Understanding and planning student journeys when learning to program

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Motivation - the problem to solve

How to surface hidden assumptions in teaching and learning

- We need to reveal the stepping stones used to teach about complex ideas
  - At a phase in learning, if students have a limited view of a concept it can lead to misconceptions and result in re-teaching at later phases
- We use teaching programming as a case study
  - We need to consider not just what programs do, but how they do it
  - We need to reveal the ‘rules of the game’ and how and when they change
- We ask - what is the objective of each phase of learning?
  - Is it programmers who solve problems flexibly?
  - Or programmers with a toolkit of heuristics to apply for each situation?
- We need a reflective tool to reveal the hidden assumptions to help improve teaching and curriculum design.

Overview

- We will explain the theory around the LCT epistemic plane
  - How we have broadly applied it
- What we found and how you might use it.

- How it might help you
  - think about where you want students to end up
  - how to better actively guide students there

Legitimation Code Theory

A theory of knowledge practice from sociology by Karl Maton

- What is considered legitimate practice (by different stakeholders)
- LCT is a set of analytical tools
- Dimensions: Semantics, Autonomy, **Specialisation**

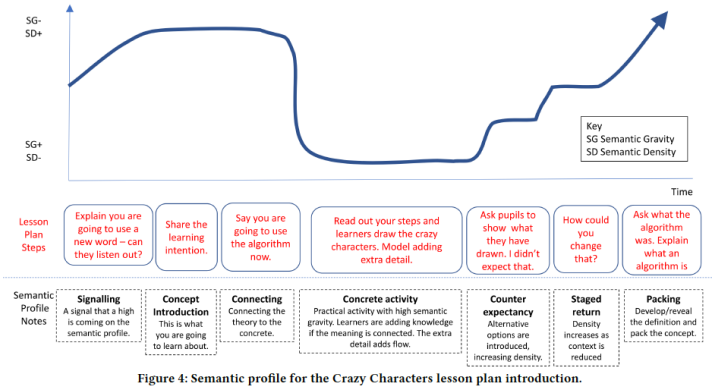
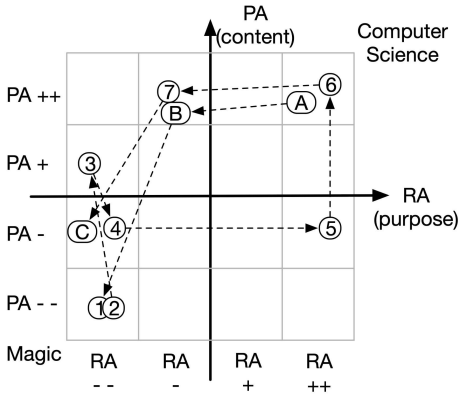
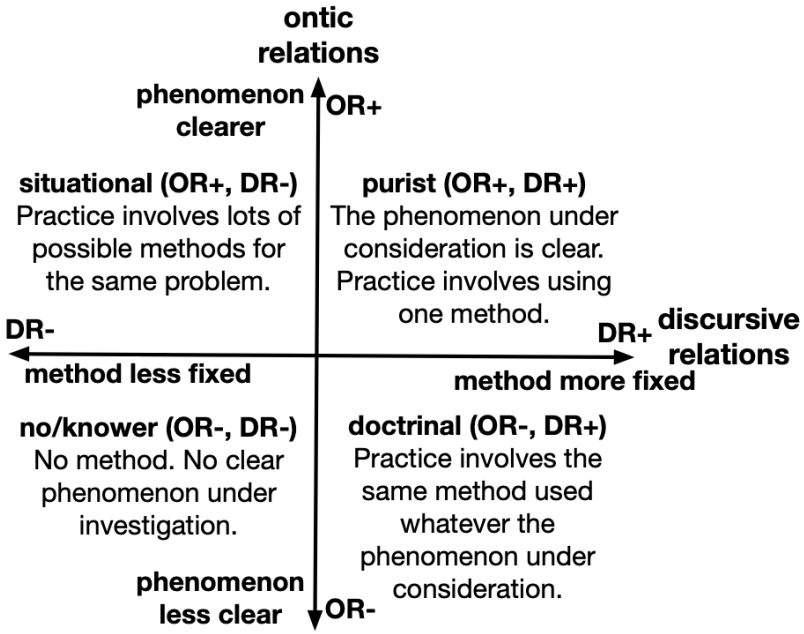


Figure 4: Semantic profile for the Crazy Characters lesson plan introduction.



