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Coordinating multiple resources to learn physics

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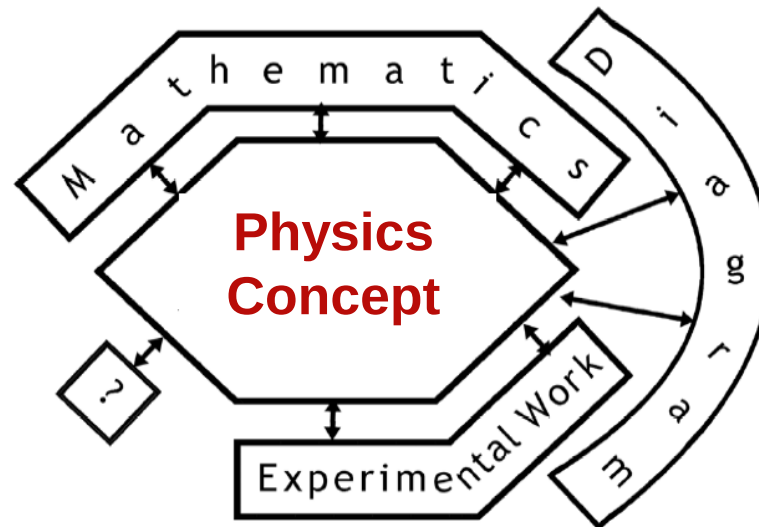


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A critical constellation

- Disciplinary meaning is **distributed** across representations (we use the term **resources** to include physical objects and experimental routines).
- Airey & Linder (2009) suggested students need **fluency** in a **critical constellation** of resources.

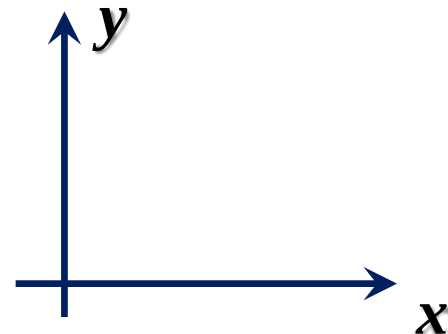


A persistent resource

- Students need a ***persistent resource*** that functions as a coordinating hub (*Fredlund et al. 2012*).

Coordinate Systems

In books coordinates appear *fixed*:



In order to successfully solve physics problems students need to realize that coordinate systems are *not fixed*... How can we teach this?

Teacher demonstration with a physical coordinate system...

But can students discover this for themselves?

Learning goal

Students work with magnetic field to **experience** the ***movability*** of a coordinate system

Mediating tool: IOLab

- Device with a coordinate system printed on it.
- Gives visual display (graph) on a laptop.
- Has **pedagogical** affordances, but generic.



Theory

Multi-representational learning sequence:

1. Set of non-persistent resources
2. Coordinated around a persistent resource
3. Creates a critical constellation
4. “Aha!” moment of understanding
5. Introduction of a new resource

