23rd Jyväskylä Summer School

Universitat de Girona

Using Language to Teach Science: Researching Classroom communication and Developing Dialogical Approaches

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Outline of the course

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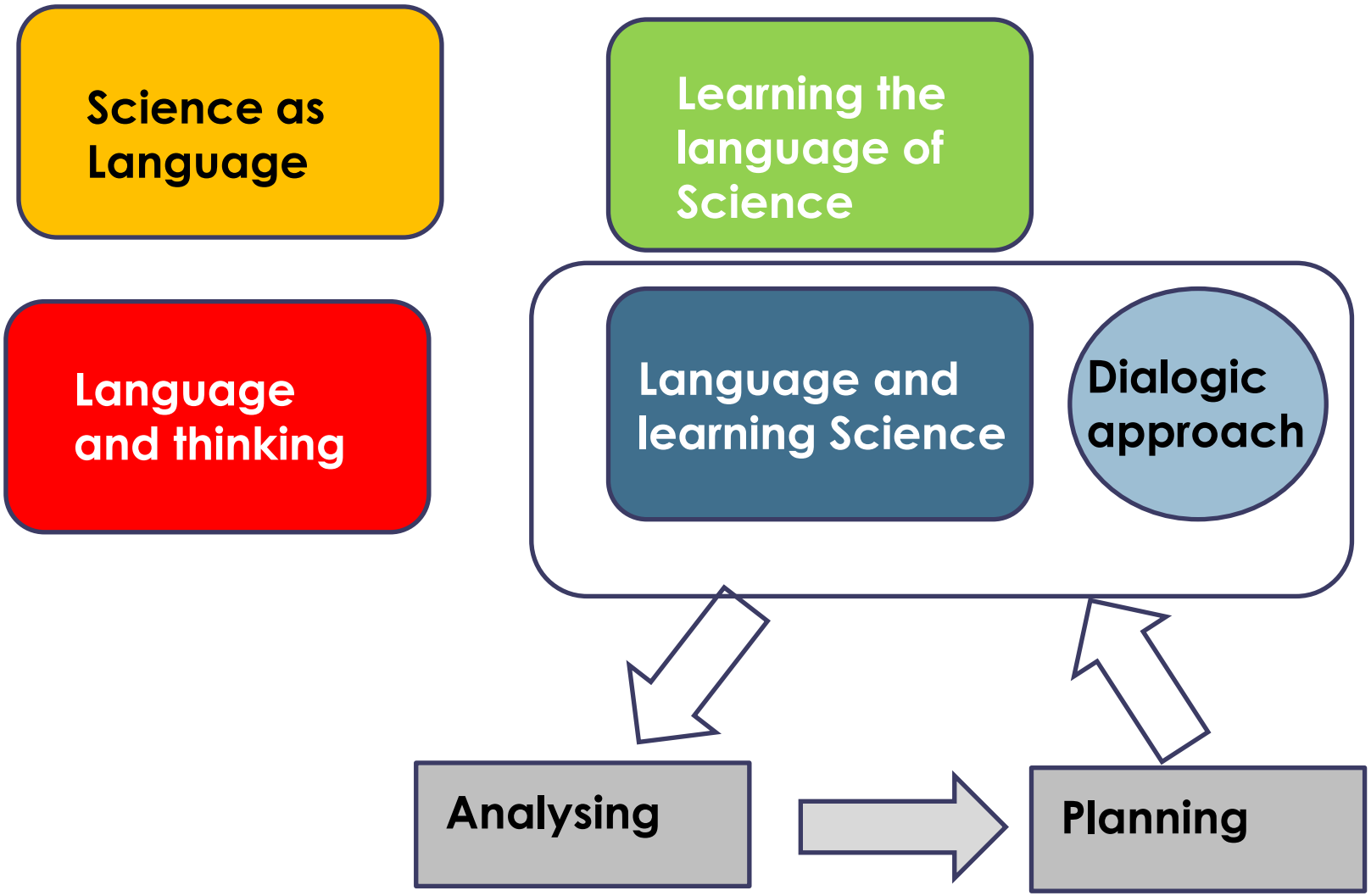

The roles of language in teaching and learning Science

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Language is a fundamental part of the activity of teaching and learning (to many the most important element).

