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Multimodal Science and Engineering Teaching: Perspectives from 8ICOM

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Overview

8ICOM / Special issue of *Designs for Learning*

#ScienceMustFall

The editorial

The individual papers

8ICOM

Science education strand at 8ICOM

GAVE RISE TO

Special issue: *Designs for Learning*

Editorial: Is science a western colonial construction that should fall?

Science does not claim to find the 'truth' it simply creates models of the physical world.

The way of judging these models is their power for explaining and predicting physical behaviour.

Any new model must prove itself to be better than the old one.

Science is therefore continually "falling" as one explanation proves to be better than another.

Bernstein's disciplinary knowledge structures

Horizontal and **Hierarchical** disciplinary knowledge structures Bernstein (1999)

Horizontal knowledge structures

Knowledge grows by finding new ways to interpret the world

Not necessary for one interpretation to be coherent with another.

The new perspective is what is important

Knowledge is context dependent and disputed.

Horizontal knowledge structures

Humanities and social sciences are more horizontal

Bernstein likens knowledge production to the introduction of new explanatory languages.

$L_1 + L_2 + L_3 + L_4 \dots$



Expansion of knowledge

Hierarchical knowledge structures

Knowledge grows by explaining more and more phenomena **within the same system.**

Hierarchical knowledge structures

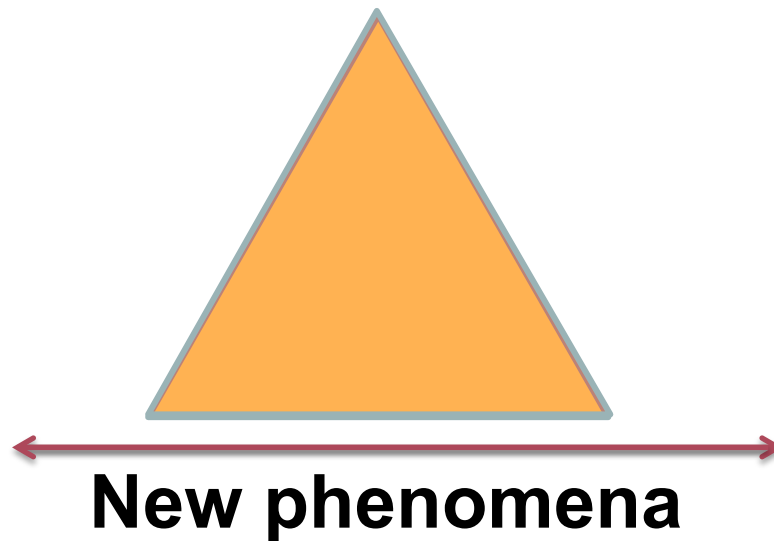
The products of science are hierarchical

A new theory cannot just explain a new phenomenon, it must also explain everything the old theory explained.

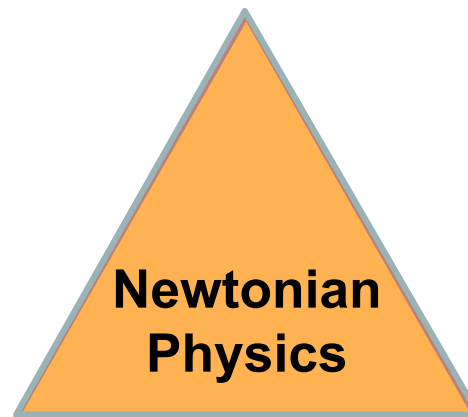
Martin (2011) likens this kind of knowledge production to a growing triangle

Widen the base to include more phenomena in the same explanatory structure.

