*. The latter have to be informed by the former: the forms of communication that are used in science education must be linked to those present outside school. Yet, school-based education also follows its own rules and conventions.

We can in general distinguish between several different phases or types of learning activities in the classroom, and this is also true for science education. Each of them involves different cognitive-linguistic demands and challenges:

4.1 Checklist of classroom activities in science education (for subject learning/teaching in general)

It is possible to distinguish the following types of learning/teaching activities within the science classroom:

4.1a Activation, acquisition, structuring and storing of scientific knowledge

4.1b Presentation, negotiation and discussion of new (as well as old) knowledge

4.1c Evaluation of knowledge and the ways by which it was gained

4.1d Reflection about the uses and limits of scientific knowledge and the validity of the world view accompanying it.

⁶⁶ See Level 4 of the Science Curriculum in England, reported in Lewis (2007a)

4.1.1. Activation, acquisition, structuring and storing of scientific knowledge

As already mentioned, science teaching practices are structured according to a finite repertoire of learning/teaching activities. Such forms of teaching vary according to educational traditions and the methodological choices made in the syllabi or by individual teachers, all of which structure the teaching. It is important to list the approaches and typical situations of scientific communication used in the different activity areas.

The first area or type of pedagogical activity i.e. the activation, acquisition, structuring and storing of scientific knowledge involves the formation of new concepts and the expansion of already existing knowledge, again taking into account the spontaneously offered conceptions of the learners and their necessary transformation. Certain learning/teaching situations are most common here like:

- presentation by the teacher (including general information, interpretations and comments, analysis of primary sources, explanation of terms and concepts, etc.) using visual aids (maps, diagrams, data tables, reproductions of evidence, etc.) (OP, AuR and WP⁶⁷);
- teacher-learner interaction about the presentation and/or data (OI);
- learners reading and studying a/the textbook (WR);
- Finding information (WR and WP; note-taking on the part of the learner);
- analysis and summary of text files (WR and WP);
- reviews of books, television programmes (WP or OP);
- reaction to a film featuring a scientific issue/controversy watched as a class (OI);
- activities run as projects (linking different competences, for example, making a promotional pamphlet or film about medical issues or those of the environment): individual and/or group research;
- introduction to scientific methodology: e.g. gathering data through observation and experimentation, collation, analysis and commentaries (OR), interpreting tables (WR)
- production of texts relating to personal preferences and decisions (WP) based on scientific knowledge and interpretation; explaining features, preparing suggestions or solutions (WP);
- restructuring a text for a particular purpose: for example, extract key points from a science text to produce notes; to convert information found on the web into an information leaflet (e.g. for use in another context or in real life)
- [...]

Specific language competences needed in this area/phase of learning would be

From the perspective of biological knowledge as a *system*, learners would be expected to

- describe cells as spatial units which consist out of several components
- explain the meaning and influence of selective environmental conditions for an ecological system
- describe or characterise / understand a number of different nutritious cycles/chains and networks
- list what a cell consists of - name and illustrate its components
- (after having done a small experiment) answer the question: "Why is there a space of air necessary in a jar inhabited by a snail, some branches and water?"
- making/giving a summary of a scientific fact, insight or text (with uses of visual representations (OR and/or OP).

4.1.2. Presentation, negotiation and discussion of new (as well as old) knowledge

This activity normally covers a large part of science education: it is above all the opportunity for learners to plan and speak coherently, to link ideas and sentences, to consider the audience and their prior

⁶⁷ Coding of communication activities based on the CEFR: **R** = reception; **P** = production; **I** = interaction; **O** = oral; **W** = written.

knowledge and to construct common ground, before presenting a finding, giving an interpretation or delivering a message.