Language plays four main roles in this activity:

a) It provides a lexico-grammatical realisation of the meaning being constructed
b) It provides a series of scientific genres
c) It shapes the interactions among participants (general)
d) It shapes the process of learning science

- **a and b** refer to **what** is being taught-learnt

- **c and d** refer to **how** it is being taught-learnt

Language and Thinking
Communicative approaches

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- All the communicative approaches are needed
- It is essental to have some opportunities for dialogue, but authoritative episodes are also required
- The quality of dialogue is more important than the time devoted to it (interanimation of ideas)
- Teachers know and use all communicative approaches but being counscious of them and planning when to use them makes a huge difference..

Analysing classroom talk:
communicative approaches

Methodological approach

Meaning making focus

- How are ideas developed on the social plane?
- Focus on content *and* nature of interactions

Teaching activity focus

- How much time is spent on different kinds of activity?

- 80% of time teacher centred
- 15% on student practical activities

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Methodology: unit of analysis

Sequence of lessons

↓

Lessons

↓

Episodes

Methodology: unit of analysis

Sequence: units of school science curriculum

Lesson: fixed by school

Episode:

- Each 'episode' addresses a specific teaching purpose, via particular communicative approaches and patterns of discourse.
- Identify the boundary between episodes by looking for changes in teaching purpose.

Data analysis

Qualitative analysis: detailed examination of video recordings, transcript data, students' worksheets and interviews, using AtlasTi to:

a) Analysis of the classroom discourse linking conceptual treatment and discursive practices

b) Trace the students' conceptual development throughout the sequence: learning pathways

Quantitative analysis: *the collocations of key words and the distributions of particular terms or linguistic forms amongst speakers.*

Analysing classroom talk

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Lesson 1
Groups

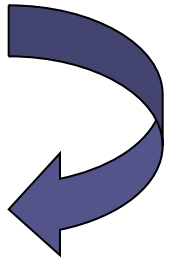
Lesson 1, Episode 1
Non-int./dialogic

Lesson 1, Episode 2
Interactive/dialogic

Lesson 4, Episode 5
Int./authoritative

Lesson 3
Groups

Lesson 2, Episode 3
Int./authoritative



Turning point

Lesson 4
Groups

Lesson 4, Episode 5
Int./dialogic
Int./authoritative

Analysing classroom talk
Communicative approaches

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What are the forces acting on the teapot?

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Communicative approaches

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Teacher: What forces do you think are acting on the teapot?

Pupil 1: There's ***gravity***!

Teacher: Is there? Tell me about that.

Pupil 1: Gravity pushes it down to the surface

Teacher: OK and what do you think? (*turning to other girl*)

Pupil 2: Like….(*comes to a stop*)

Teacher: Are there any other forces….other than gravity?

Pupil 2: No (*shakes head*)

Teacher: No? Just one force acting on the teapot. OK!

Analysing classroom talk
Communicative approaches

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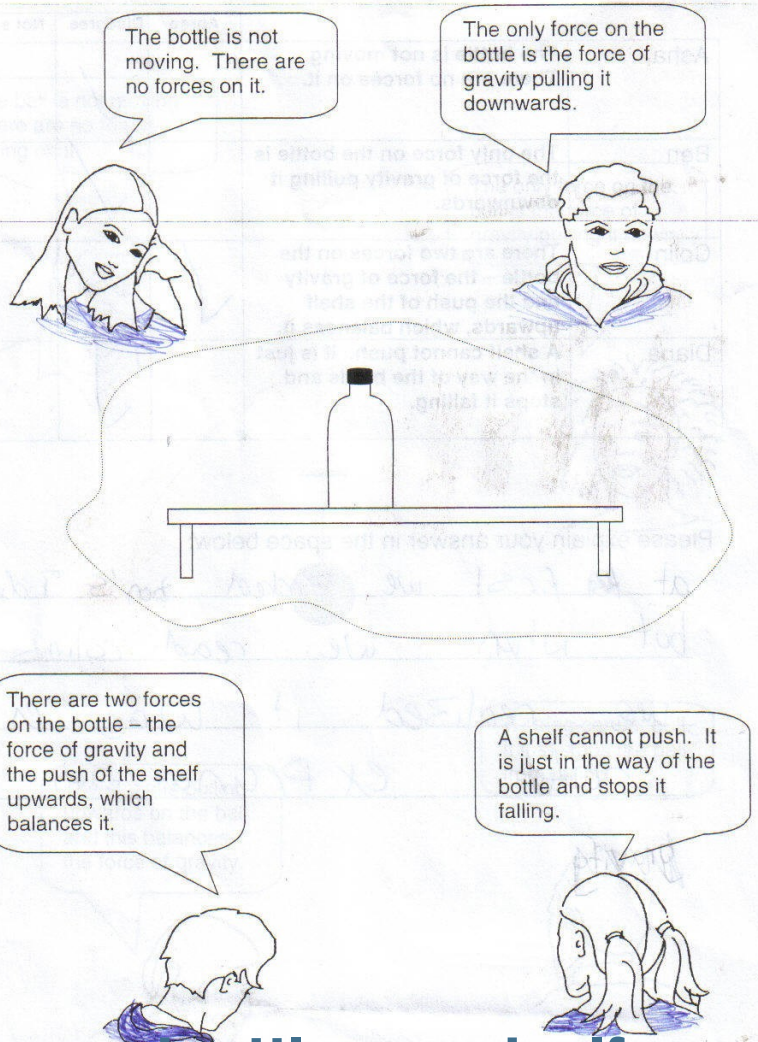
Bottle on a shelf

