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How teachers build a curriculum for their classrooms and how LCT might help

SIoE April 23

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EDGE FOUNDATION

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Outline of this talk

- The problem space and my experience of the problem
- Share my analysis of teachers' curriculum development and how teachers design practical work
- The potential for using LCT with (some) teachers

A curriculum (development) framework

Site of activity	Examples of activity	Examples of actors
Supra	Transnational curricular discourse generation, policy borrowing and lending; policy learning	OECD; World Bank; UNESCO; EU
Macro	Development of curriculum policy frameworks; legislation to establish agencies and infrastructure	National governments, curriculum agencies
Meso	Production of guidance; leadership of and support for curriculum making; production of resources	National governments; curriculum agencies; district authorities; textbook publishers; curriculum brokers; subject-area counsellors
Micro	School level curriculum making: programme design; lesson-planning	Principals; senior leaders; middle leaders; teachers
Nano	Curriculum making in classrooms and other learning spaces: pedagogic interactions; curriculum events	Teachers; students

(Priestley et al. 2021)

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The curriculum development problem

Teachers have a huge part to play in the translating the curriculum into the school-based and then classroom-based curriculum.

These practices [curriculum development, planning, classroom-based design] can be described as ‘relational, complex, multidirectional practice, in which teachers reflect, make decisions and take actions to translate policy, using a variety of resources based on their concerns, priorities, and future projects in relation to their unique contexts’ (Hizli Alkan, 2022, p2).

Yet, these practices are poorly understood, under-researched and under-theorised.

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The curriculum development problem…continued

Teacher training and professional learning seems to have a blind spot when it comes to curriculum scholarship required for curriculum planning and design.

This leaves teachers engaging in curriculum design acting on gut instinct, trial and error, and experience accumulated over time.

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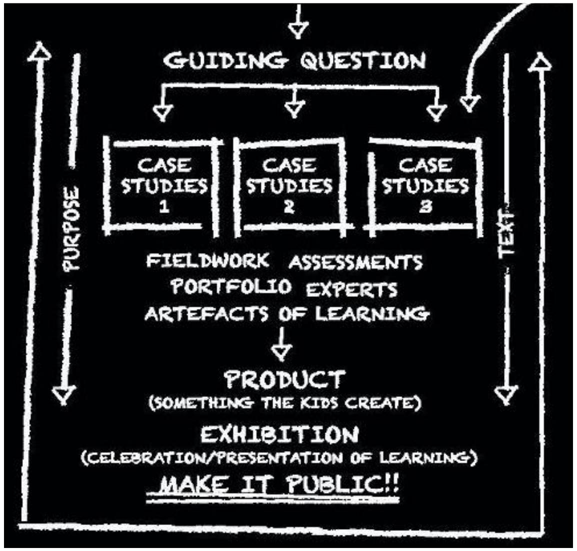
My work at XP School

- The curriculum at XP is based on ‘expeditions’, a problem-based learning, thematic and cross-curricular curriculum developed by EL Education in US
- XP teachers are curriculum makers
- XP teachers start from subject standards, then integrate subjects in a ‘principled’ way, finally they attend to subject boundaries to review (Pountney & McPhail, 2019)
- The knowledge and expertise for this work learnt through apprenticeship.



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Research Aims

- To examine what is meant by active learning in the science curriculum
- To understand what constitutes the professional knowledge base required for developing the curriculum
- To develop a model to support teachers' curriculum making practices

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Methodology

- Used a social realist approach
  - Move beyond surface description to get at the basis of practice
- Instrumental Case study approach
  - Five schools
  - Interviews and curriculum documents

