CLIL in Natural Science Subjects: language and task

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Artikulu honen lehenengo zatiak Bigarren Hezkuntzako Biologia, Fisika eta Kimikaren hizkuntza ikertzen du eta hizkuntza hori identifikatzeko bideak iradokitzen ditu. Artikuluaren bigarren zatiak, zientzia-gai hauek bigarren hizkuntza baten bidez ikastearen inplikazioak deskribatzen ditu, bereziki ikasgelako ataza edo zereginen diseinuari dagokionez.

Giltza-Hitzak: Eduki eta Hizkuntza Integratuko Ikaskuntza (CLIL). Ikasgaiaren berariazko hizkuntza. Curriculumean zeharreko hizkuntza. Ataza edo zereginen diseinua. Hitz-maiztasuna. Ingeles bidez zientzia ikastea. Hizkuntza akademikoa. Hizkuntza-laguntza.

La primera parte de este informe estudia el lenguaje propio de la biología, la física y la química y sugiere diferentes maneras que permiten identificar dicho lenguaje. En la segunda parte se describen las implicaciones que tiene estudiar estas materias científicas a través de un segundo lenguaje, como un método específico de enseñanza.

Palabras Clave: Aprendizaje Integrado de Contenidos e Idiomas (CLIL). Lenguaje especializado. Lengua interdisciplinaria. Método específico. Frecuencia de palabras. El inglés en las ciencias. Lenguaje formal. Soporte lingüístico.

La première partie de cet exposé examine le langage des sciences biologique, physique et chimique secondaires et avance différentes manières de l'identifier. La seconde partie du rapport décrit les possibles conséquences dérivées de l'apprentissage de ces matières scientifiques à travers un deuxième langage, comme une méthode d'enseignement spécifique.

Mots-Clés : Apprentissage Intégré d'un Contenu et d'une Langue (CLIL). Langue spécialisée. Langue interdisciplinaire. Méthode spécifique. Fréquence de mots. L'Anglais dans les sciences. Langage soutenu. Support linguistique.

This paper explores language in the natural science subjects of Biology, Physics and Chemistry in the secondary curriculum, outlines ways for identifying this language, where to look for it and how to record it and makes suggestions about what the implications are for second language learners of these science subjects in terms of task in the classroom.

The background to this paper is one where the author carried out research of numerous secondary science textbooks, curriculum documents and made use of transcripts of video recordings of English-medium and mother-tongue Science lessons. The discourse analysis which was the result of this research ultimately fed into the writing of a vocabulary resource for second language learners of secondary science subjects (Kelly, 2008).

– Which language?

The author identifies three levels of language for discussion in the science lesson. Firstly, there is the *subject-specific* language of the science subject. This language is the language science teachers would describe as indespensible for learning a science subject. For example, within the Biology topic of 'cells and tissues', Biology teachers might be justified in claiming this topic cannot be learned without knowing the term 'epithelial'. These subject-specific terms tend to be the noun phrases which make up the core concepts of the science subject. Occasionally, but not always, these terms can be found in overview sections of curriculum documents of the topics being studied in the science subject. Students invariably spend a lot of their time learning this subject-specific language and it is often the case that assessment of student knowledge involves reproduction of this language. A second level of language in the science lesson is the *general-academic* language which occurs. This general academic language is also sometimes described as cross-curricular language or language which is not solely the domain of one curriculum subject but is met in many subjects studied. An example of this might be the language of 'cause and effect'. It is reasonable to assume that this language would occur in a number of subjects across the curriculum and not just science.

The third and last level of language in the classroom is the *peripheral* language of the classroom. This language is the teacher's language of management for the lesson, it is the 'chat' between students and between students and teacher, it is the incidental language around the language of learning and the subject. On a further level the general overall language of the teacher can be classified in this area in that the general level of language of the teacher creates the general language environment of the classroom.

The paper is divided into three sections which broadly represents the three levels of language described above.

1. SUBJECT-SPECIFIC LANGUAGE

Which words should we be learning?