A bottle is sitting on a shelf. What forces are acting on the bottle?



Concept cartoon: bottle on shelf

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Concept cartoon: bottle on shelf

The bottle is not moving. There are no forces on it

A

The only force on the bottle is the force of gravity pulling it downwards

B

There are two forces on the bottle – the force of gravity and the push of the shelf upwards, which balances it.

C

A shelf cannot push. It is just in the way of the bottle and stops it falling.

D

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'A starting point'

Teacher: Now I was over there with Josie and with Ryan …they were looking at this and I tell you what…they really didn't agree at all…So I'm going to ask them if they can lead off for us and just have a look at some of the ideas they talked about…

Josie: Well like, I don't think that a table can push. Cos gravity pulls, it's a force…but a table can't push upwards, it's just in the way of the erm…that's all.

Analysing classroom talk
Communicative approaches

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Teacher: Right. Let's have a listen to what she's saying there…She's talked about the force that a lot of you have talked about, *gravity*. But the disagreement between the two of them is whether the *table* can *do* anything.

Now I think when I was listening to Ryan that he was here. That there are two forces on the bottle the force of gravity and the push of the shelf up which balances it. And I think that Josie is here. A shelf cannot push it is just in the way of the bottle and it stops it falling.

Now let's use that as a starting point…

Non-interactive/Dialogic

'Anybody else…?'

Teacher: Anybody else like to join in with this one?

Zoe: I thinks it's, erm…there's two forces, because there has to be something that's holding it up that stops gravity pulling it down. So erm, the table must be pushing it up in some way.

Teacher: …so you're kind of going that way [points to view C]. Let's ask some more people..

Interactive/dialogic

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Two days later….

Teacher: I'd like to get you to think about one of the ideas that you really *argued* about on Monday… What was the idea that you were arguing about? Josie was in the middle of this and Jordan was in the middle of this argument. What were you arguing about? Josie?

Josie: That a table can't push up.

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The table is pushing

Teacher: What's he done to the shape of the balloon there Sean?

Sean: pushing it down…

Teacher: He's pushing it down. What's he done to the shape?

Sean: Flattened it.

Teacher: Flattened it. Now, he's only got one hand on there at the moment. Where on Earth is the other force that's changing the *shape*?

Holly: From the table.

Teach: Holly says the *table is* pushing. Levi what do you say?

Levi: I think the table is pushing

Teacher: The *table* is pushing. What do you say Penny?

Interactive/authoritative

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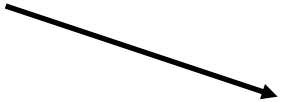
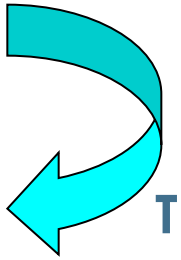
Shifts in communicative approach

Reviewing students' ideas
[Non-interactive/dialogic]



Exploring students' ideas
[Interactive/dialogic]