Some of those activities designed to develop learners' subject-specific communication skills might include the following:

- share or question ideas: for example, working in small groups to agree on an explanation of a phenomena or the correct scientific explanation for an observation, for an open question
- present individual work or the results of group work (OP) based on notes, powerpoint slides, posters, graphs, etc.;
- understand a presentations, the goal, the findings, procedures, the discussion of results (OR)
- explaining and/or justifying a question, an investigation, procedures chosen, interpretation of data, conclusions drawn etc.
- Contributing to a whole class activity (e.g. collecting ideas, points, elements, expectations (e.g. in the reaction of two or more chemical substances)
- Role-play: take a particular role (e.g. that of a local farmer in a debate about genetically manipulated crops), study this role/the arguments and present the farmer's case to the class
- Relating pros and cons of a certain issue to one another (OP and OI)
- Organising a debate (with adverse positions/multiperspectives) (OI) – if on the basis of texts or notes (WP)
- Moderating a (formal) discussion
- [...]

4.1.3. Evaluation of knowledge and the ways by which it was gained

This phase or type of learning/teaching activity is closely linked with the one under 4.1.2 and could be integrated into it. However, it may be helpful to deal with this area of learning explicitly and separately, since it helps understand how certain findings in science come or came about, a representative a certain data base is, how much generalisation or analogy is involved in certain interpretations, what the degree of validity or certainty is concerning controversial or unresolved issues.

This stage of classroom learning heavily draws on the epistemological competences already dealt with in section 3.2:

- Evaluate methods of data collection of data reduction
- Re-analyse the design chosen for a specific experimentation,
- Consider the reliability and validity of certain (empirical) observations, findings, studies
- Identify and differentiate scientific claims, evidence and conclusions in an utterance or text
- Identify inferences drawn and deductions made in detail
- Check the convincingness of certain arguments as evidence
- Interpret the epistemic status of statements correctly (as presented in an oral or written discourse)
- [...]

4.1.4. Reflection about the uses and limits of scientific knowledge and the validity of the world view based on it /accompanying it.

This phase of science education provides possibilities of linking explicitly what is being acquired and learnt in the classroom to social situations of communication and decision-making outside of it, as listed in section 2.

- List and discuss possibilities of energy saving in the private household/for air traffic
- Evaluate benefits, drawbacks and risks of certain technological developments (e.g. safety measures in powerful, energy-consuming cars, production of mass medication etc.
- Argue for and against the alleged/supposed “threats” of genetic manipulation (e.g. in food, in animals, in human beings etc.)

- Consider the implications (advantages, dangers etc.) of atomic energy production
- Reflect on the role of “experts” in certain law cases or decision-making bodies
- Consider how decisions involving science and technology are made, including those that raise ethical issues
- Reflect about the social, economic and environmental effects of such decisions as well as chances to influence them individually or as a group (e.g. ways of contributing to the rescue of the tropical rain forest, from protests to consumption behaviour).

4.2 From classroom situations to discursive forms

All of these types of science teaching and learning activities can be described in terms of linguistic capacities and types of discourse. For situations of “scientific” communication, it is in fact possible (as started in 2.2 above) to develop descriptors from the characteristics of the discursive style used in those situations.

4.2.1. Example 1

Giving a (prepared) presentation to the class

This type of discourse relates to oral production (see CEFR 4.4.1.1.: addressing audiences), based on notes, slides or a whole manuscript in written form. This involves:

science-related cognitive skills such as the ability to:

- Read and summarise relevant documentation;
- Locate the different sources of information;
- Adapt an existing historical discourse;
- Interpret primary data;
- Interpret quantitative data;
- Report the opinion of professional historians;
- Give and support one’s own point of view, explaining its source and nature;
- Highlight the gains and the problems;
- [...]

linguistic and semiotic skills such as the ability to:

- State a plan, a scheme of presentation or “narration”;
- “Give clear, systematically developed descriptions and presentations, with appropriate highlighting of significant points” (Descriptor B2 in the CEFR p. 58);
- Emphasise the stages of the presentation as it unfolds;
- Present and organise the linguistic commentary of tabulated data, a diagram, etc.;
- Make the presentation attractive: manage voice and intonation;
- React with restraint to objections or criticism from class or teacher;
- Answer questions concerning the findings and/or the procedures applied afterwards;
- Assess one’s own performance (without or with the help of others);
- [...]