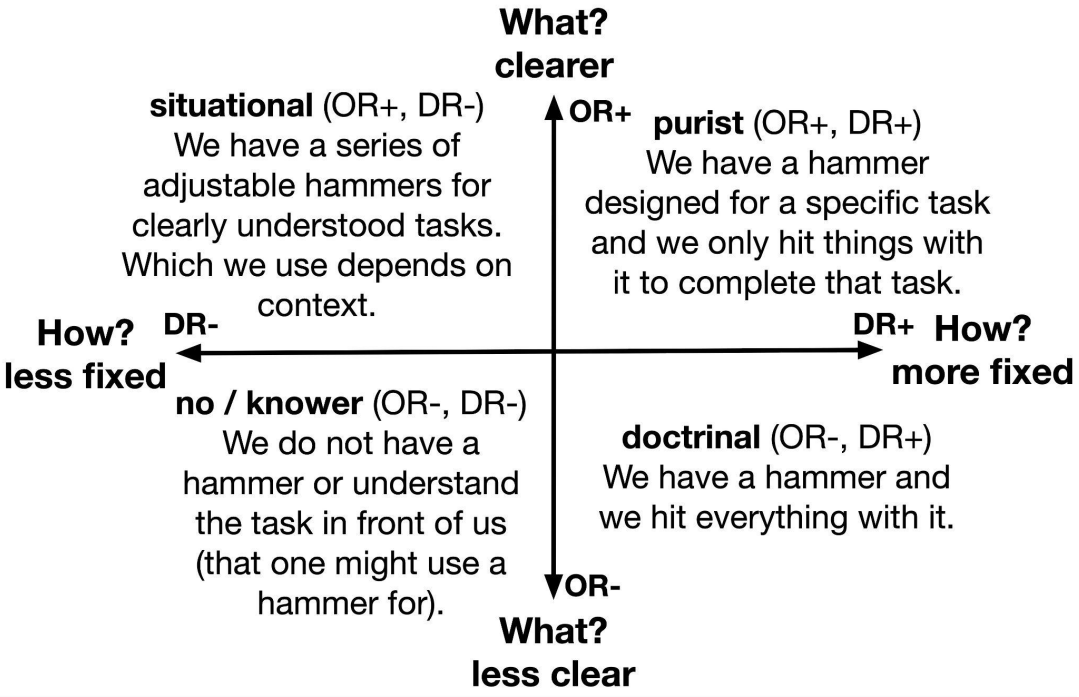
The epistemic plane

- A generic framework that can be applied to a wide range of knowledge practice
- Ontic relations
  - How clear / well defined is the concept (the what)
    - Y-axis
- Discursive relations
  - How fixed or less fixed is the method to be used (the how)
    - x-axis



How vs What: “I have a hammer … I hit everything with it!”