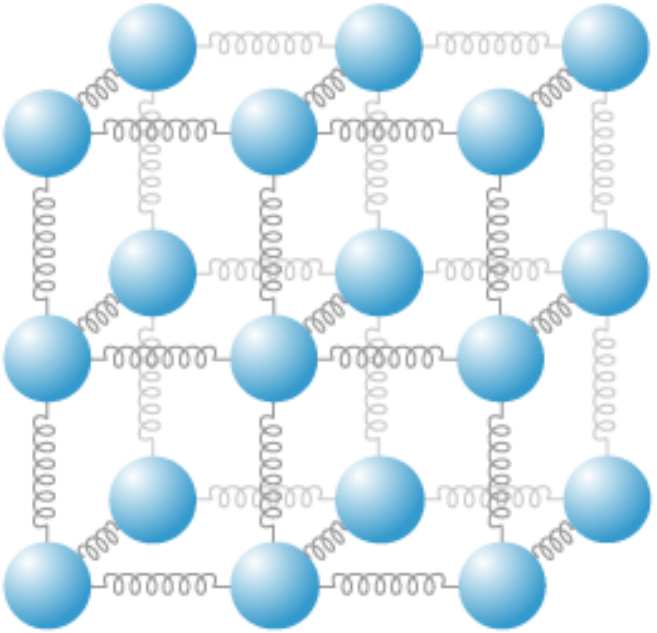


Turning point

Introducing science view
[Interactive/authoritative]

Applying science view
[Interactive/auth.]
[Interactive/dialogic]

Mattress pushes up: as springs are compressed

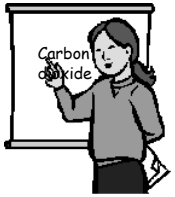


Surface of table pushes up: as atoms are pushed closer together

But…does it work?

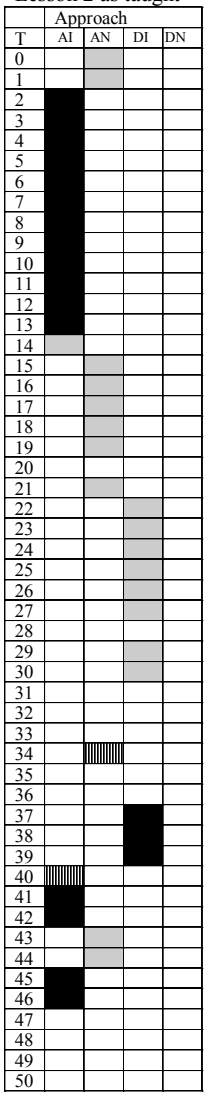
1. Is teaching which includes dialogic interactions likely to be more effective than that which does not?
2. Is this kind of teaching more demanding of teachers…and students?

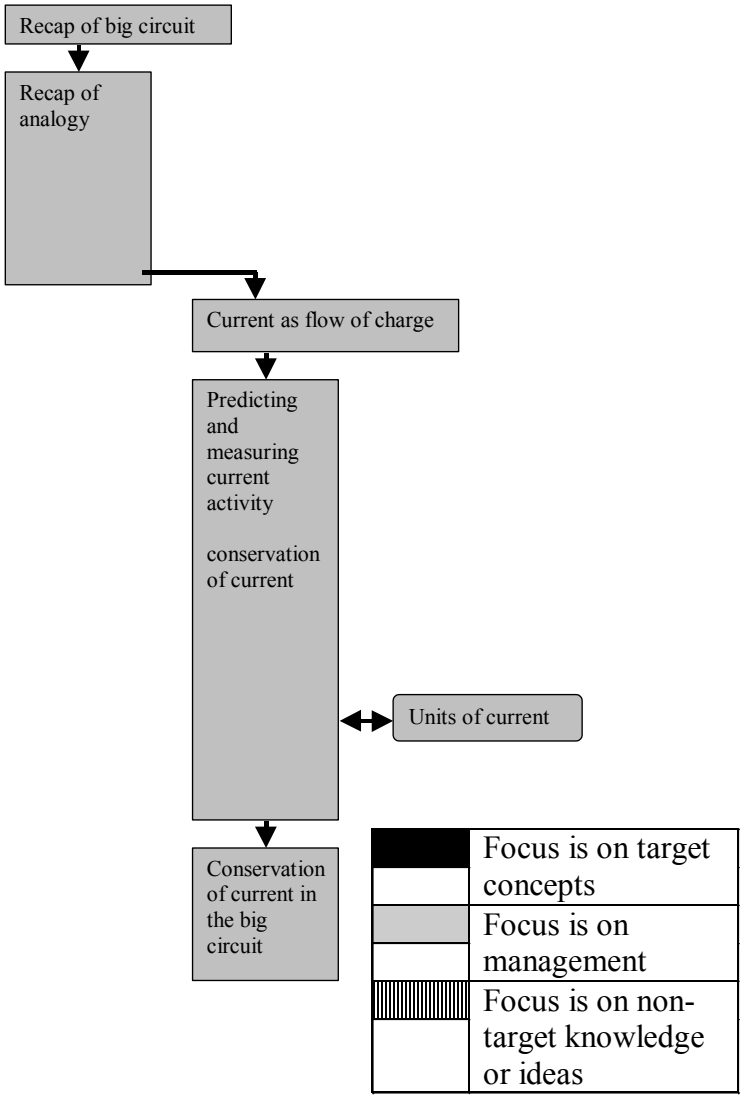
Planning teaching

		The purpose of the talk	How and When it happens
Presenting		You are introducing or reviewing **new ideas** relating to the analogy and to the scientific model.	This may be through a presentation by you or by whole-class discussion led by you.
Discussing / probing		You are finding out about the pupils' ideas and understandings relating to the analogy and to the scientific model.	This may be through asking open questions, 'what do you think?' in whole-class or small group situations.
Supporting		You are supporting the pupils as they talk about their developing ideas, using key questions and offering appropriate responses to their questions.	This is likely to be achieved as the pupils are working on paired or small group activities.

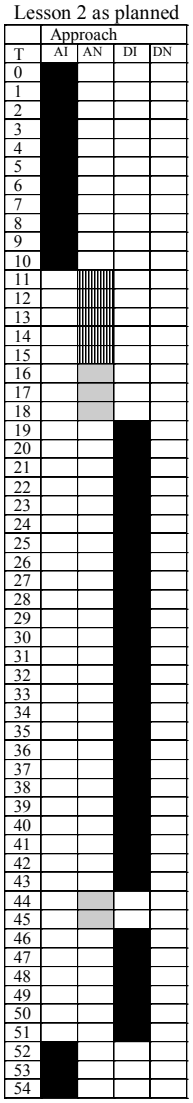
Lesson: as taught...as planned

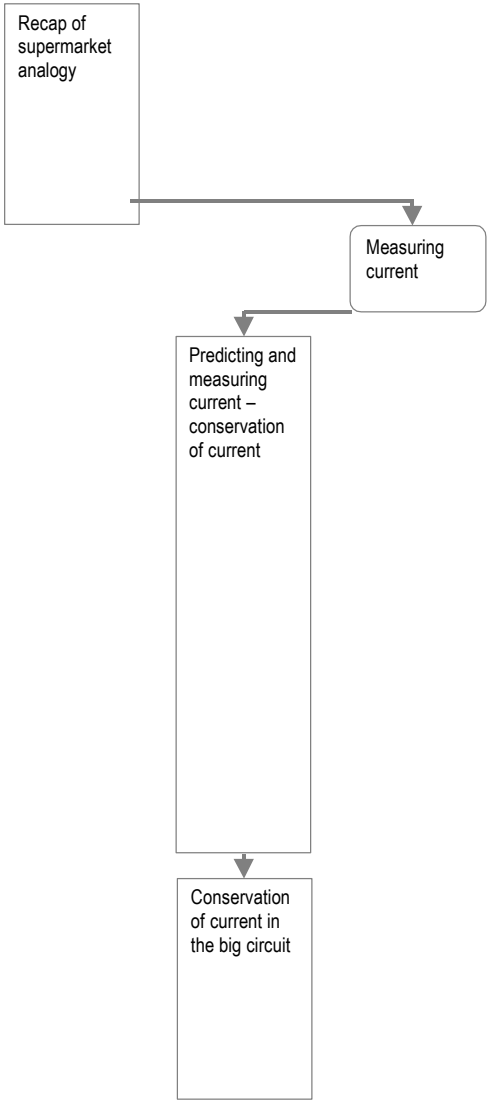
Lesson 2 as taught





Lesson 2 as planned





Findings: 13 case studies

- 4 development and 9 transfer (323 pupils)
- No significant difference between 'experimental' and 'comparison' groups on questions requiring factual recall
- Significantly more pupils in *all* 13 cases offered explanations consistent (or partially consistent) with the taught scientific view.
- Learning outcome differences range from 20% to 74% in all but 2 cases.

And so…

- A systematic approach to planning science instruction involving researchers and teachers
- Precise definition of learning goals
- Attending to teacher/student interactions
- Some evidence of enhanced learning
- Designed teaching approaches as 'worked examples'…of workable detail
- Evidence of effective transfer to other teachers
- A bottom-up approach to teacher professional development….?

Why not just 'tell them'?

Asking pupils' for their points of view:

- Draws them into the problem
- Motivates
- Sets up a question to be answered
- Helps them to make connections…promoting meaningful learning
- Dialogic talking encourages dialogic thinking