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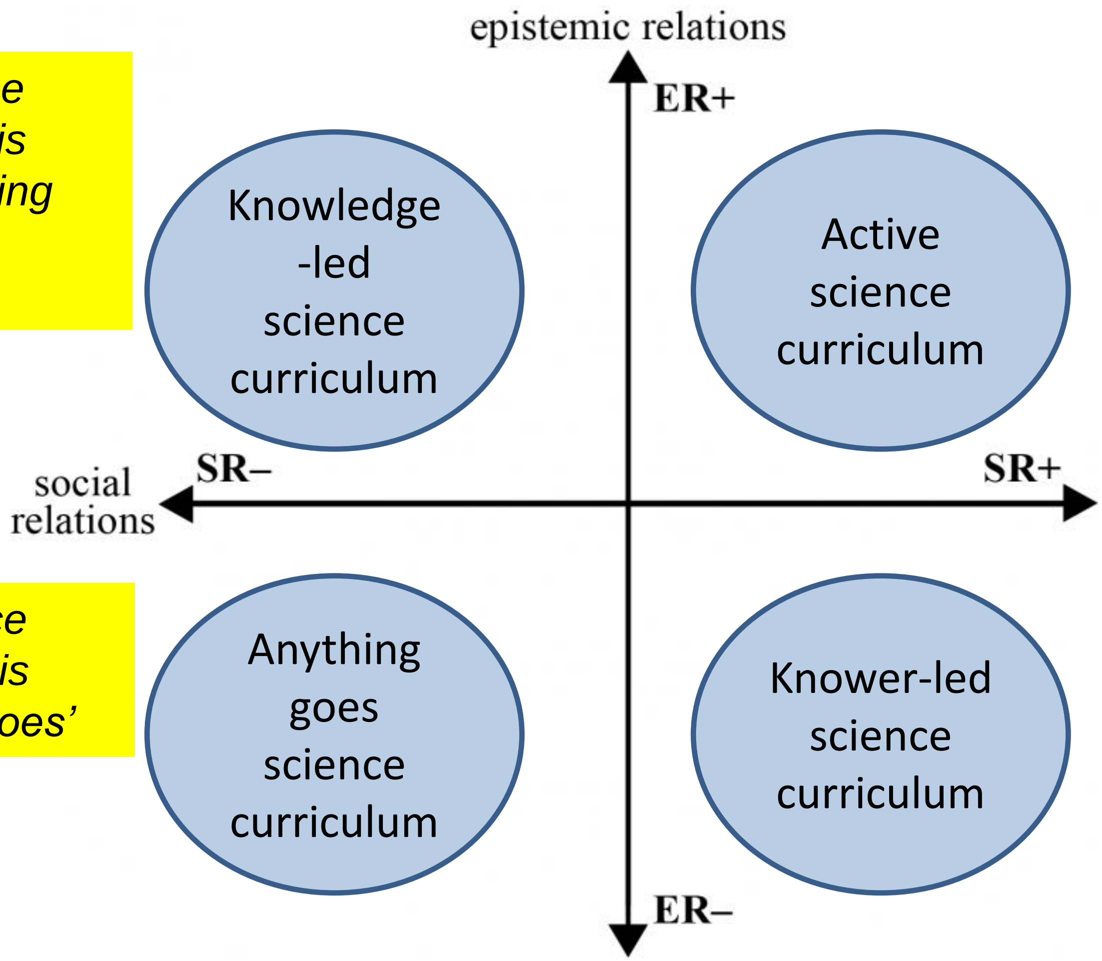
Using specialisation codes for understanding KS3 science curriculum

KS3 science curriculum is about building specialised knowledge

KS3 science curriculum is about specialised knowledge and being the right kind of knower



KS3 science curriculum is 'anything goes'

KS3 science curriculum where who the students are is emphasised

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Translation device

Code		Indicators
Knowledge	ER+ / SR-	Teacher design principles have an emphasis on developing science specialized knowledge, principles or procedures and students' qualities, attributes, dispositions and engagement with science are downplayed.
Knower	ER- / SR+	Teacher design principles have an emphasis on students' qualities, attitude, disposition and engagement in science and the emphasis on science specialized knowledge, principles or procedures is downplayed.
Elite	ER+ / SR+	Teacher design principles have an emphasis on both developing science specialized knowledge, principles or procedures and students' qualities, attributes, dispositions and engagement.
Relativist	ER- / SR-	Teacher design principles have no / little guiding emphasis. Anything can be legitimately accepted. Specialized knowledge and knower characteristics are deemed unimportant.