An ensemble of resources

Graph

Manipulation –
proprioceptive

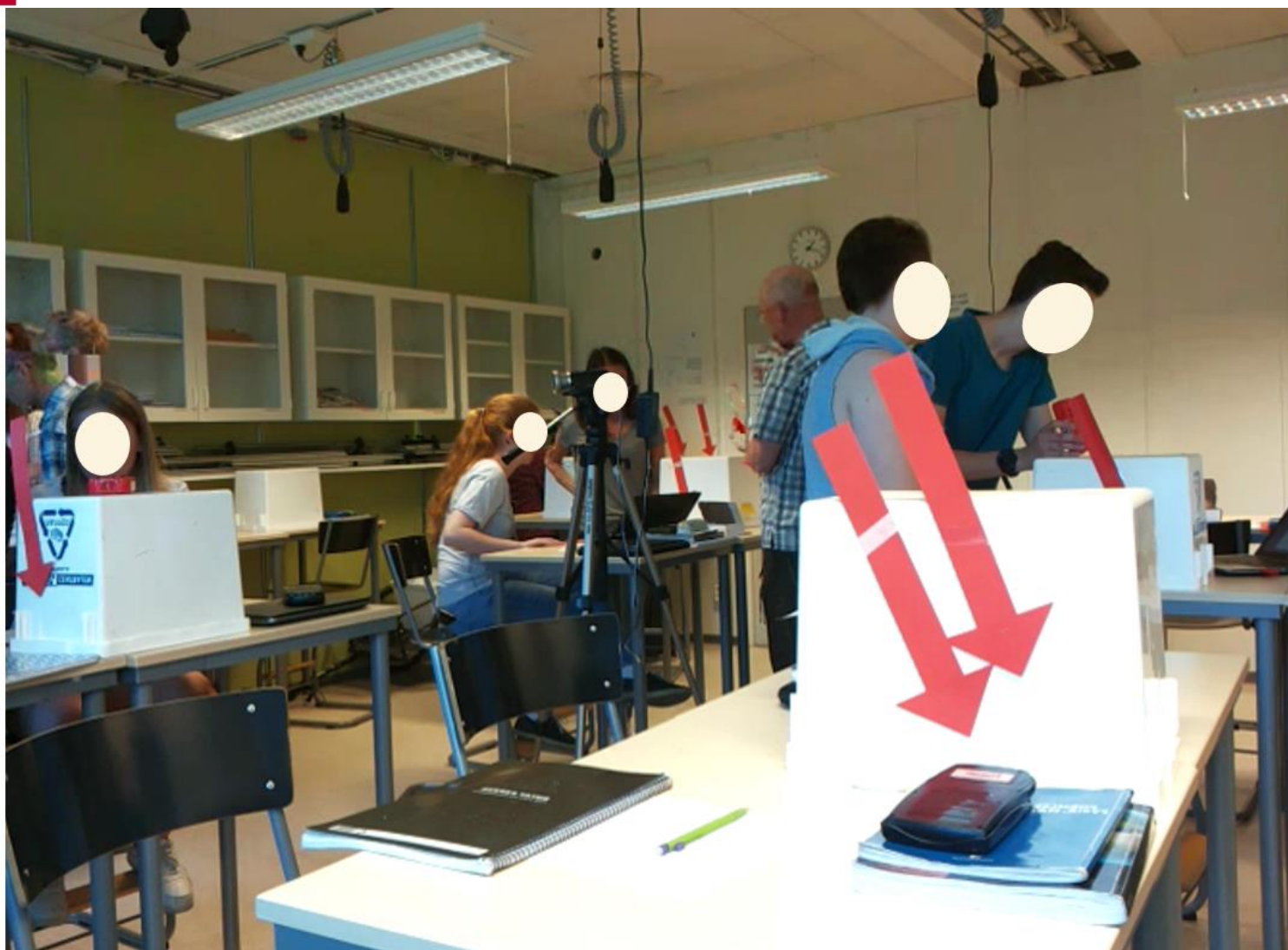
Speech



Persistent representation



Arrow represents field



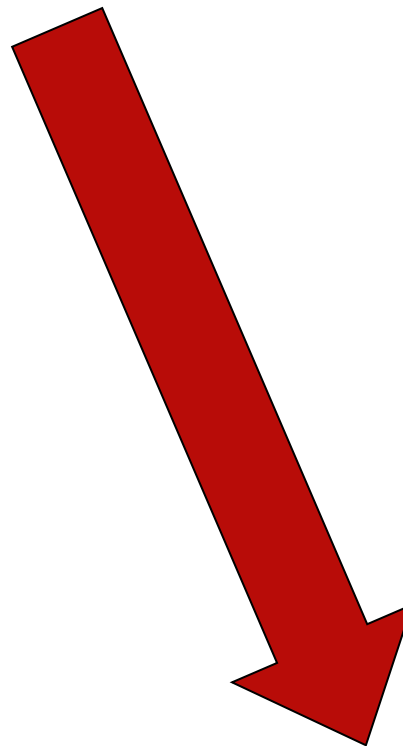
A critical constellation

Graph

Manipulation -
