

Uncertainty and emotion in physics problem-solving

Interviews with first-year physics students (March 2022)

Jon Fenton

Senior Teaching Fellow (Physics)

Research project for MEd in University Learning & Teaching

Uncertainty and emotion in physics problem-solving

In your working life, how does uncertainty make you feel?



Uncertainty and emotion in **physics problem-solving**

Interviews with first-year physics students (March 2022)

Jon Fenton

Senior Teaching Fellow (Physics)

Research project for MEd in University Learning & Teaching

Uncertainty and **emotion** in physics problem-solving

satisfying

rewarding

stuck

struggle

intimidated

jarring

daunted

unmanageable

overwhelmed

shock

terrified

panicked

tend to shut down

panic spiral

Words used about physics problem-solving
First-year physics student interviews

“Problem solving in physics? Well, that’s about...”



Draw a diagram

Identify principles

Maths skills

Make a plan

Domain knowledge

Break into sub-problems

Mastery of physics concepts

Familiarity with similar problems

Check back

Student perspective

How do you **view** the process of problem-solving?

Epistemology
Perry, Baxter Magolda, Schommer



Reproduce a recipe?

Simple, certain knowledge
from authority figure
who knows 'the truth'



'[At school] it was always, kind of, "here's the problem. Here's how you do it." [...]even with experiments[...]' (Caroline)*

*pseudonym

Student perspective

How do you **view** the process of problem-solving?

Epistemology
Perry; Baxter Magolda; Schommer



Reproduce a recipe?

Simple, certain knowledge
from authority figure
who knows 'the truth'



Choose the tools for the job?

Construction by learner
Not just one valid approach

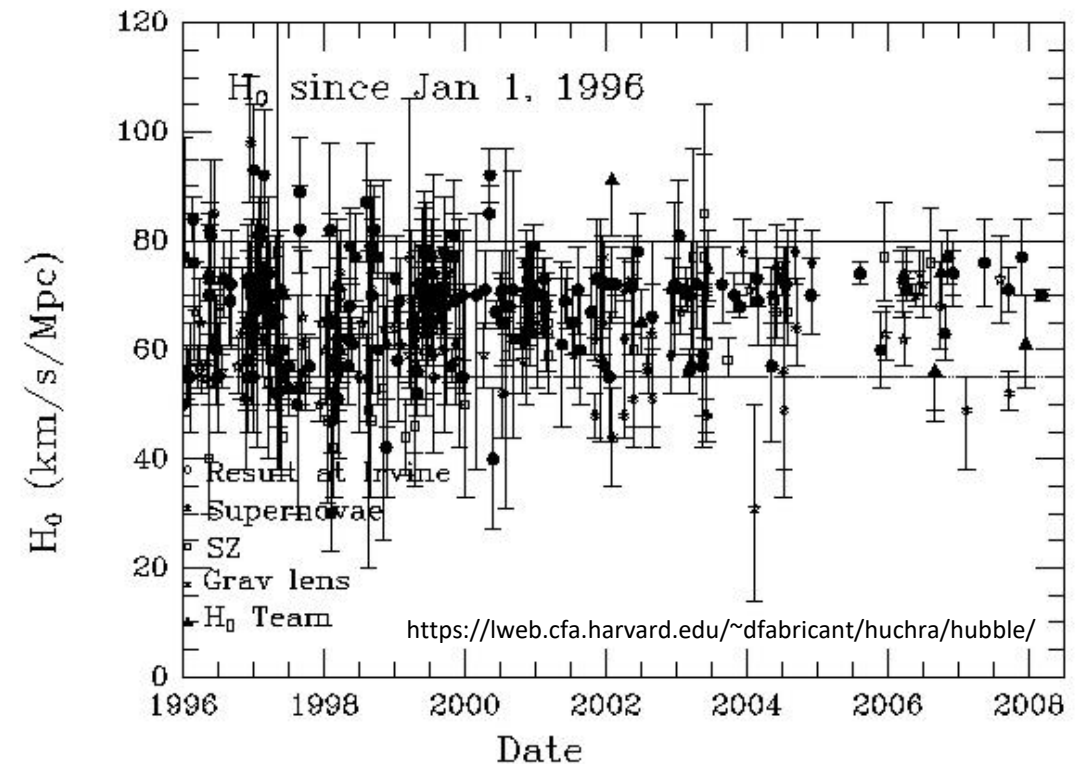


Uncertainty is normal - reassurance from being in community

1. Scientific community

“Weirdly, finding out that [...] nothing’s certain [...] has helped. [...] It’s like: ‘Cool. Well, I don’t know this, but also we’re still trying to work out how the universe works. So, you know, relatively, I’m doing pretty well here’” (Caroline)

Different values obtained by the scientific community for H_0 do not all agree!



Uncertainty is normal - reassurance from being in community

2. Learner community

On small-group tutorials:

*“harshly, as I've seen [...] other people get things wrong and can't do things either[...] [P]art of me, [...] was a bit **worried that everybody else would be able to do things** and I was just gonna sit there and not have a clue where to start [...] but I've realised **actually that's not true** [...] I've definitely just got a lot of confidence out of doing group work” (Anna)*

Summary

At the large scale:

Problem-solving is not just (or mainly) the nuts-and-bolts component skills
Emotion, metacognition and community are (just as) important

At the small scale: e.g. uncertainty

The value of reassurance about uncertainty being normal

How do we present uncertainty...

...explicitly, in what we say about the place of uncertainty?

...indirectly, in how we design the curriculum?