(Mis)Understanding Physics: How do secondary school students develop and understanding of tricky physics topics?

How to cite:

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Version: Poster
Methods
This study is using a multiphase mixed methods design. This means that both qualitative methods (such as interviews) and quantitative methods (such as statistical analysis) are being used. The results of the earlier phases will feed into the later phases.

Rationale
Students frequently find physics difficult and teachers often do not know why. The teacher can give the student all the information they think the student needs and the student still does not understand it. This research project is investigating how students develop an understanding of these particularly tricky physics topics with the aim of producing some useful teaching resources.

Findings So Far
The interviews with physics teachers for Phase One have been completed and analysed. The tricky physics topics identified for further research in Phase Two are:

- Electricity, Forces and Radioactivity.

Electricity and forces have often been identified by past research as tricky topics for students to learn, but there has not currently been much research into students’ understanding of radioactivity, so this is an interesting finding.

Even though teachers from two different schools were interviewed, their students have similar issues and the same misconceptions (such as confusing the nucleus or a plant/animal cell with the nucleus of an atom and thinking an atom has DNA).

What Makes Physics Difficult?
Research, including this study, indicates that students often find physics difficult because:

- Physics concepts (e.g. forces) are often abstract so you cannot see or touch them.
- Our everyday experiences sometimes conflict with scientific theory.

For example, most of us only experience gravity on Earth, so students sometimes think that gravity on other planets must be exactly the same. In fact, gravity is stronger on bigger planets and weaker on smaller ones.

Students frequently struggle with maths, such as equations.

Students pick up bad science from everyday sources such as movies or even past teaching.

Motivated Reasoning
Once a student has a misconception, it’s really difficult to get rid of it because of motivated reasoning.

This is when people apply their reasoning in a one-sided manner that supports and rationalises their beliefs while rejecting information that doesn’t fit in with their beliefs.

Frankenstein Thinking
Who is this?

Lots of people think this character is called Frankenstein, but it’s actually Frankenstein’s monster. Dr Frankenstein is the one who created the monster.

Teachers and researchers often assume that misconceptions like this are easy to fix by simply giving students the correct information, but it often doesn’t work like this with science as students simply reject what their teachers tell them.

A lot of research just lists students’ misconceptions, which isn’t enough. We need to look for the causes of misconceptions.

Why are some people so smart?
Intelligence is influenced by more than DNA.

Upbringing
Health
Nutrition
DNA
Motivation

There seems to be a link between students enjoying a subject and them being motivated to learn about it:

Note: Having fun is therefore important!!!