It will be noticed that in the example given the same descriptors can be used as those in the CEFR, devised for foreign languages, to the extent that it describes a group of discursive forms employed in science (addressing an audience). Yet not all are relevant, even in this case, as the CEFR takes no account of learners’ ages. Thus, the descriptor B2 (CEFR p. 60): “Can depart spontaneously from a prepared text and follow up interesting points raised by members of the audience, often showing remarkable fluency and ease of expression” might not be suitable for ALL 15-16 year old learners, at an age when compulsory education often ends. Likewise, the level C1 and C2 descriptors can furnish material for descriptions but probably cannot be adopted as such.

4.2.2. Example 2

Planning, doing and evaluating an experiment

This type of discourse requires many considerations, plans and cognitive decisions which will have to be documented (verbalised) either immediately or later (less preferred).

science-related cognitive skills involved include the ability to:

- plan to test a scientific idea, answer a question or solve a problem;
- formulate an assumption, a hypothesis
- collect data from primary or secondary sources, including using ICT sources and tools;
- use both qualitative and quantitative approaches;
- work accurately, either individually or with others, when collecting first hand data;
- document the on-going results and the procedures chosen
- prepare data in such a way that you can check the hypothesis (either visually or with mathematical means)
- design the structure of a report
- ...

linguistic and semiotic skills include the ability to:

- recall, analyse, interpret the scientific information gained
- relate the findings to your assumption or hypothesis
- make a table of contents and write a draft version of the report
- present information coherently
- develop an argument and draw conclusions, using scientific, technical and mathematical language, conventions and symbols and ICT tools;
- write the correct terms and variable names in the captions (e.g. of a table)
- edit the report (be as accurately and convincing as possible)

5. Specific linguistic and semiotic competences needed for science education

So far we have identified and exemplified

- social situations of science-related communication (2.1. checklist)
- and the corresponding types of discourse (2.2.)
- and the components of scientific knowledge structures (3.1. checklist)
- the ingredients of epistemological competence in science (3.2. checklist)
- in-school situations of communication with a scientific goal/content (4.1. checklist)
- the corresponding types of discourse in science lessons in school (examples in 4.2.).

Based on these different steps (and their underlying principles) it is now possible to single out and generalise specific linguistic competences suited for science teaching and learning, aimed at imparting knowledge and expertise as well as instilling social communication skills. As already demonstrated, for learners these cannot be restricted to command of specialised terminology or the ability to piece together elements of scientific knowledge, even where these may be clear and logically derived from data. The necessary linguistic competences involved in science education, also involve complex thinking and discourse skills and ways of relating the two via lexical, grammatical and textual choices.

To describe these linguistic competences in more general terms, we shall adopt a subject-based model of *capability* and *communication*, arranged in four sets of components, the first three of which form what is strictly speaking linguistic communication competence:

- strategic component/competence (see 5.1.)
- discursive component/competence, mastering types of discourse) (5.2.)
- formal component/competence (5.3)
- interdisciplinary/cross-curricular competences, not peculiar to science teaching: these will have to be dealt with in another module.

5.1. Strategic competence

General communicative ability includes a psycho-cognitive component termed *strategic* that controls observable linguistic behaviour in order to generate, produce and understand texts. “Strategies are a means the language user exploits to mobilise and balance his or her resources, to activate skills and procedures, in order to fulfil the demands of communication in context and successfully complete the task in question in the most comprehensive or most economical way feasible depending on his or her precise purpose.” (CEFR p. 57).

In the CEFR the strategies are situated at the same level as communicative activities (as oral/written interaction [OI/WI], oral/written production [OP/WP] and aural/written reception [AuR/WR]). This level of specification allows teachable actions to be defined in terms of planning, execution, evaluation and repair⁶⁸, which seem independent of the languages and discourses used. We shall proceed from these specifications to describe the communication proficiencies needed to teach/learn science.