Fig. 1. Word frequency and usage

- 750,000 – words in English
- 650,000 – words in OED
- 40,000-45,000 – used by average speaker
- Every 12th – 'the'
- 2,500 = 80% of all words we use
- 7,500 = 90% of all words we use (star words)
- 10% = the rest, topic specific (black words)

(Fox G unpublished)

According to Fig. 1 there are roughly three quarters of a million words in the English language. There are 650,000 of these words in the OED. An average native speaker of English uses between 40,000 and 45,000 words. Every twelfth word we see and hear in the English language statistically is the word 'the'. All of this information is out there for us to find out and know, and good dictionaries today offer information about usage of words. The Macmillan advanced learners' dictionary (Macmillan Education, 2007), for example, identifies the 2,500 most frequently used words in the English language with three red stars. These words make up 80% of all the words we use in our daily lives. The words between 2,500 and 5,000 are given two red stars and 90% of all the words we use comes to a sum total of 7,500 words, one red star. All of the rest of the three quarters of a million words are 'black words'.

Clearly, information about frequency and usage is useful for teachers and learners of foreign language when thinking about what they need to teach and learn and when. The data given above, however, ignores the very specific language characteristics of the foreign language science classroom. It goes without saying that this science classroom will have many, many black words in it.

How much do we actually know about this language and its use in the science classroom?

What follows is an extract from a general science text to do with hygiene and infection.

Try to do the task which goes with the text:

Task 1 - Identify the 'black' words in the text below, there are 12 of them.

Infections

Food and water are sources of infection. Raw food is covered in microorganisms. Most are harmless or do the body good. They grow in our intestines and protect them from more harmful germs, but others cause disease, especially if food's been contaminated by sewage or animal waste, or hasn't been cooked properly. Contact with animals also exposes us to new microorganisms. A bite from an infected dog could lead to rabies, for example. While cleaning out a lizard's cage could lead to salmonella.

(see answer key at end of article)

One way of gathering qualitative (use) and quantitative (frequency) information about this language is to analyse the discourse of the secondary science classroom. This means investigating the language of the science textbook, the classroom and the science teacher and learners themselves. Recording language use and frequency in the classroom is a time and energy consuming business, but it is only by carrying out such research that we can be certain that we are offering second language learners of science the right language at the right time. Language can be recorded using audio recording equipment, by video recording lessons and by transcribing the language used. Another less time-consuming, but no less simple way to start to carry out such an analysis is with concordancing software and with electronic text versions of textbooks. The following table shows the top one hundred science words from one integrated science textbook (Chung-Harris, 2005).

The numbers alongside the words in Fig. 2 indicate the word frequency, that is how many times the word appears in the book. It is no surprise to see that the word 'the' is top of the chart. It is also predictable that the words are mainly function words with very few technical or specific words. 'Water' is the first word in the top twenty which we might label as a content word. These concordancing lists become interesting when we begin to filter them for specific parts of sentences. An example is given in Fig. 3.

With information like this the teacher can begin to see accurately which verb phrases occur in the textbook for specific science purposes and begin to make decisions about the importance of the phrases in terms of their frequency in the subject.

The next step in the process is to have the software produce lists of contextualised sentences of specific verb phrases. This is shown with the verb phrase 'form' in Fig. 4.

Fig. 2. Top 100 science textbook words

16205 the	632 used	347 some
6989 of	628 at	347 their
5218 and	**626 blood**	340 plants
5192 a	608 not	339 may
4454 to	588 page	337 make
4410 in	582 your	337 up
4269 is	544 body	331 we
2315 are	544 so	324 all
1724 that	540 if	319 does
1557 water	526 have	305 surface
1555 as	**515 light**	304 between
1420 it	514 explain	302 give
1347 which	510 food	297 different
1279 for	488 also	292 because
1256 from	481 into	292 soil
1158 or	471 through	292 where
1143 be	453 use	288 very
1132 on	442 one	271 was
1118 what	440 why	268 many
1079 this	411 called	267 but
1045 figure	407 these	264 out
1032 with	**405 temperature**	253 object
1027 by	**399 cells**	253 them
969 can	398 such	252 force
940 you	390 more	250 then
913 an	386 do	249 its
807 will	381 other	**240 oxygen**
767 energy	375 there	240 system
755 they	373 has	237 during
735 when	358 each	237 using
675 air	357 two	230 after
665 science	353 heat	230 cell
640 how	350 than	230 would
		229 plant