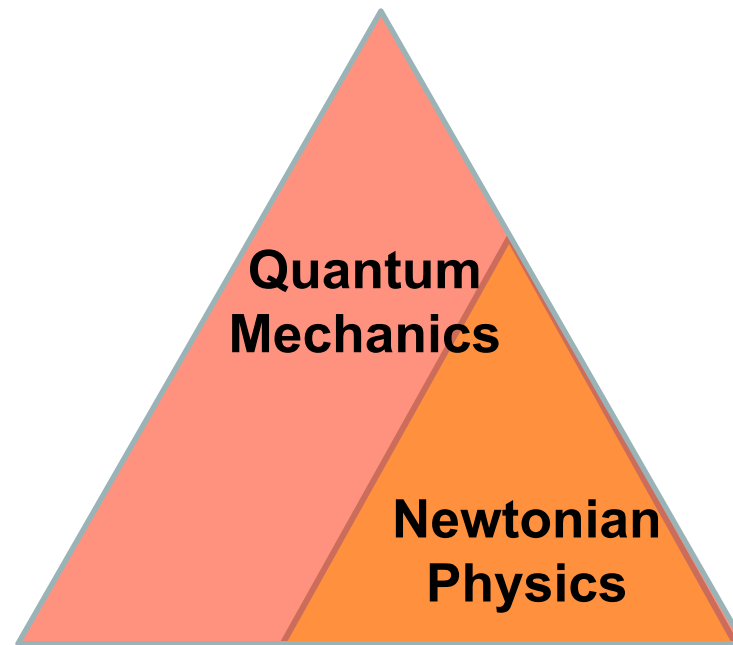
Hierarchical knowledge structures



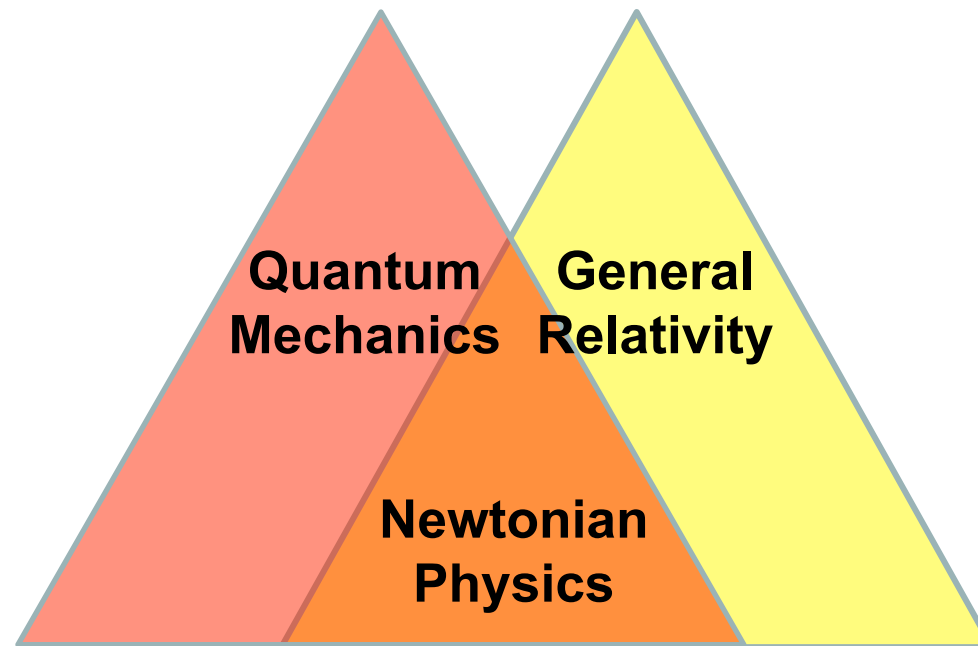
Hierarchical knowledge structures



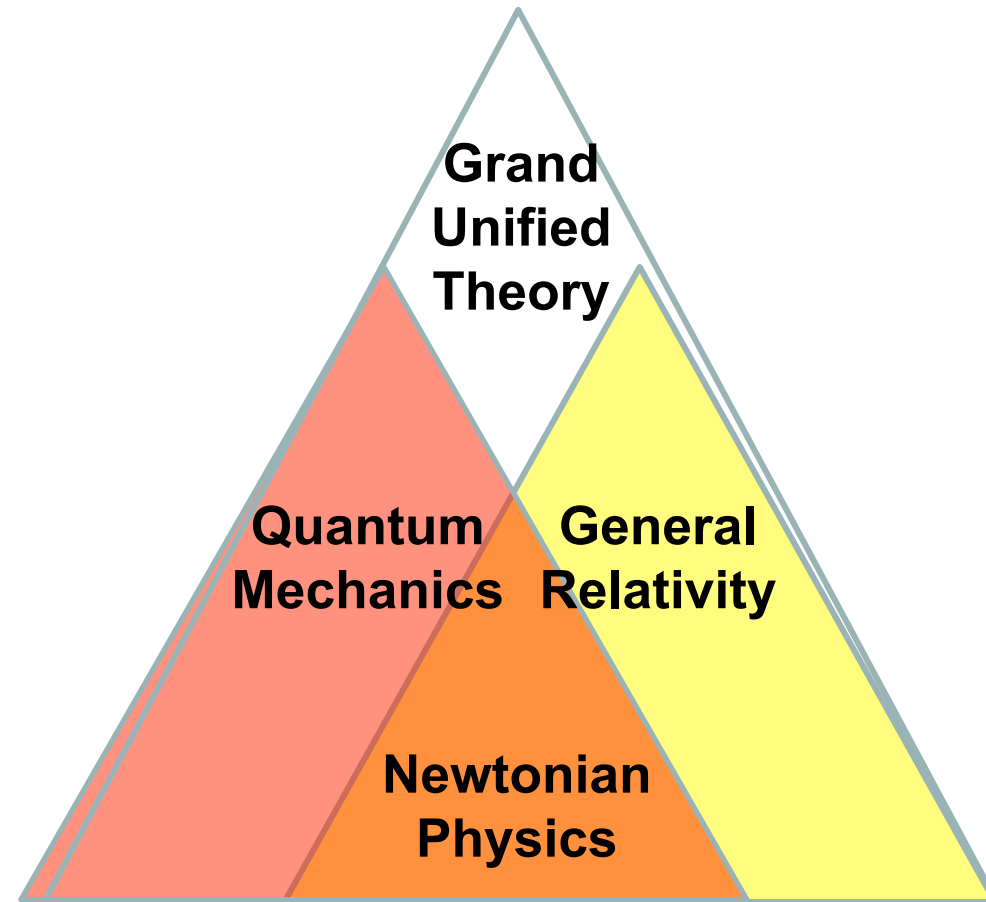
Hierarchical knowledge structures



Hierarchical knowledge structures



Hierarchical knowledge structures



See Airey (2012). Adapted from Lindström (2011)

Why science cannot fall

Science is more than a western construction that can be “decolonized”

Science is by definition open to change and new explanations

BUT: any “new” science must explain everything the “old” science could

What about multimodality?

Science is inherently multimodal

Scientific phenomena are often 'invisible' and abstract

Access to 'science' (it's technologies and modes of representation) is **unequally distributed**

Each of the papers deal with multimodal access to science

What can multimodal social semiotics offer science teaching?

The issue is not that science must be decolonized

Unequal access to science is the problem.

**The papers all deal with representational means by
which scientific knowledge is produced and
disseminated**

The papers

Six papers (7 with the editorial)

All deal with multimodality in teaching and learning science and engineering.

A range of:

Educational levels

Disciplines

Settings

Fredslund Andersen & Munksby

Student generated digital multimodal representations

7th and 8th Grade school students in Denmark

Develop awareness of the affordances of representations

Provide principles for teachers for introducing the multimodal nature of science

Fredslund Andersen & Munksby

Three (four) design principles:

- 1. Introduce activities that raise the awareness of different affordances**
- 2. Hands-on learning by using representations to show science data**
- 3. Produce digital multimodal representations of their learning**
- 4. Evaluate and reflect on what has been produced**

Volkwyn, Airey, Gregorcic & Heijkenskjöld

High school physics students in Sweden

Arrow as a physical coordinating hub

Transduction in physics itself

Transduction in teaching physics

**Transduction as a sign that learning is taking
place**

Airey & Ericsson

- **High school physics students in Sweden**
- **Semiotic analysis of a central diagram in astronomy.**
- **Demonstrate a number of counterintuitive historical anomalies that can cause problems for students.**