Using specialisation codes for understanding KS3 science curriculum

School	Suggested specialisation code	Sample of indicative comment (I = interview, CD = curriculum document)
School 1	Knowledge code	"When you look at electricity scheme of work, you're thinking about the GCSE and you're thinking, okay, these are the foundational building blocks which we need to get right to key stage three and therefore provides a good step to Key Stage four for electricity." (I)
School 2	Elite code	"Whilst they want them to have like an enjoyable experience, they can have both. They can both have an enjoyable experience and something things bound by knowledge." (I)
School 3	Elite code	"For me, there is a body of knowledge which kids need to know, understand, remember, and build on." (I) "So again, I guess it's at the heart of our curriculum, not just in science, is about kids being an activist." (I)
School 4	Knowledge code	"So I need to lay the secure, um, fundamental principles in science so kids can feel comfortable about building on them, uh, and diving deeper into kinda like, uh, key stage four." (I)
School 5	Knowledge code	"It [threshold concepts] is a concept of curriculum we've embraced. So we have determined what are the key threads that run through our curricula that if you do not get these particular things, you will have a limited ability, you'll have poor foundations to build your learning upon." (I)

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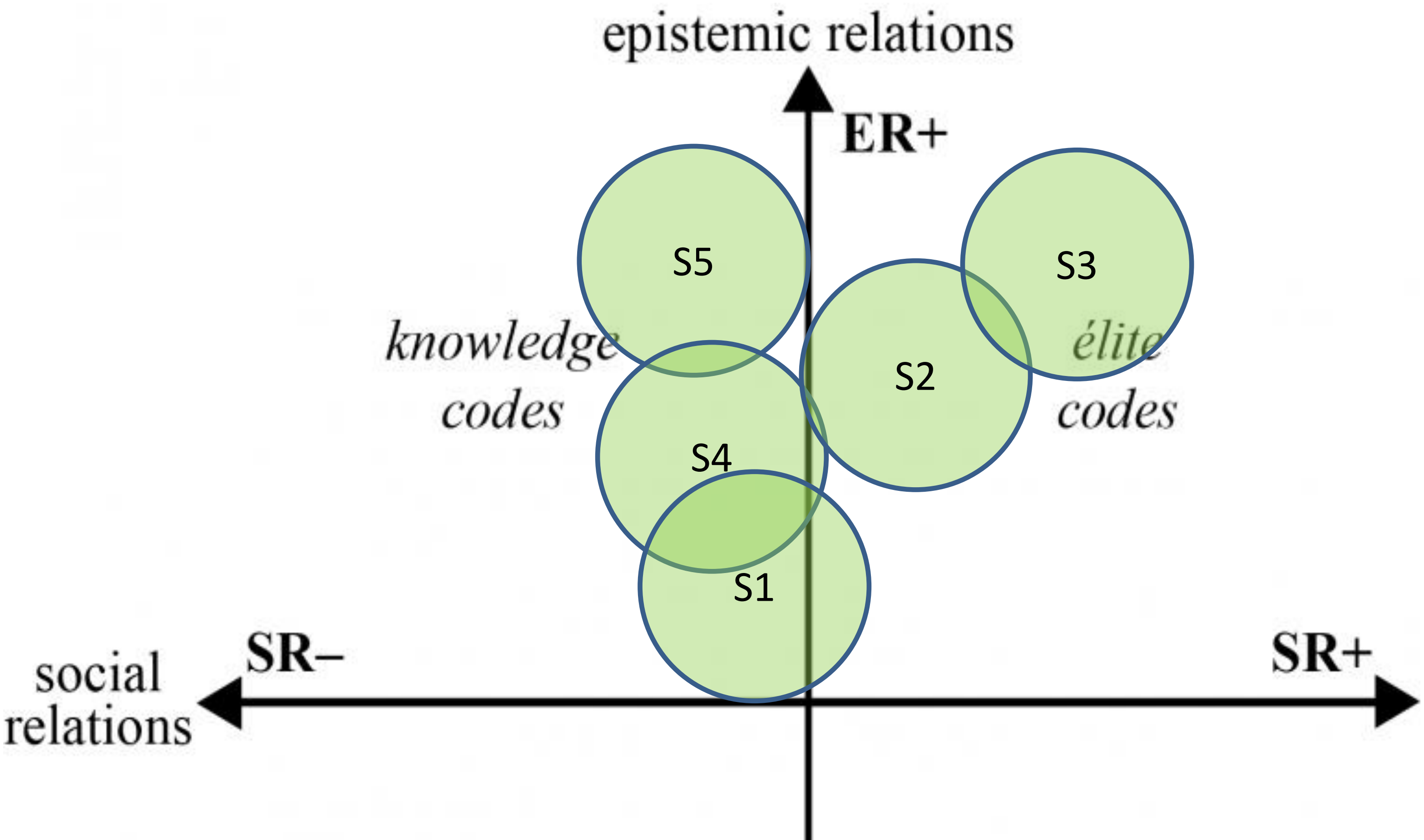
Using specialisation codes for understanding KS3 science curriculum