proprioceptory

Speech

Arrow



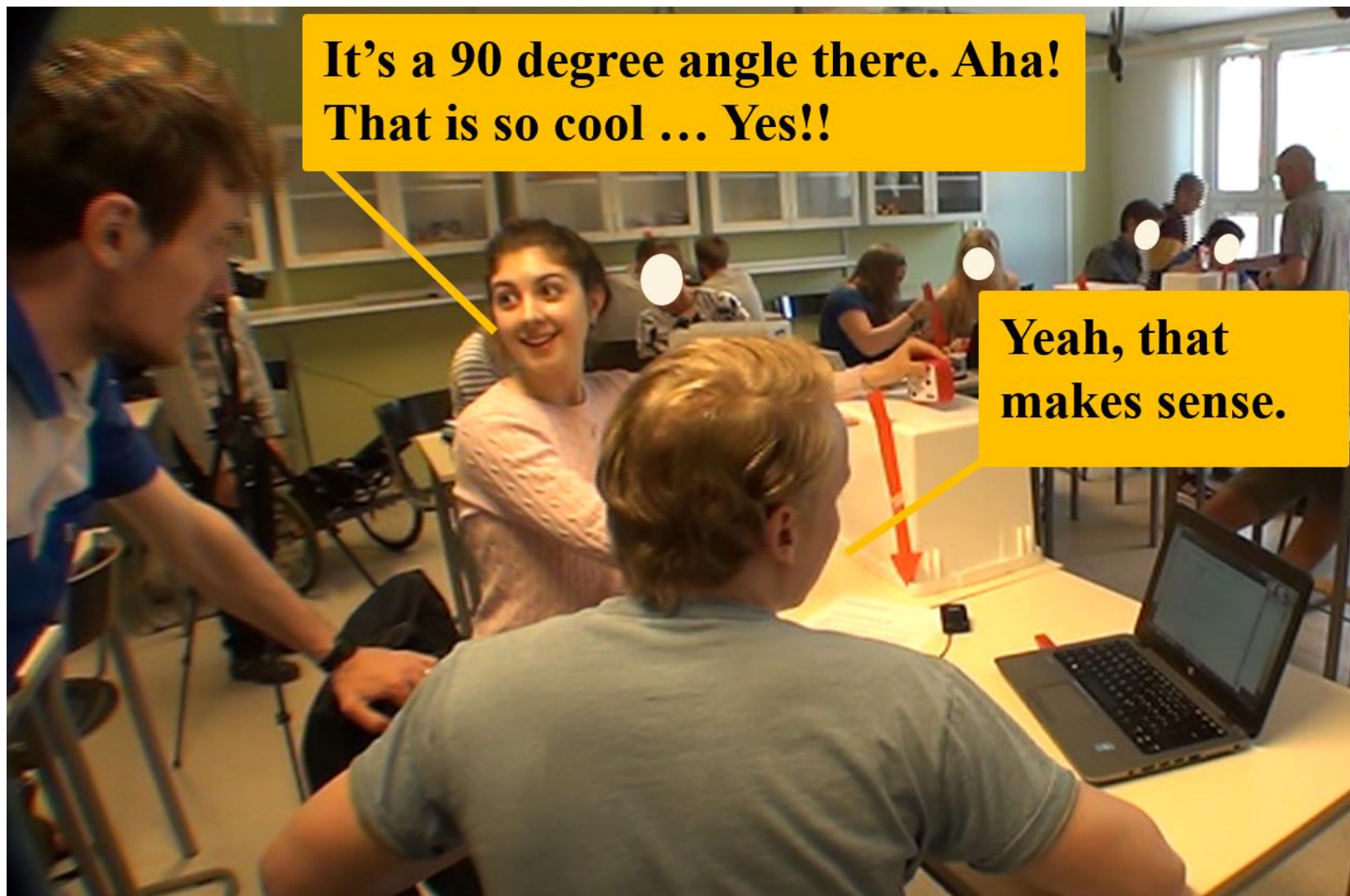
Fredlund *et al.* (2012) persistent representation
as a coordinating hub for meaning making

Theory

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The Aha! Moment...