Samuelsson, Elmgren & Haglund Dolo, Haglund & Schönborn

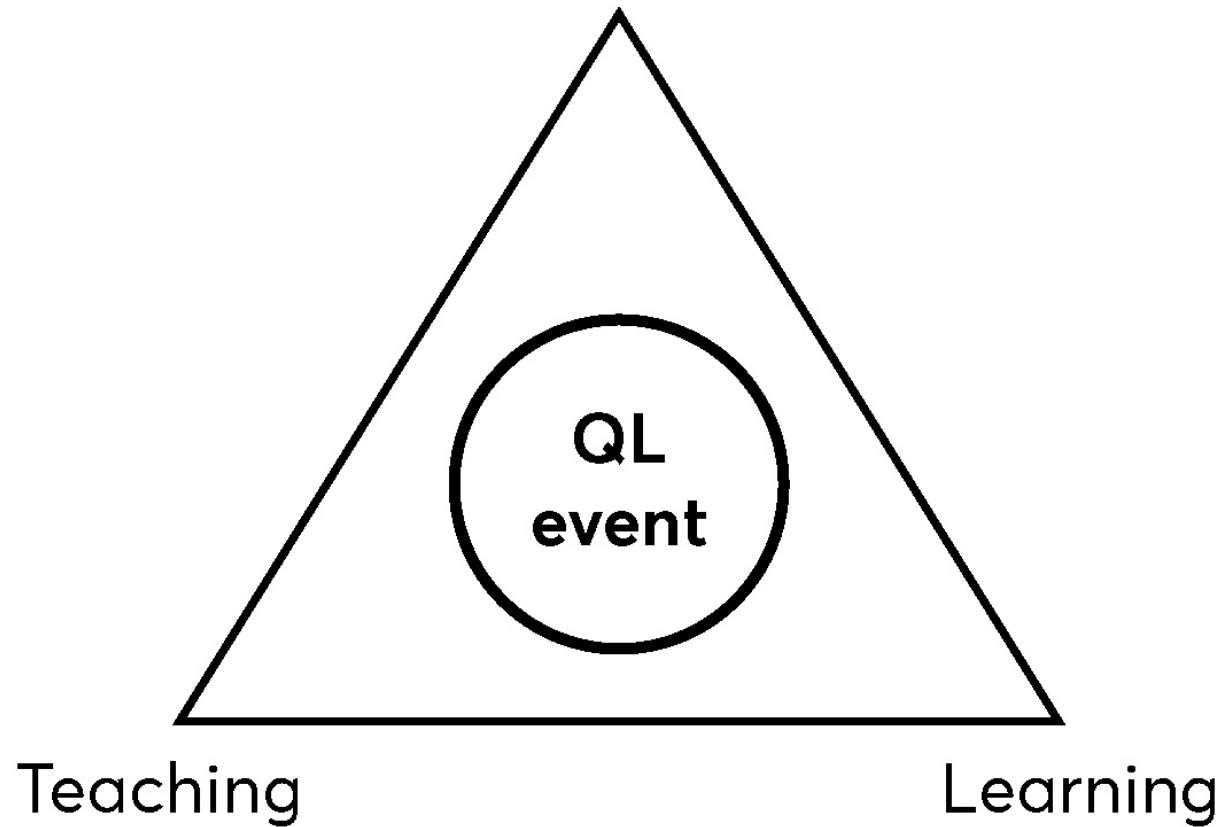
- **Both these papers demonstrate the pedagogical and disciplinary affordances of technology (IR cameras) for science learning.**
- **But, they also show that technology limits action and talk on the part of learners, fixing these in particular ways.**

Simpson & Prince

- **Undergraduate civil engineering university students in South Africa**
- **Traditional frameworks fail to account for possibilities of difference in the texts produced by students.**
- **Teaching and learning events are cultural performances that situate individuals in relation to the scientific phenomena under study.**
- **Artefacts not mere 'tools' that passively represent human endeavour; rather, they 'fix' human endeavour to particular points in time and space**

Simpson & Prince

Frameworks



So what?

- Each of the papers addresses the issue of access to scientific knowledge, with a focus on classroom pedagogy.
- The last begins to look at how dominant discourses/frameworks beyond the classroom equally require attention.
- Access is an issue in the classroom, but is also a global issue in terms of the production and dissemination of science.

Questions and Comments

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