Oral and written production ⁶⁹		
	General activities	Activities in the school setting of science teaching and learning
Planning	Locating resources Preparation and/or rehearsal Consideration of the recipient and audience Adaptation of message	Identifying the relevant information sources Producing successive tentative versions of the text to be produced. Verifying its length (if WP). Taking account of the audience’s receptive capabilities, level of knowledge and status, etc., Transposing, paraphrasing, summarising, mentioning, quoting and commenting on source texts
Execution	Building on prior knowledge Trial (experimentation)	Reliance on existing texts of the same kind as the one contemplated Making successive provisional versions of the text to be produced.
Evaluation	Checking of results	Testing through listeners’ reactions (if OP) the intelligibility to an outsider not directly addressed (if WP)
Repair	self-correction	Improving self-correction through an external evaluation

⁶⁸ CEFR, 4.4.1.3. for OP/WP, 4.4.2.4. for OR/WR and 4.4.3.3. for OI/WI.

⁶⁹ According to CEFR. p. 53.

Aural and written reception ⁷⁰		
	General activities	Activities in the school setting of science teaching and learning
Planning	Framing (selecting mental set, activating schemata, setting up expectations)	Identifying type of discourse and its potential contents
Execution	Identifying cues and making inferences	Working out the meaning of technical terms or scientific deductions from language knowledge and scientific knowledge
Evaluation	Hypothesis testing: matching cues to schemata	Matching up the interpretative hypotheses and developing critical sense
Repair	Revising hypotheses if required	Reconsidering one's position about a theory, explanation, validity of data and their interpretation

It is obvious /plain that the specifications of the CEFR relate more to reading as comprehension than as interpretation or critical response. For languages of instruction, the comprehension strategies need to be re-interpreted as a function of the knowledge in the discipline (in this case, critical comprehension).

Spoken and written interaction ⁷¹		
	General activities	Activities in the school setting of science teaching and learning
Planning	Framing the issue (establishing a line of approach) Judging what can be presupposed Planning moves	No relevant descriptors in the CEFR, since the interactions between teacher and learner or among learners occur in the language of schooling. But it is necessary to understand what is expected of the classroom interactions whose aim is to provide insight into the knowledge presented and which are not ordinary social interactions. It is thus important to know their implications for imparting knowledge.
Execution	Taking the floor Co-operating (interpersonal) Dealing with the unexpected Asking for help	These specifications are altogether relevant in the context of debates, discussions and arguments staged in class about scientific questions
Evaluation	Monitoring (schema, praxeogram) Monitoring (effect, success)	No particular specificity to the science-related verbal styles in or out of class
Repair	Asking for clarification Giving clarification Communication repair	Relevant as regards terminology, foreign borrowings, knowledge and patterns of scientific reasoning and explanation...

⁷⁰ According to CEFR. p. 65.

⁷¹ According to CEFR. p. 73.

These descriptors of strategies, as may be seen, need specifying if possible, as far as types of communication with “scientific” content are concerned. This reference grid should be considered provisional. From a pedagogical standpoint, the descriptors of planning, which relate to the learners’ preparation of the statements (oral or written) should no doubt be more developed than those concerning monitoring or correction (except in the case of OP or WP).

These strategic abilities are valid for all subjects taught, so a comparison with the terms in which they are specified for history, mathematics or art (e.g.) is called for.

5.2. Discursive competence

The concept *type of discourse* (or *discursive form*) has been used to denote the forms taken by communication as practiced in a given social situation and communication community. The types of discourse are specific discursive forms identified as such by a standard name and certain characteristics (physical location, type of participants, medium, etc.) of the situations where they occur: lecture, news item, observation, dispute, myth or prayer, etc.

The texts that pertain to a given type tend to follow the conventions typifying these discourses; the conventions concern not only contents but also the structure and/or verbal forms of realisation/productions. A text is more or less consistent with the discursive form whose specific outcome it is. The types of discourse themselves are more or less strained and formalised (lecture *versus* casual conversation).

The concept of discourse type is less abstract than that of textual type (narrative, descriptive, imperative, expository, persuasive, etc.). Typologies of this kind have never really been adequate for describing classes of texts since it is readily acknowledged that *most actual texts correspond simultaneously to several types*. This typology may nevertheless be used to denote the style (or discursive regime) adopted by certain segments of texts: for example, in the “film/book/record/review” discourse type in written media, there is often a segment at the beginning which has a descriptive or narrative tone (film); the texts then continue with a segment with an evaluative purpose, before summarising and highlighting the main points.

One aim of plurilingual and intercultural education, hence of languages in learning/teaching, is to broaden learners’ discourse repertoires (in some/all of the languages of their language repertoires) in relation to their initial experience/proficiency in types of discourse and to give them the opportunity for new experiences (through texts and documents including non-verbal forms of representation) of the diversity of disciplines, academic cultures and of otherness..

As in every other subject, science syllabi may be specified according to discourse type:

- types seen as already entering into the learners’ repertoires (textbook, scientific documentary, illustrations of (abstract) relationships and functions, info brochures, etc.)
- types present in the learners’ social environment (periodicals: general-interest press, science-based journals; websites, expert debates, moderated public and/or political discussions, etc.)
- types to which a certain form of exposure is sought by science teaching.

For the purpose of choosing the types of discourse with which learners are to be familiarised, attention needs to be paid first to the academic status of statements of “facts” and of popularised science reports. These are very diverse in nature because of the role assigned to them in diverse texts in the public domain which have some connection with the natural sciences. For example, with respect to written scientific reports, it may be deemed important for learners to be brought into contact with:

- academic/disciplinary discourse types written by specialists for specialists (articles, communications, monographs, theses and the like);
- types produced by specialists, presenting new knowledge meant for and made accessible to the (“educated”) general public;
- types used in popularisation in book form or as TV features by professional scientists, knowledgeable amateurs and authors specialised in scientific dissemination;
- journalistic discourse types of the press specialising in science issues;

- journalistic discourse types of the ordinary daily press relating to scientific questions and debates (reviews of published books, accounts of “discoveries” and/or issues of health and security, interviews with scientists like biologists, medical doctors, with interested laymen, etc.);
- educational discourse in the form of science textbooks, summaries for school learners, multi-media presentations on film or video;
- the encyclopaedic discourses of dictionaries, encyclopaedias, wikipedia / the internet in general, etc.;
- the direct testimonies recorded for example in autobiographies, recollections and personal diaries, statements of representatives of interest groups, etc.;
- fictional or “literary” works of a scientific nature: novels, films, TV series, etc.;

The choice of the discourse types which it is considered learners should experience and partly even produce (either by way of simulation or by way of (local) participation), depends on the general choices already described above (values, social situations of communication, scientific knowledge, status of knowing, controversies involved, etc.) but may be fine-tuned in the light of descriptors relating to:

- the nature of the instructional activities which are to draw upon these texts (WR, OI...)
- the expected degree of competence or proficiency for each (see sections 3 and 4)
- the interest (or motivation) which these discourse types may arouse
- the proximity or familiarity of the types compared to those already experienced by the learners
- the necessity of dealing with certain discourse types due to their importance and impact outside school.
- Characteristics peculiar to the discourse types may also be used as a basis for decision-making on the following levels:
 - length of the texts pertaining to them
 - predictability (as to layout, form of paragraphs and phraseology)
 - complexity (no. of items linked, nominalisations, embedded constructions)
 - use of explicit headings and subheadings, summaries, etc.
 - use of graphics, illustrations, maps, diagrams, etc.

These inventories lend themselves as a basis for decision-making about the discourse types suitable for science education in school and as a checklist for evaluating the traditional materials and discourse types used so far in different parts of Europe. The inventories are helpful and appropriate to guide choices in planning curricula and compiling teaching programmes which may differ, yet which are based on similar categorisations of discursive forms.

5.3. Formal competence

Lexical/terminological competence has already been dealt with as part of scientific knowledge in section 3.1. The attention paid to proficiency in spelling, morphology and syntax, although it may take up a lot of time in the teaching activities, should not mean that the activities relating to discursive competence can be neglected. They are of equal importance. In addition to both, a more formal competence of handling the macro and micro structures of the discourse types involved plays a decisive role: this involves the capability of linguistic expression of cognitive processes underlying the analysis (comprehension) and the construction (production) of concrete discursive forms (or texts).

5.3.1. Pragmatic and cognitive categories

The conventions of form recurring in types of discourse (i.e. the linguistic and structural deliveries of the texts) may thus be described by means of categories unconnected with the syntax of the sentence.

These may be categories like speech acts/language functions or, on a higher, more abstract level, *discourse functions*. These analytical categories applied to texts (and also or alternatively to the *cognitive processes*) are to be understood as the discursive representation of both the cognitive processes and their

linguistic realisation (in the sense of enactment) brought into play for the development/exposition of knowledge.

These discourse functions mark cognitive operations *and* their verbal performance at the same time; they are at the interface between cognition and verbalisation, they include operators (or terms) such as:

<i>analyse</i>	<i>illustrate/exemplify</i>
<i>argue</i>	<i>infer</i>
<i>assess</i>	<i>interpret</i>
<i>calculate</i>	<i>judge/evaluate/assess</i>
<i>classify</i>	<i>correlate/contrast/match</i>
<i>compare</i>	<i>name</i>
<i>describe/represent</i>	<i>outline/sketch</i>
<i>deduce</i>	<i>prove</i>
<i>define</i>	<i>recount</i>
<i>distinguish</i>	<i>report (on) a discourse</i>
<i>enumerate</i>	<i>summarise</i>
<i>explain</i>	<i>specify [...]</i> ⁷²

Among these many discourse functions, there are some which are more basic or comprehensive and relatively distinct from one another in terms of cognitive operations and discursive forms involved (they might be called *macro functions*), while others may appear under several macro functions and serve a number of them, not just one (these might be called meso and micro functions – for our purposes we just refer to them as *micro functions*).

Among the macro functions, there are at least the following ones:

1. SEARCHING (explorative function)
2. NAMING/POINTING (indexical function)
3. DESCRIBING (referential function)
4. NARRATING (narrative function)
5. EXPLAINING (relating function)
6. ARGUING (argumentative function)
7. EVALUATING (evaluative function)
8. NEGOTIATING (interactive function)
9. CREATING (creative function)

Among the many micro functions, we could list the following ones:

Asking questions	Summarizing
Questioning	Presenting
Guessing...	Sequencing
Identifying	Relating
Classifying	Structuring
Labelling	Contrasting
Collecting	Hypothesizing
Selecting	Predicting
Reporting	

⁷² See the extended list in Vollmer et al. 2008 which was arrived from the analysis of modern science curricula (and other subjects) for grade level 9/10 in Germany.

These micro functions operate on a lower level than the macro discourse functions, but they also describe and specify both cognitive *and* verbal activities at the same time.

5.3.2. Discourse functions in science education

In science education, all of the macro functions mentioned above would play an important role in characterising academic discourse in this subject area, whereas a specific subgroup of cognitive/discursive operations/processes on the micro level would be prominent only in specific contexts such as:

- *reporting /recounting* (on an experiment)
- *classifying* (objects, phenomena, processes)
- *defining* (an element, an interaction between substance, a concept like energy)
- *representing* (textual or factual data)
- *interpreting* (generated or given data)
- *matching and/or contrasting* (data and interpretations)
- *deducting* (interpretations/conclusions from data)
- *justifying* (chosen procedures, deductions, ethic decisions)
- *embedding* (an observation/a finding into a larger structure)
- *reflecting or weighing* (arguments for and against ...)
- [...]

For each of these operations it is possible to identify the linguistic resources needed for their enactment, with likely variation between discourse types. It may be assumed that the above “words” (verbs, verbal operators) referring to cognitive operations have equivalents in all languages and that an attempt could be made to compile transposable inventories (for different languages and different subjects).

To compile such inventories of forms required to express the cognitive-discursive operations occurring in given types of discourse, one ought to use again the *Descriptions of language-specific reference levels in the CEFR*⁷³ as much as it seems feasible.

5.3.3. Examples with possible descriptions/descriptors

In the following two examples will be given, involving descriptions or descriptors and the identification of the linguistics forms and resources associated with them.