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Curriculum development practices used by teachers

School	Threshold concepts	Curriculum narrative	Big ideas	Big questions	Cross-curricular links	Science capital approach
School 1	*				**	
School 2	*	x	x	x		x
School 3	x	x	x	x	x	
School 4	*				**	
School 5	x			x		x

Table to show the curriculum development principles used by schools
(* can be argued that explicit focus on prior knowledge as a curriculum principle is similar to thinking about threshold concepts at secondary school
** making explicit links across biology, chemistry, and physics as KS3 science is taught in separate disciplines)

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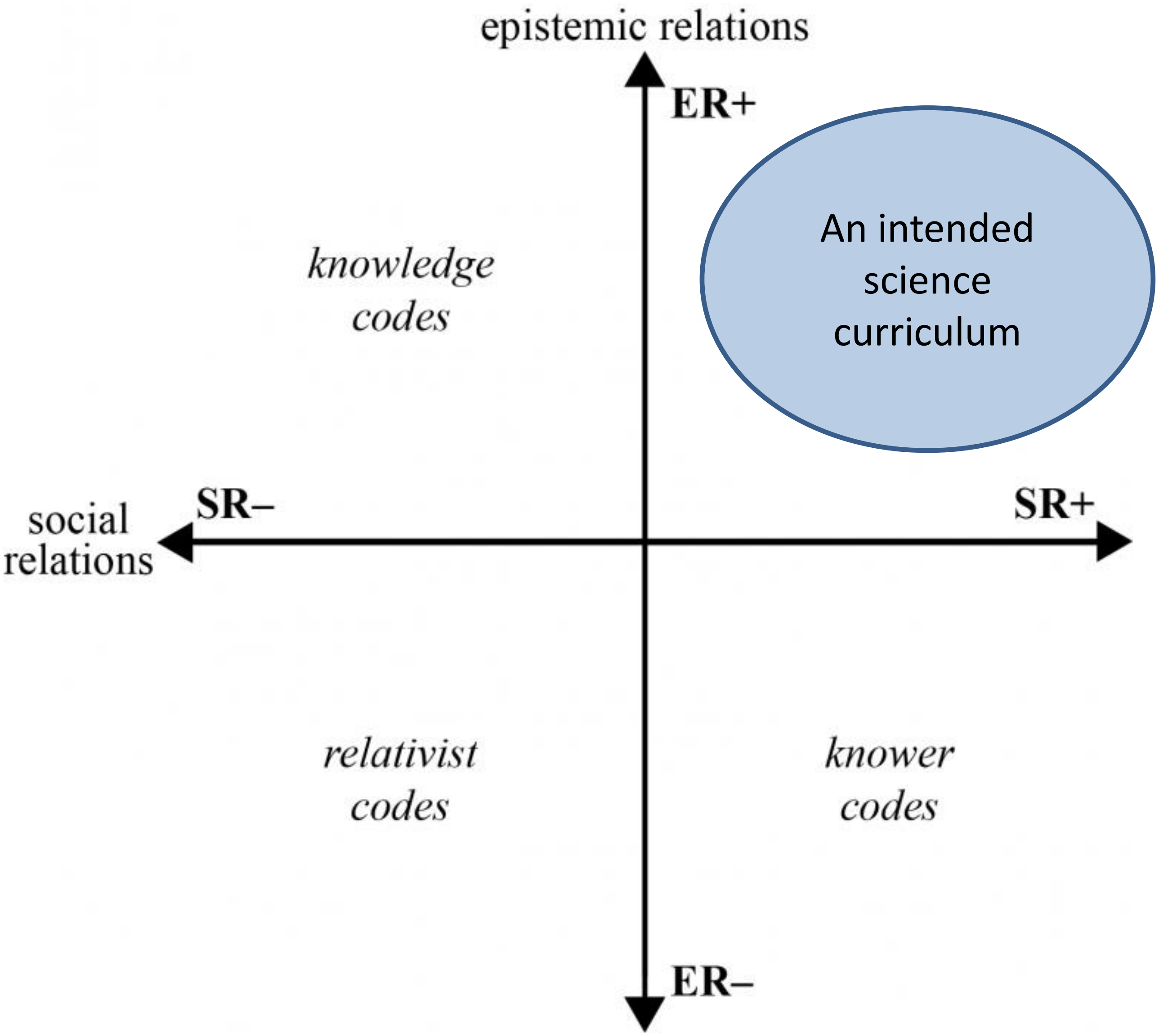
Curriculum design practices and their effects

