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Fysikensdidaktik

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Department of Mathematics and Science Education
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• 120 employees
• Most work with teacher training
• Full spectrum pre-school to university-level
• Unique in Sweden
• Science faculty

2. The research I do.

3. University pedagogy, University didactics, or something else?
Discipline-based education research

“investigates learning and teaching in a discipline using a range of methods with deep grounding in the discipline’s priorities, worldview, knowledge and practices”.

Long-term goal: “to understand the nature of expertise in a discipline”.

US National Research Council (2012, p 9)
A history of physics education research (PER)

PER is discipline-based.

Started in the US in the late 50s.

Had one single contributing factor…
Sputnik

Signalled the start of the “space race”.

America needed physicists quickly.

Lots of money was fed into physics education.

Attracted academics who would not normally have been interested in education.
History of PER

Focussed on student problems with physics.

Empirically tested different ways to overcome these problems.

More interested in what worked than why.

If the students could the solve physics problems then they understood the physics, right?
History of PER

Well actually, no…

Found that students could now solve the physics problems, but they didn’t really understand physics.
Misconceptions

Students were found to have similar, incorrect ideas about physics

Led to research on:

Conceptual change

Diagnostic concept inventories

E.g. The force concept inventory

Hestenes et al (1992)
A bowling ball accidentally falls out of the cargo bay of an airliner as it flies along in a horizontal direction. As observed by a person standing on the ground and viewing the plane as in the figure below, which path would the bowling ball most closely follow after leaving the airplane?
The force concept inventory

Spawned a large number of different concept inventories. (I’ve even been involved with one!)

Hill et al (2014)

Led to a focus on conceptual understanding rather than problem-solving ability
Growing interest in students’ attitudes to science.

Work on identity ”becoming a physicist”.

Focus on inclusiveness for different groups.

Mainstream still deals with student understanding of different areas of physics.
In my work I’m interested in physics knowledge and how it is represented. Airey (2006, 2009)

Graphs, diagrams, mathematics, language, etc.

Interested in how these resources work both alone and together to make ”physics”.

If we understand this relationship, then we can begin to understand how to teach our students.
My work starts empirically but always tries to scale up to theoretical mechanisms.

Always have recommendations for teaching.

An example:

Two theoretical terms derived from my work:
Disciplinary affordance

The **agreed meaning making functions** that a resource fulfils for a particular disciplinary community.  

Airey (2015)
Definition:

*The aptness of a resource for teaching some particular educational content*

Airey (2015); Airey & Linder (2017)
Disciplinary affordance

Low

Pedagogical affordance

High

Airey & Eriksson (2019)
Airey & Eriksson (2019)
Disciplinary discernment

Too much information

Students don’t know where to look!
Simplified and re-structured the information

See Fredlund, Airey & Linder (2015)
Disciplinary affordance

Pedagogical affordance

Low

High

Airey & Eriksson (2019)
Conclusion

In university physics education we discovered:

• There are a lot of student misconceptions
• We know how to deal with many of them
• We found this out empirically

How will future physics lecturers be introduced to this important body of work?

Is the same true for other disciplines?
Pedagogy, Didactics or something else?

I suggest discipline-based education research.

What (mis)conceptions do students come to us with and how can these be addressed?

Solutions to known problems in the discipline.

Moves from specific cases to general theories rather than presenting general theories that teachers need to apply to their teaching.

Takes account of disciplinary teaching traditions.
Questions and Comments
References