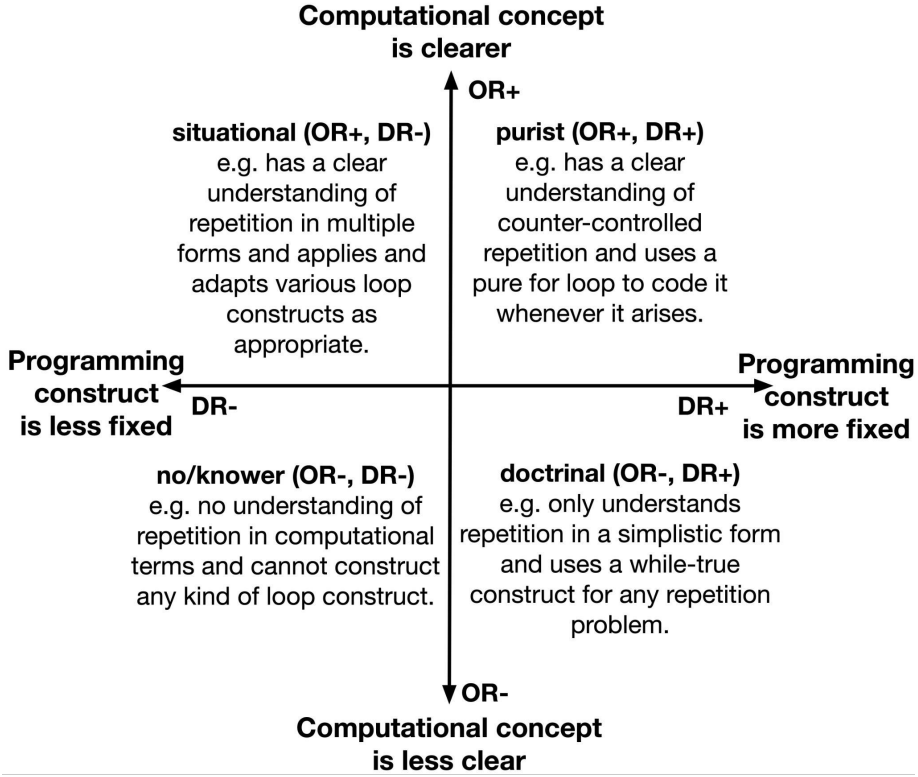
Image by Steve Buissinne from Pixabay



The epistemic plane applied to programming

Make a distinction between:

- Computational concepts
  - eg counter controlled loop
- Constructs/code to implement it (method)
  - For loop v
  - While loop + counter v
  - …

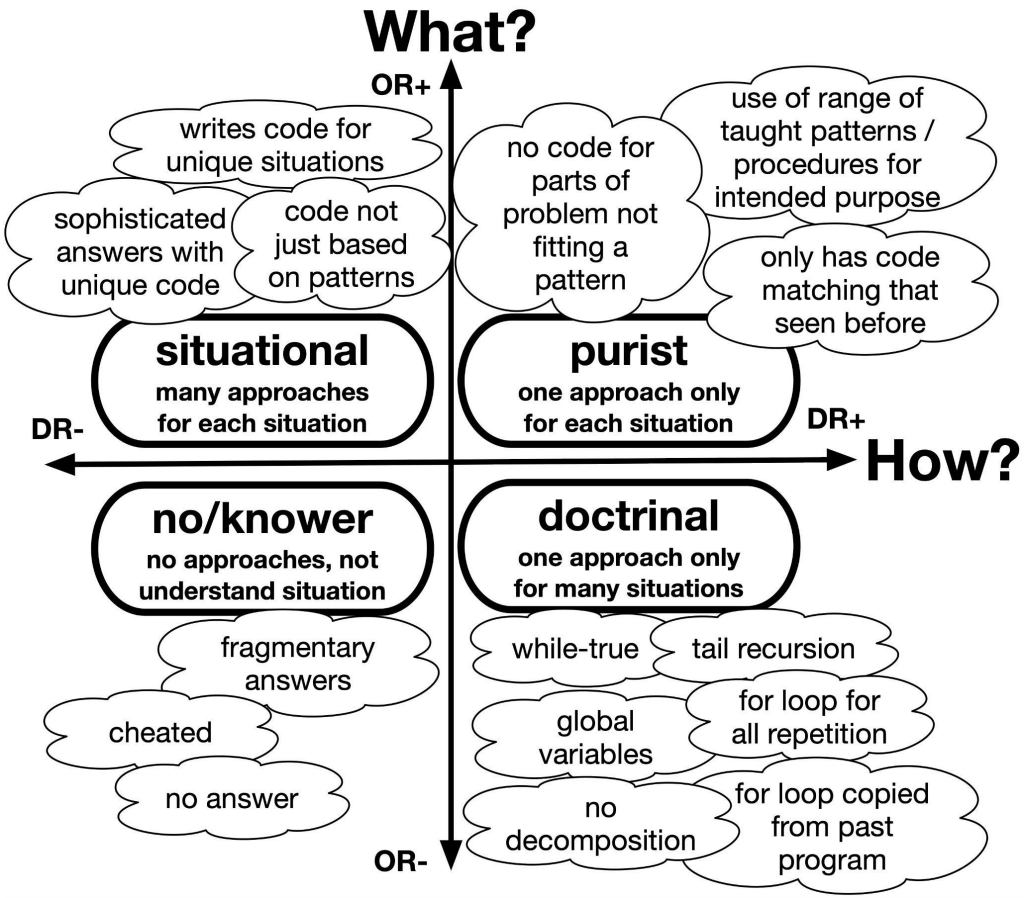


Analysis of Positions, Pathways & End points

Gives a visual reflective tool to think about:

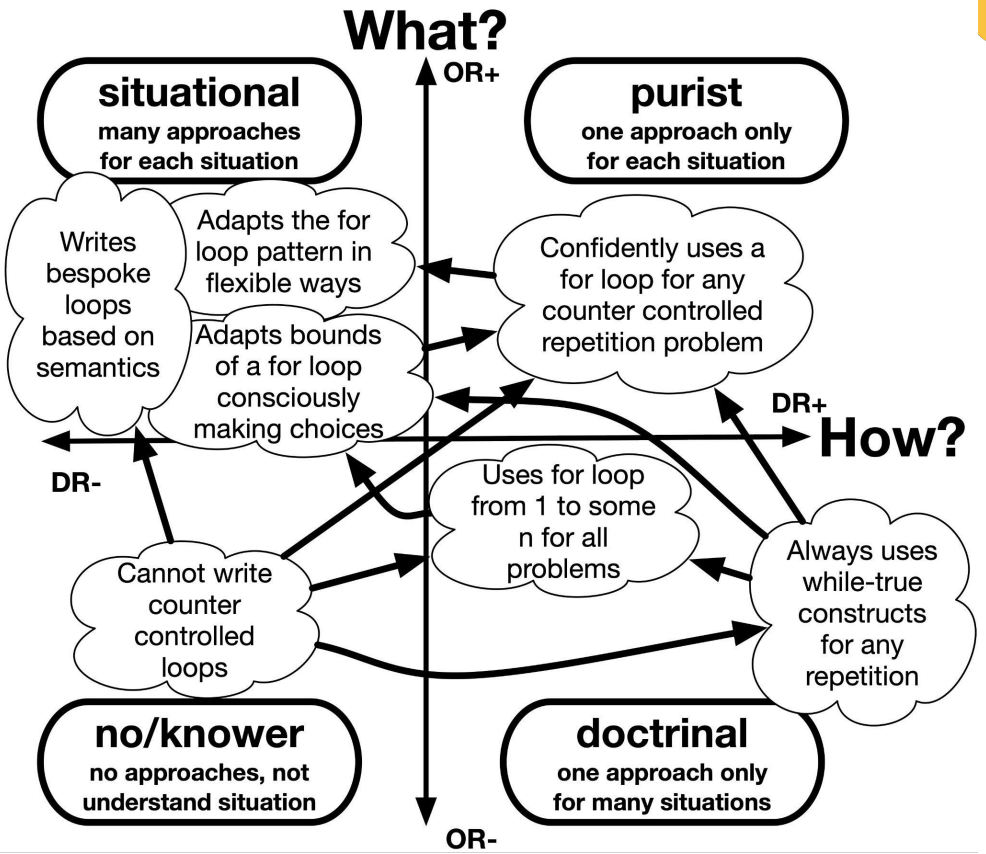
- Positions
  - Can analyse locations of student practice
  - Compare with desired practice looking for clashes
- Pathways
  - Look at pathways students follow
  - Plan pathways to help them get where you want them (in a single lesson or across phases)
- End points
  - Reveals end points
  - Enable reflection and change

Positions: Some examples of where practices fit

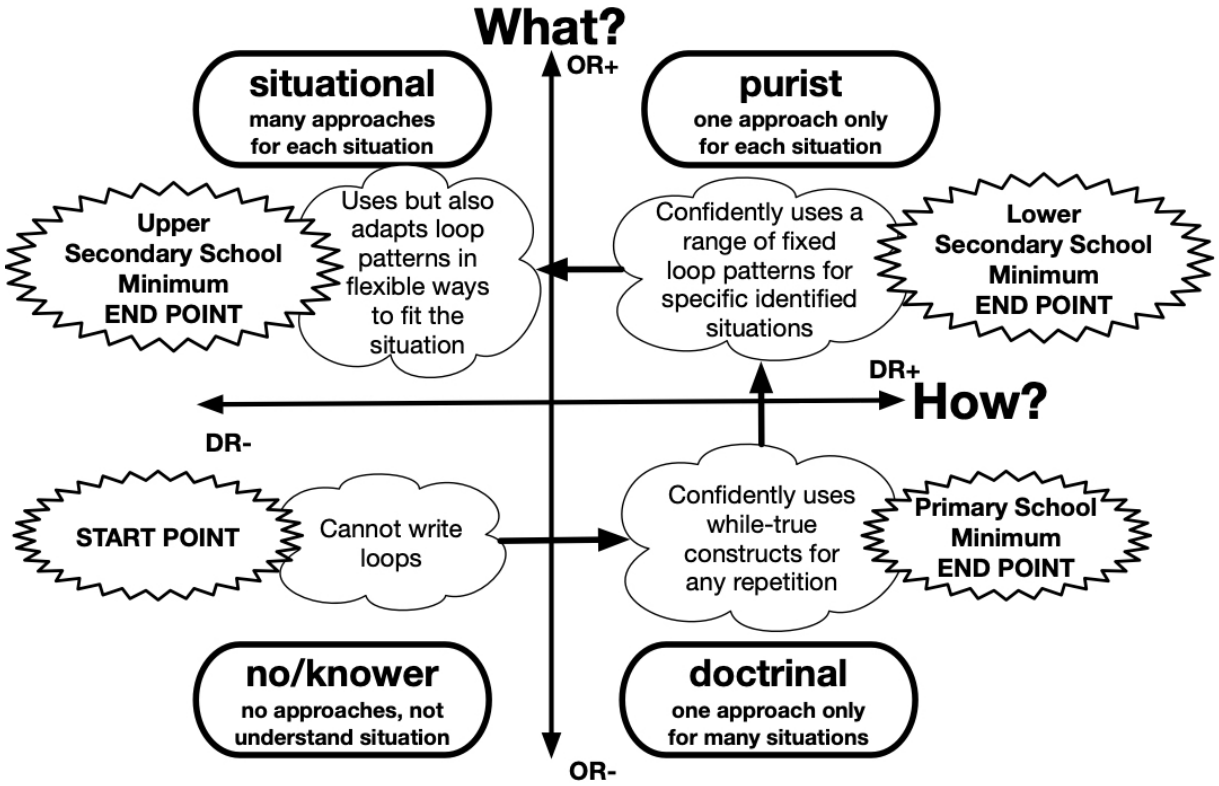


Many different potential pathways

- What is the end point at this stage of education?
  - Primary - could be doctrinal?
  - Early secondary - purist?
  - Different for different aspects
- Can we guide students there?
- Do so in a spiral round the plane, adding new concepts



End points: some hypothetical end points



Practical opportunities for stakeholders

- Use to clarify **content** and progression
- Use routes to figure out **pedagogy**
- Reveal and review routes for **assessment**
- Review
  - rules (content / curriculum);
  - planned routes (pedagogy);
  - routes taken (assessment / progression);
  - potential bias and clashes.

The epistemic plane is useful to:

- Help educators better understand misconceptions that arise with respect to the importance of not just **what programs do**, but **how they do it**.
- Surface issues over
  - what kind of solutions (doctrinal, purist, or situational) are considered appropriate in different contexts;
  - being aware of end points and the paths to get there; and
  - how such solutions may be stepping stones; and
  - the conceptual shifts and potential clashes with student beliefs of the ‘rules of the game’ at points of progression;
  - the importance of thinking about concept development.
- A reflective tool for educators, resource developers and policy makers designing curriculum.

Thank you

If you have used semantic waves please complete our impact survey:

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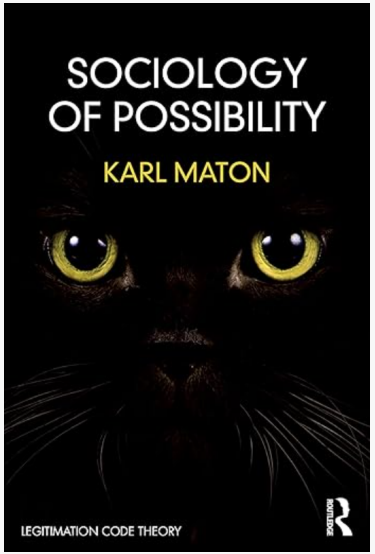

Out soon