Fig. 3. Concordancing verb list

4269	is	2315	are	1143	be	807	will	632	used
526	have	514	explain	411	called	386	do	373	has
339	may	337	make	319	does	302	give	271	was
252	force ***	237	using	230	would	217	made	207	see
199	need	188	should	184	cause	181	place	179	move
162	formed	149	effect	146	form ***	142	control	132	get ***
124	produce	122	changes	122	uses	121	needed	120	able
111	been	109	contains	109	did	109	reduce	108	contain
105	causes	103	means	103	take	102	become	102	required
100	makes	94	caused	94	leaves	94	test	93	change
91	being	90	describe	90	increase	89	following	89	keep
89	prevent	87	occur	86	happens	85	effects	85	pass
85	released	85	supply	83	passes	82	could	81	record
81	remove	80	making	80	provide	79	shows	78	affect
78	grow	77	identify	77	infected (black)	77	stored	75	eat
75	lift	74	given	74	help	72	known	72	line
70	done	70	find	68	becomes	68	live	67	occurs
67	reading	67	taken	66	due	66	look	65	removed
63	converted	62	produced	62	produces	61	increases	60	placed
60	transfer	59	takes	58	allow	58	lower	58	try
57	draw	56	decay	55	begins	55	forms	55	moves
55	pull	55	start	54	turn	53	broken	53	gives
52	said	52	treated	51	heated	51	involves	51	lost
51	spread	51	stop	50	add	50	break	50	measure
49	cool	49	had	49	passing	49	shape	48	breathing
48	complete	48	getting	48	release	48	transmitted	47	causing
47	dilute	47	feed	47	happen	47	inclined	46	absorbed

Fig. 4. Verb phrase form

```
form
   33    system, transmitted in any/form or by any means,
  381            25/Seed and fruit formation 25/Fruit and seed
  421 8/How are gametes (sex cells) formed? 69/Comparing the
  615 49/What is soil and how is it formed? 350/Components in the
  652   /30 Energy and machines/384/Forms of energy and energy
  763       ./The specially created format is the same for all of
  897   carbon dioxide and water to form glucose (food)./
 1128  represented by the following formula equation:/C6H1206 + 02
 1133 smaller molecules combined to form larger/ones within the
 1147    of stool (defecation) is a form of/excretion, but this is
 1281  cells,/usually result in the formation of toxic by-products
 1362 however the new bud begins to form a bud of its own before
 1369    ./How many bacteria can be formed from a/single one after
 1393 a human. Each cell divides to/form eight new cells which
 1408  /cause/dysentry or/Entamoeba/form cysts which are/excreted
 1463       this way. The young are formed/inside the mother's
 1471      ./The spores are usually formed inside a spore case
 1472    mass of fine threads which form/the body of the mould.
 1511    wet season, and roots that form on the lower/organs?
 1517         where the new/corm is formed/swollen stem filled/
 1569    and contractile roots that form underneath the horizontal
 1571    of the rhizome may grow to form new lateral rhizomes (
 1591 potato root/tubers./new shoot/formed at top/of main root/
```

With this list available it is relatively straightforward for the teacher to see information about the many characteristics of root words in subject-specific texts. Sentence can be collected which show which prepositions are commonly used with the verb phrase and for what purpose; we can see if there are irregular verb forms, we can see if the word is used in other grammatical forms such as nouns, adjectives, adverbs and what other words collocate with the word being investigated. All of this information is valuable for the teacher when planning how to deal with language in the subject classroom.

Two pieces of simple free downloadable software for concordancing are given below:

- SCP – Simple concordancing programme
  www.textworld.com/scp
- SWF – Searching for words in files
  www.factworld.info/computers/SWF/SWF.htm

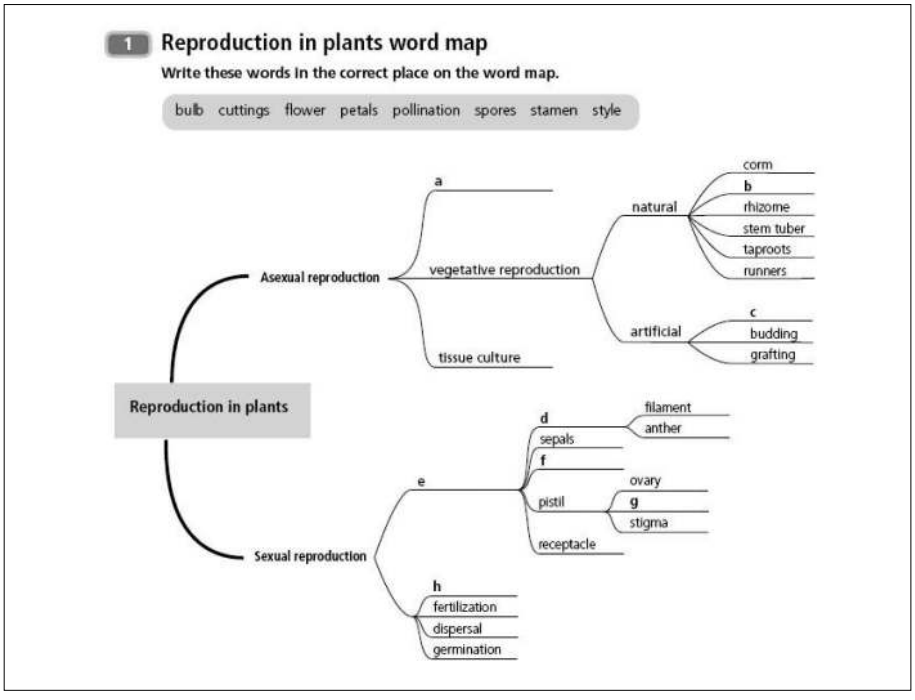
1.1. Organizing language

Once decisions have been made about which language to focus on in the subject classroom, there are decisions for the teacher to make about *how* to present the language to learners. One simple approach to presentation is to give learners word maps which reflect hierarchical and relational connections between words such as the one in Fig. 5: Plant reproduction word list (Kelly, 2008).

Fig. 5. Plant reproduction word list

Plant Reproduction:	pollination
	spores
asexual	stamen
sexual	style
cuttings	budding
vegetative	grafting
tissue culture	fertilization
natural	dispersal
artificial	rhizome
corm	stem tuber
bulb	taproots
germination	runners
sepals	filament
pistil	anther
receptacle	ovary
flower	stigma

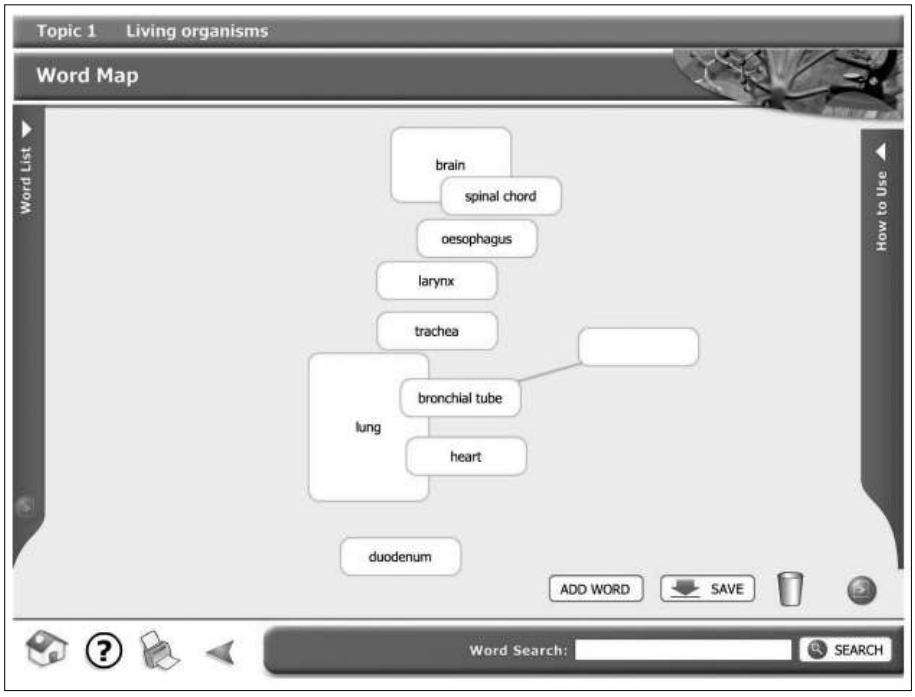
Fig. 6. Plant reproduction tree diagram



Students frequently spend a lot of time and effort trying to create links and relationships between subject terms in their attempts to memorise them. It is a simple job for the words to be organized logically before the topic is studied and the resultant diagram being exploited for content and language work. Fig. 6: (Kelly, 2008) presents a tree diagram based on the wordlist from Fig. 5.

Not only is the tree diagram a good aide memoire for learners overloaded with new vocabulary, it is also a good structure in this particular context for developing the language of classifying and naming and attributing parts of plants. Clearly materials like these support the language load, but also offer instruments for learning. Similar tools are software which allow learners to create their own tree diagrams like the one shown in Fig. 7: *Word mapping software* (Kelly, 2008).