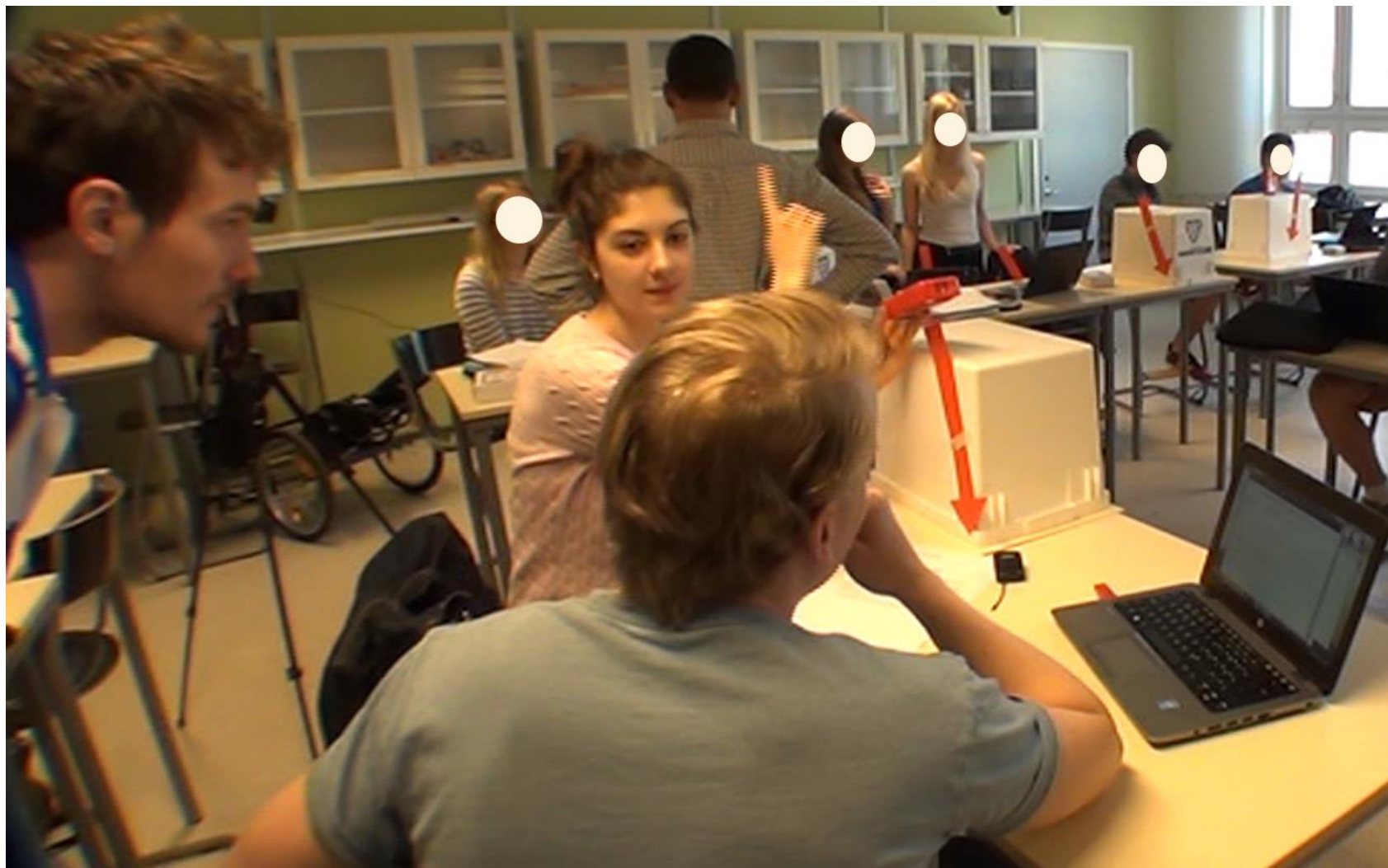


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But what happens next?



New gesture I



New gesture II



Conclusions for teachers I

- Physics **meaning is distributed** across resources.
- So there is a **critical constellation of resources** that is needed.

Conclusions for teachers II

- Task must **facilitate** appropriate **coordination**.
- Need to carefully decide what the **persistent coordinating resource** will be.
- Should look for **introduction of new resources** as confirmation that learning is occurring.

Questions



References:

