

Construing Meaning in Science: Language in a Secondary School Science Class from a Linguistic Perspective

Brian Donovan
Trinity College, Dublin
(donovanb@tcd.ie)



Acknowledgements...


- Dr. Seán Devitt (for supervision, focus and direction),
- Ms. Elizabeth Oldham (for continuous and challenging dialogue),
- Prof. Ruqaiya Hasan (for remote supervision).
- This research is being carried out with the assistance of a scholarship from the Irish Research Council for the Humanities and Social Sciences (IRCHSS).

Structure of presentation

- Does science have a language? If so, what is it?,
- Aspects of lexicogrammar to see how language means what it means:
 - Not 'verb', but Process,
 - Process have Participants,
 - Looking at 'tense' in a new way...
- Extracts and initial analysis,
- Group linguistic analysis,
- Conclusion,
- Questions.

The 'language' of science?

- Does science have a language?
 - Educational perspectives...
 - Linguistic perspectives...
- Specific linguistic perspectives:
 - Cognitive
 - Rhetorical
 - Functional
- Recent moves...
 - Towards gesture and multimodality...



Aspects of language to begin seeing how language means what it means:

- Not 'verb', but Process (and the Process types),
- Each Process type has specific Participant type,
- Looking at 'tense' in a new way...
- I will explain these briefly, and look at examples drawn from the classroom data,
- And then give you the opportunity to identify some aspects of each...



Not 'verb' but Process...

- Six Process types:
 - MATERIAL: typical doing or action.
 - BEHAVIOURAL: based on reaction to something.
 - MENTAL: based on cognition.
 - VERBAL: semiotic act, beyond purely verbal.
 - RELATIONAL: something IS like something else.
 - EXISTENTIAL: something IS.
- Now, I want to show examples from the science class.

Identifying Process types in a science class

- I'm going to attempt to make some carbon dioxide.
- Remember this from before?
- Marble is also called limestone...
- A flask sounds...not too bad.
- Do you know that word?
- you can use it as a recipe to make carbon dioxide
- There is carbon inside the chemical.
- they're just like little stones
- Would you find it in your body anywhere?

Processes and Participants...

- | | |
|----------------|---------------|
| ■ MATERIAL: | ACTOR |
| ■ BEHAVIOURAL: | BEHAVER |
| ■ MENTAL: | SENER |
| ■ VERBAL: | SAYER |
| ■ RELATIONAL: | CARRIER/TOKEN |
| ■ EXISTENTIAL: | EXISTENT |

Identifying Participants from the science class...

- I'm going to attempt to make some carbon dioxide.
- Remember this from before?
- Marble is also called limestone...
- A flask sounds...not too bad.
- Do you know that word?
- you can use it as a recipe to make carbon dioxide
- There is carbon inside the chemical.
- they're just like little stones
- Would you find it in your body anywhere?

Seeing 'tense' in a new way...

- Past, present, future--and beyond...
 - Seeing embedded tenses...
 - ...working...
 - ...going to be working...
 - ...had to have been going to be working...
- First is 'present'
- Second is 'future in present'
- Third is 'past in past in future in present'.

Identifying Tense...

- I'm **going to attempt to make** some carbon dioxide.
- **Remember** this from before?
- Marble **is** also **called** limestone...
- A flask **sounds**...not too bad.
- Do you **know** that word?
- you can **use** it as a recipe to **make** carbon dioxide
- There **is** carbon inside the chemical.
- they'**re** just like little stones
- Would you **find** it in your body anywhere?

Now it's your turn...

- I have extracts from second year science classrooms. The subject being introduced is Carbon Dioxide (CO₂) and the teacher is only beginning to introduce it.
- I have marked the Processes in RED.
- You have three tasks:
 - Identify the Process type from the list given,
 - Identify the relevant Participants,
 - Identify the Tense as illustrated.

Conclusion

- Language is important for three reasons:
 - It is the principle, but not sole, method for teachers to help students construe science in education,
 - Understanding how such construal occurs may contribute to improving student learning,
 - Basing science teaching on understanding 'content THROUGH language' can then allow us to explore more deeply other semiotic modes...
- The goal, however, is to help understand and improve science teaching and learning...
 - Not for everyone to become a linguist... :-)

Questions to ponder...

- Is it time, in Irish educational (and research) contexts, to begin exploring the use of language in science, and other content area, classes?
- Is it possible to move beyond educational lenses for that exploration, and into a linguistic framework?
- Will such a 'linguistic turn'* contribute to, or inhibit, such an exploration among educationalists?



Select references:

- Halliday, M.A.K. & Matthiessen, C.M.I.M. (1999) *Construing Experience Through Meaning: A Language-Based Approach to Cognition*. London: Continuum.
- Halliday, M.A.K. & Matthiessen, C.M.I.M. (2004) *An Introduction to Functional Grammar, 3rd ed.* London: Edward Arnold.
- Halliday, M.A.K. (2004) *The Language of Science* (Vol. 5 in the Collected Works of M.A.K. Halliday, edited by Jonathan Webster). London: Continuum.
- Halliday, M.A.K. & Martin, J.R. (1993) *Writing Science: Literacy and Discursive Power*. London: Falmer Press.
- Lemke, J.L. (1990) *Talking Science: Language, Learning, and Values*. Norwood, N.J.: Ablex Publishing Corporation.
- Martin, J.R. & Veel, R. (1998) *Reading Science: Critical and Functional Perspectives on Discourses of Science*. London: Routledge.



Select references (2):

- Mortimer, E.F. & Scott, P.H. (2003) *Meaning Making in Secondary Science Classrooms*. Maidenhead: Open University Press.
- Osborne, J. (2002) "Science Without Literacy: A Ship Without a Sail?", in *Cambridge Journal of Education*, Vol. 32, No 2, 203-218.
- Yore, L.D., Bisanz, G.L. & Hand, B.M. (2003) "Examining the Literacy Component of Science Literacy: 25 Years of Language Arts and Science Research", in *International Journal of Science Education*, Vol. 25, No. 6, 689-725.