Fig. 7. Word mapping software



In some contexts where Science is taught through the medium of English, the learning can be reduced to simply learning words when learners are struggling to cope with the heavy word load. Science learning is clearly more than just the sum of all of its words.

Part 1 Summary:

– It is helpful for teachers to be aware of which words are used most and least in their subject. This means knowing about the other parts of the sentence apart from noun phrases.

– Subject specific vocabulary in the form of glossaries are useful as they can focus on:

- Pronunciation
- Translation
- Contextualisation

– Subject specific vocabulary can also be made accessible and is easy to organize in a form which reflects the subject with word maps such as tree diagrams.

Further reading:

Tony Buzan - http://www.buzanworld.com/
Keith Kelly - Macmillan Science VPS, 2008
Jim Scrivener - Learning Teaching, Macmillan, 2005, Chapter 11 - Lexis

2. GENERAL ACADEMIC LANGUAGE

When learners are asked to say or write in their content subjects in a foreign language there may be a need for them to have access to language beyond subject-specific vocabulary. This language is the language of the curriculum and is a general academic language which may appear in many subjects and be specific to no single one subject. A clear example of this can be seen in Fig. 8 (Clegg, unpublished).

Some coursebooks may have extracts of language like this, but what is needed is a thorough inventory of the general academic language of the subject made available to learners for the specific tasks they are asked to do in their subject lessons. This language is not hidden, but it does need identifying and made explicit to learners in their materials. One place to look for this language is in the curriculum documents which inform classroom teaching. Fig. 9 is one example.

The specifications also describe in linear text what is expected of learners in terms of the skills given in the extract in Fig. 9. For example, **Grouping and Classifying**. Separating and grouping objects or phenomena into categories based on certain criteria such as common characteristics or features.

This curriculum document is extremely useful for teachers in that it actually tells us what the language functions are that we will need to use. Learners will put objects into categories according to common characteristics or features. Sadly, what it does not do is explicitly provide the teacher with samples of language, phrases which exemplify this area of critical thinking in Science. The curriculum specifications are in need of an extra column which goes alongside the thinking skills and offers teachers examples of phrases such as those found in Fig. 8 and it needs to be done for the whole of the curriculum. In this way, teachers can then offer a model to learners of parts of the whole of the sentences they are expected to produce.

Fig. 8. The language of thinking (Clegg, unpublished)

<table>
<tr>
<td>2 Classifying:

Teacher questions:

How would you classify …?

How many kinds of … are there?

Who can classify …?</td>
<td>Statements:

<table>
<tr>
<td>There are</td>
<td>three</td>
<td>kinds
types
forms
classes
categories</td>
<td>of</td>
<td>……</td>
</tr>
</table>

<table>
<tr>
<td rowspan="2">……..</td>
<td colspan="2">fall</td>
<td rowspan="2">into</td>
<td rowspan="2">three</td>
<td rowspan="2">kinds
types
classes
categories</td>
</tr>
<tr>
<td>can be</td>
<td>divided
classified</td>
</tr>
</table>

We / you / one can classify … according to …criteria
This class has … characteristics / features</td>
</tr>
</table>

Fig. 9. Extract from Malaysian Curriculum Specifications

Scientific Skills	**Thinking skills (Critical and creative)**
Observing	**Critical thinking skills:**
Classifying	Attributing
Measuring and using numbers	Comparing and contrasting
Inferring	Grouping and classifying
Predicting	Sequencing
Communicating	Prioritising
…	…
Thinking strategies	**Creative thinking skills:**
Conceptualising	Generating ideas
Making decisions	Relating
Problem solving	Making inferences
Reasoning	Predicting
	Making generalisations

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Fig. 10. Making curriculum language explicit

Stage	Curriculum area	Activity	Functions of language which may be used	Structures of language which may be used
Primary 4/Year 4	PE	Groups to plan and implement sequences of movement involving rolling	Planning, giving instructions, evaluating, suggesting, expressing position, explaining	I think we should . . . If you do a (forward roll) I could do a . . . That's better than . . . Maybe we could . . . I'll stand behind . . . You need to start here.
Secondary 2/Year 9	Art	Reporting on a visit to a gallery	Expressing likes and dislikes, comparing, evaluating, agreeing and disagreeing, identifying	My favourite was . . . The (Van Gogh) was more (colourful) than the . . . I didn't think the (Picasso) was as (realistic) as the . . .

Smyth (2003) suggests this language identification is an essential part of the teachers' job in working with children for whom the curriculum is in a foreign language. Fig. 10 shows how samples structures can be plotted alongside functions, task and subject area. It is only a small step to then create ways of embedding this language within the tasks themselves and furthermore use the language to feed into the assessment process.

There is very little of this delivery of language in any of the literature on the market today and if publishers are to provide teachers with the instruments they really need for working in integrating content with foreign languages, they still have a lot to do in this area of materials provision. Ideally, textbooks would have a language section which offers core functions and language for each unit of topic of the book in the same way that we are now beginning to see glossaries of terms in some textbooks.

One example of this form of 'language support' is shown in Fig. 11.

Fig. 11. Expressing physics formulae as sentences

The volume of a rectangular block	equals is is equal to	the length mass volume mass the distance moved distance moved in a particular direction *m* gain in velocity mass	times over multiplied by divided by	the width times the heigth. volume. density. density time taken. *a* time taken acceleration.
Density				
Mass				
Volume				
Average speed				
Average velocity				
F				
acceleration				
Force				

This language is given in the form of a simple substitution table where students are expected to make a sentence to express a given formula in Physics. The point is that it is impossible to make a grammatically incorrect sentence, and this leaves the learners free to attempt to get the content right. There are many ways of providing this kind of support for learners, whether it be on the page of the textbook alongisde the task (the ideal place for it), in the form of a handout, as a poster on the wall, in a booklet of subject-specific function language, as models from the teacher orally or on the board and many others.

There is a drastic need for such materials in textbooks in CLIL contexts. It should also go further than the provision of general academic language and include language functions which are specific to curriculum subjects like the example given in Fig. 11.

Part 2 Summary:

It is possible to identify cross-curricular language which is important for subject lessons and provide it in an accessible form to learners so that they can produce extended utterances and make sentences to fulfill content tasks.

It means that there is a job to do in task design for the teacher, or publisher, to identify this language and embed it in content tasks.

This can be done among others with:

- language handouts (with substitution tables)
- on-the-page phrase boxes
- wall posters
- teacher modelling
- CALP phrase books

Further reading:
Pauline Gibbons - Scaffolding Language Scaffolding Learning
Geri Smyth - Helping Bilingual Pupils to Access the Curriculum

3. PERIPHERAL 'CLASSROOM' LANGUAGE

The general language of the classroom is another dimension of language input for attention in foreign language content teaching. Teachers give instructions, check comprehension, organize certain tasks such as laboratory work in Biology, use language to maintain order and many others. Teachers may use their own particular style of language, a style of which they may not be explicitly aware. In some CLIL contexts there are cases where teachers may need help in developing their own language to meet the 'demands' of the learners. This means that there is a certain level of language expected from the teacher in order to manage the classroom effectively in a foreign language. This language can be identified according to the function of the language at a given time in the classroom. The language can be scripted if necessary so that the teacher can prepare for managing the class in the foreign language.

Fig. 12. Scripting language for teachers (Kelly 2006)

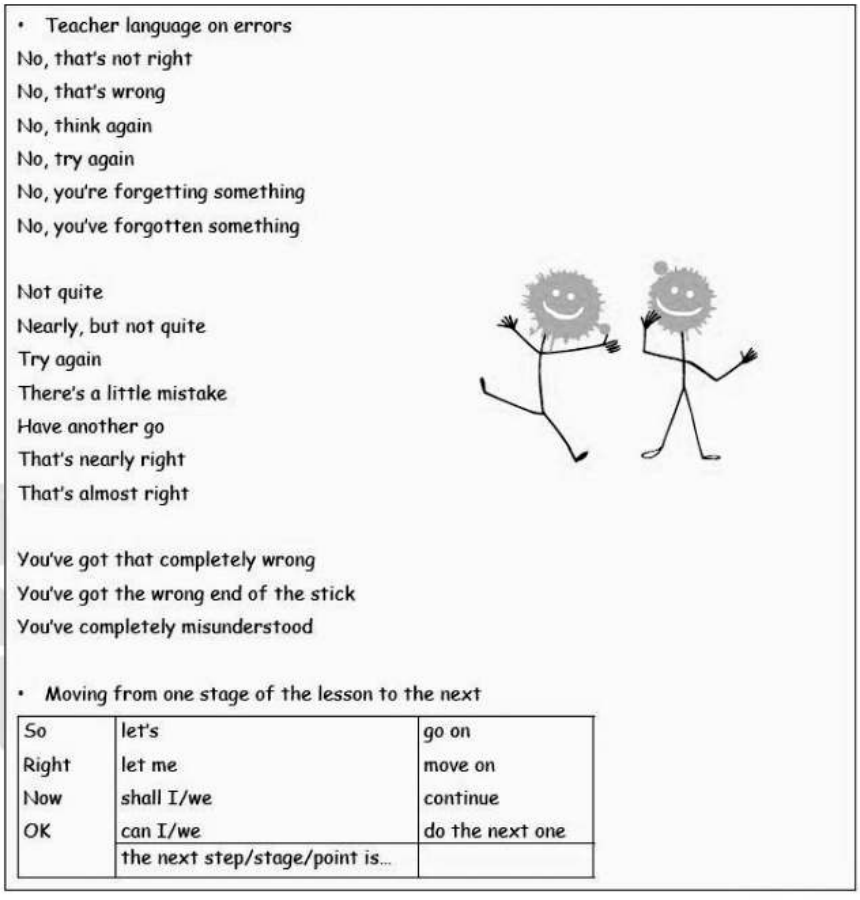


Fig. 12 (Kelly, 2006) gives an example of language support for teachers with a focus on dealing with errors in the classroom.

At the same time, there may be an opposite extreme where a native speaker will need to 'tone down' their language to the level of the learners in the classroom.

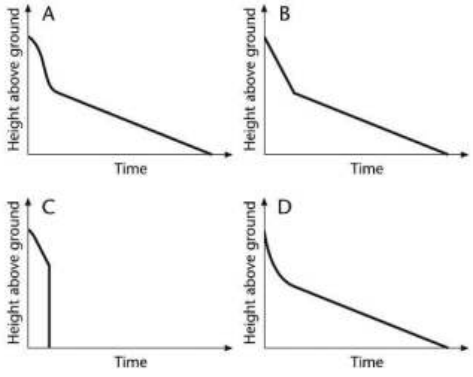
Fig. 13: *Parachute jump* gives a sample task for discussion. Here, we have a task in mathematics where learners are expected to a) make a decision about which is the correct graph depicting the parachute jump being described and b) explain why the other graphs are wrong. The original focus of attention was on identifying the language that learners will need in order to be able to answer the question paying attention to these two areas.

Fig. 13. Parachute jump (SEC QATAR)

5 Generate and solve problems with functions and graphs

5.1 Use a graphics calculator to plot and interpret a range of functional relationships, some continuous and others discontinuous, arising in familiar contexts.

Ahmed does a parachute jump. He jumps out of the plane and falls faster towards the ground. After a few seconds his parachute opens. He slows down and then falls to the ground at a steady speed. Which of these graphs shows Ahmed's parachute jump? Explain why each of the other graphs is wrong.



In an interview with a native speaker teacher about the above question, the following language was recorded in answer to the question.

> MA – Height above the ground over time… We know that when somebody jumps out of a plane that they accelerate at gravitational acceleration which is nine point eight metres per second squared. Now the slope of the graph is the speed that the

person is traveling at and the speed will increase at nine point eight metres per second for each second that they are falling

MA – So the (what am I trying to say here?).

MA – The speed, er, if we had a graph of the speed against time it would be a straight line, so a graph of the height against time should be, erm a parabola, I think, I think it has to be D.

Why are the others wrong, well C is wrong because that would suggest that the height… What does C suggest?

MA – It falls …

KK – It suggests he hits the ground doesn't it … time stops

MA – Well, somehow he manages to go from twenty feet above the ground to zero feet in no time. That's what that graph suggests happens.

KK – Yes, that's C yeah.

MA – B suggests that there were two different phases of falling.

KK – yeah, there isn't a slowing…

MA – Oh, hang on, I haven't read the question properly… He jumps out of the plane, falls fast towards the ground after a few seconds his parachute opens. He slows down, and then falls to the ground at a steady speed. So, it is B, it is B, because the first little bit of the graph is the bit before his parachute opens, the second little bit is the bit after his parachute opens when he's going slower so it's a more gradual decline, he doesn't go through as much, it takes longer to go through the same kind of distance, that means he's traveling slower. A and D both suggest a gradual slowing down, not an abrupt change with the parachute opening.

We can analyse the language on a number of levels. Firstly, let us look at the text from the perspective of the vocabulary.

Fig. 14. Parachute jump vocabulary

Vocabulary	
Subject specific:	**NANS ***
accelerate	now
gravitational acceleration	somehow
slope	suggest
parabola	manage to
at a steady speed	slowing
graph	hang on
General academic:	little bit
phase	abrupt change
gradual decline	
distance	

* Non-academic non-subject specific

We can see three areas of vocabulary: subject specific; general academic and non-academic non-subject specific. We can also look at the text from the point of view of the grammatical structures used:

Fig. 15. Parachute jump grammar

Structures

We know when … that … (which is …)	-relative clauses and conjunctions
The … is the … that … is …	-definitions
If we had a … it would be …	-third conditional
A graph of the … against … should be a …	-modal auxiliary verb for deduction
C is wrong because that would suggest that …	-modal *would* to make statement sound less definite
He goes from … to … in … (time)	-prepositions
… after a few seconds … and then …	-sequencing phrases
… it takes … so … that means …	-concluding
A and D both suggest …, not …	-juxtaposing

It is only by transcribing this language in its entirety that we see the level of complexity involved. There are two issues here. Firstly, the main issue in this section is that the CLIL mathematics teacher will need to think ahead about the language they will use in giving an explanation of a task like the one in this example. It may be that they will need to simplify the structures in their explanation, but not only simplify the language, also deliver it in a way which will enable learners to take it and use it as their own in answering questions by themselves. This will involve careful preparation so that the explanation maintains its integrity, but that it is at the level of language of the learners.

Part 3 Summary:

– Teachers may need help in raising the level of their language to meet the needs of their subject classroom. This can be done by providing teachers with semi-scripts to help them develop their language for specific classroom purposes.

– Teachers may also need to lower the level of their language. This can be done with careful preparation and analysis of tasks and the language needed for tasks in the subject classroom.

Further reading:

Scripting for teachers of Maths and Science

English Language Teaching Centre Malaysia http://www.tutor.com.my/tutor/etems/

English for Primary Teachers, OUP.

4. CONCLUSIONS AND FINAL THOUGHTS

Clearly, there are questions for teacher education in the light of the discussion above. Teachers need an awareness of the language of their subject beyond the noun phrases which make up the concepts of their subjects. In addition they need strategies and techniques for dealing with and making accessible this language for the learners in their classrooms. This paper has only touched on the issue of task design and teacher education and is the substance of a further paper on this topic. Teachers working in a subject through a foreign language will also need considerable knowledge of the general academic language of learning in their school environment and this carries expectations for colleagues to be familiar with the content and language of other subjects in the school curriculum, it suggests that there is a need for close collaboration between subject teachers, and between subject teachers and language teachers to enable learners to have an efficient preparation in the language they encounter throughout the curriculum. Finally, this paper suggests that there is still much for publishers to do to provide for the needs of learners and teachers working in content and language integration. This means that there is a great need for resources written specifically for this target group, for the moment most colleagues and learners are developing their own strategies and techniques for dealing with translated materials, and materials imported from mother tongue contexts. Only a small number of resources written specifically for the CLIL market are in the book shops at the time of writing (Kelly, K., 2008; onestopclil.com).

Key:

Food and water are sources of infection. Raw food is covered in microorganisms. Most are harmless or do the body good. They grow in our intestines and protect them from more harmful germs, but others cause disease, especially if food's been contaminated by sewage or animal waste, or hasn't been cooked properly. Contact with animals also exposes us to new microorganisms. A bite from an infected dog could lead to rabies, for example. Cleaning out a lizard's cage could lead to salmonella.

BIBLIOGRAPHY

CHUNG-HARRIS, T. (2005). *CXC Integrated Science*. Macmillan.

CLEGG, J. (2005). *The Language of Thinking*. Unpublished document.

English Language Teaching Centre Malaysia. http://www.tutor.com.my/tutor/etems/

FOX, G. (2007). Unpublished presentation of Macmillan Advanced Learners' Dictionary. Plovdiv, Bulgaria.

GIBBONS, P. (2002). Scaffolding Language Scaffolding Learning. Heinneman.

KELLY, K. (2006). *Content and Language Integrated Learning*. Lithuanian Ministry of Education and British Council Lithuania. http://www.smm.lt/ugdymas/docs/lkmp/Integruotas-mokymas_internetui.pdf.

——. (2008). "Macmillan Vocabulary Practice Series". *Science*. Macmillan ELT.

Macmillan Educ (2007). "Macmillan English Dictionary for Advanced Learners". *Macmillan ELT*; 2nd Edition.

SMYTH, G. (2003). *Helping Bilingual Pupils to Access the Curriculum*. London: David Fulton Publishers.