Example 1: Summarizing

In one or more specified types, the learner is capable of:

- reproducing (W or O) some of the ideas/points in the text (minimum level)
- reconstructing the major ideas of a text, close to the source itself (intermediate level)
- producing (W or O) in an autonomous way a concise representation of the major ideas of a text (advanced level)

A summary appropriate to the types in question would make use of some of the following linguistic resources:

- close analysis/comprehension of the original text
- identifying the key words or expressions
- finding synonyms and/or hyponyms/
- using etymology and/or lexical inferencing (for difficult words)
- formulating the main idea per paragraph and/or section
- paraphrasing (while leaving out less relevant information)

⁷³ Available, or being produced, for English, German, Spanish, French, Italian, Greek, Portuguese... (see www.coe.int/lang → Reference Level Descriptions)

- creating super-ordinate terms as a means of densifying the content
- using subject-specific conventions/appropriate terminology
- naming the overall topic (e.g. by way of title or in the introduction: *the text is about...*)
- linking and sequencing ideas in verbalised form
- constructing semantically dense sentences (without necessarily being complex in syntactical terms)
- choosing appropriate cohesive devices
- use of descriptive and reporting verbs
- editing the summarising text as to correctness, coherence, audience, message etc.
- [...]

Example 2: *Defining*⁷⁴

In one or more specified types, the learner is capable of:

- recognising (W or O) (minimum level)
- and/or producing (W or O) (intermediate level)
- improvising/creating/proposing (OI/WI) (advanced level)

A definition appropriate to the types in question would be realised by making use of some of the following linguistic resources:

- through a series of examples
- through one or more comparisons
- through contrast
- by paraphrasing
- through hypernyms/hyponyms
- by giving a translation
- through etymology
- through internal characteristics
- by relating the term to concepts or a theory...
- [...]

Such inventories make it possible to move from the specifications of strategic/discursive competence to the definition of the required linguistic forms.

5.3.4. *Linguistic categories for the description of discourse types*

Discourse types can be described by using speech acts and/or cognitive operations or, as suggested here, by using *discourse functions* which link cognition and verbalisation, since a specific discursive form is a verbal object, yet governed by cognition underlying it. Discourse functions (on the macro as well as on the micro level) are distinct from utterance, text, speech act, type of text, etc.; their verbal conventions may be apprehended

- as relatively stable types of utterances, in the case of highly restrictive types, set phrases, etc..
- as the relatively stable or predictable general scheme or elements of their structure, which may be broken down into stabilised successions of speech acts or cognitive operations (for example, the series: represent, interpret, match...)

⁷⁴ This example, translated from French, has been offered for history, but could easily apply also to the sciences and to mathematics.

- as the preferential forms, in a given type, with which to deliver them. This conformity determines the appropriateness of the utterances (and not their accuracy or grammatical correctness), that is their compliance with common “rules” on the acceptable makeup of discourse types.

These conventions may be described on the basis of various general linguistic categories (= independent of individual languages), such as:

- forms of actualisation of the speaker (for example, in English: *I/me, we, one*, impersonal, passive, reflexive, etc.);
- forms of actualisation of the person addressed;
- presence/distribution and expected forms (in a given type) of assertive, appreciative, ethical and other formulations;
- presence/absence/distribution and forms of meta-discursive indications (statement of text plan, etc.);
- standard form of certain paragraphs;
- discursive tone (serious, humorous, personal touches, etc.).
- [...]

All descriptive categories used when analysing a discourse may serve as a starting-point for descriptors of formal mastery, especially with respect to reception or production. Nonetheless it has to be taken into account that:

- texts of the same discourse type comply to varying degrees with the (often unstated) model underlying it;
- discourse types themselves may be conventional to varying degrees either as a whole or in some of their constituent parts (for example, the beginnings of scientific articles may be quite conventional/predictable while those of newspaper articles are fairly unpredictable).

This specification of forms should be underpinned by the expected language skills in other subjects taught and in language as a subject. This requires cross-curricular cooperation and planning

5.3.4.1. For example, to state a plan (in OP) there would be descriptors such as:

In one or more given types, the learner is able to

- recognise (W or O) (minimum level)
- produce (W or O) (intermediate level)
- improvise/create/propose (OI/WI) (advanced level)

a statement of plan appropriate to the types under consideration (here, presentation to the class), by activating some of the following linguistic resources:

[Highlight the structure of the forthcoming discourse]

[statement of the general schema]

- I am about to speak of/examine/deal with the question/the issue of...
- I shall talk about...
- My topic is...

[each point introduced by means of cohesive devices, but without using a predictable sequence (such as *firstly, secondly, thirdly*)... which is readily considered “clumsy” in English]

- first of all, first, to begin with, etc.
- next, then, as the second point
- the following point
- ...
- a final aspect is..., etc.

[announcement of the end]

- lastly, to conclude, to finish, in conclusion.

5.3.4.2. Another example would be “Writing a report about a scientific experiment in the classroom” – with descriptors such as:

The function of “Reporting” (W) requires

- the description of goals/purpose, actions and processes in a sequential form and in a mode as objective as possible (minimum level of all reports)
- the identification and description of (different) results (intermediate level)
- perceived implications and possible consequences (advanced levels of a scientific report).

Language-wise “reporting” requires the use of a rich repertoire of qualitative and quantifying vocabulary, especially adjectives, noun phrases and verb forms, in addition to knowledge of the right terms for the equipment and the procedures undertaken. A report is basically written in present tense, the sentence type and mode are indicative. In contrast to other types of reports there is no link to the statements or positions of others and thus no use of indirect speech necessary.

Given the type of discourse under consideration (here, written scientific reporting), some of the following linguistic resources will have to be activated:

[Highlight the structure of the forthcoming discourse: Introduction]

- In the following, I will write/report about...
- The report is about...
- My topic is about...

[statement of the general goal of the experiment]

- The purpose of the experiment was... to find out whether/in how far/...how much...
- The experiment was to examine/to deal with the question/the issues) of...
- In the experiment I looked at...
- We were asked to observe... /find out...

[name necessary subtopics like: setting up of the experiment, carrying out/performing the experiment, observing and documenting the results; each point introduced by means of paragraphs with cohesive devices: contrary to oral presentations (see 5.3.4.1 above) the use of a predictable sequence (such as *firstly, secondly, thirdly*)... is also acceptable]

- first of all, first, to begin with, etc. was set up...
- next, then... sth. was started/initiated...
- the next step was
- ...An observation sheet had been prepared for...
- It could be seen/observed that...
- As a result (we can say/we have...)/ It showed that...
- Finally,..., etc.

[announcement of the success/failure of the experiment and/or of the end (of the report)]

- So, the experiment was...
- As to the goal of the experiment,...
- The experiment showed that...
- To conclude, to finish, in conclusion...

Inventories of this type may be common to different languages and to different disciplines in some respects, but they necessarily comprise language-specific realisations owing to their morphological and syntactic structures and the diversity of discursive forms in the classrooms, in a country, in a discipline.

6. Summary and Perspectives: Thresholds and stages of development

So far we have looked at language competences involved in science teaching and learning in general and made suggestions how to identify and describe them for use in the classroom and for curriculum planning. We did not deal with issues of how these language competences can be taught in a systematic way, integrated into the teaching of subject-based knowledge. Nor did we deal with issues of quality in mastering these competences (levels of performance, levels of expectation, defining standards or thresholds) nor with different stages of development in working towards and reaching the set goals (in view of age and/or school grade). This would require some developmental model in relation to an unfolding set of linguistic competences over time. In the past, we have rather concentrated on describing two particular levels of achievement or points in this process, that of the end of primary education and that of the end of compulsory education, also called ISCED 1 and 2 (= International Standard Classification of Education, developed by UNESCO).

From the categories set out above it will have to be decided by the users and member states which thresholds of knowledge and language skills (concerning science-related discourse types) the learners should possess, according to:

- expected levels of proficiency (OI, OP...)
- types of discourse to be mastered (for reception or production)
- cognitive operations or discourse functions which they must be able to recognise or deliver
- forms for delivering the above, which they must know how to handle correctly and appropriately.

In the long run, only empirical studies of the applications of these forms in real classrooms and under real production conditions (e.g. formal tests or examinations by learners who have taken courses of this kind) will show whether the results hoped for are actually achieved and whether the expectations and demands laid down in curricula were met and justified. But these and other issues will have to be dealt with in a separate paper.

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