Curriculum principle	Relative code shift effect	Code
Threshold concepts	Strengthen epistemic relations	ER↑
Narrative / Story *	Strengthen epistemic relations	ER↑
	Strengthen social relations	SR↑
Big ideas	Strengthen epistemic relations	ER↑
Big questions	Strengthen social relations	SR↑
Cross-curricular links*	Strengthen epistemic relations	ER↑
	Strengthen social relations	SR↑
Science capital teaching approach	Strengthen social relations SR↑	SR↑

Teachers used * principles in two ways: To strengthen conceptual understanding and to strengthen engagement

An example: School 3

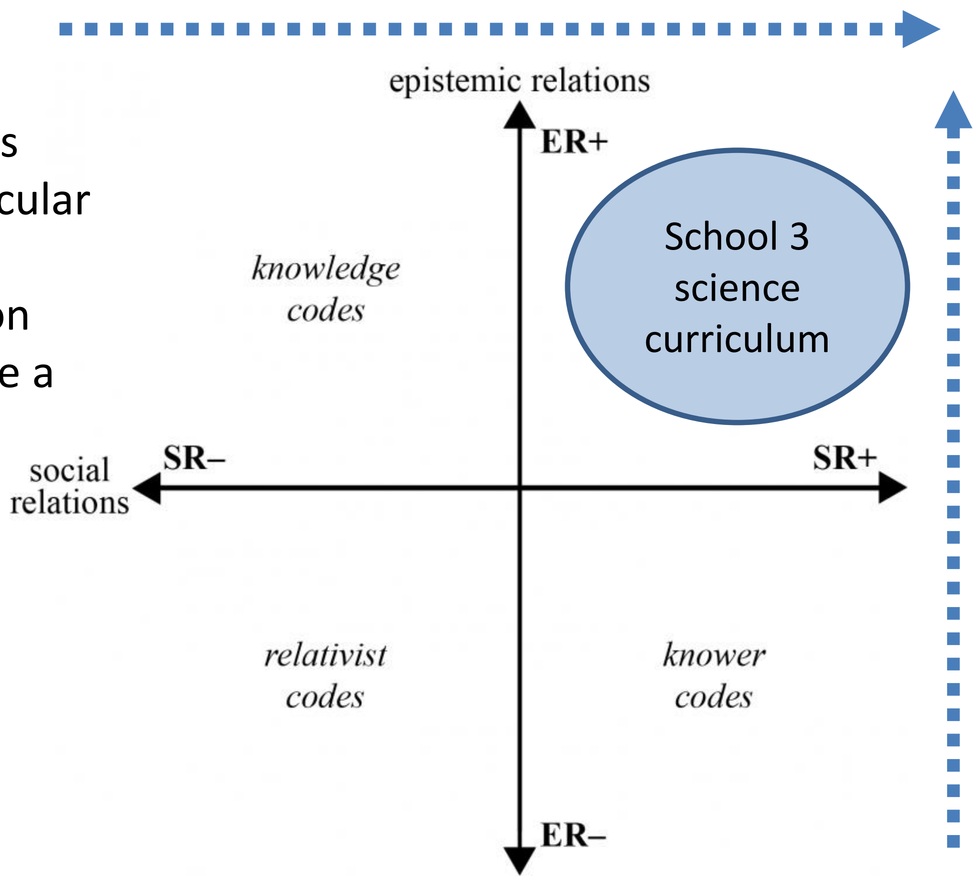


Curriculum intent
- *Knowledge and understanding*
- *Being a scientist*
- *Making a difference to the community*
- *Activism*
- *Relevant and connected*

Examining curricular decisions

Big questions
Enjoyable curriculum experiences
Cross-curricular links
Emphasis on thinking like a scientist

Strengthen SR



Strengthen ER

Threshold concepts to support sequencing of knowledge
Big ideas
Exam specification

Further exploration of design principles … using semantics

- ‘concepts of context dependence and complexity remain at best tacit, entangled and wholly descriptive’ (Maton, 2020, p65).

- **Semantic Gravity** - the degree to which meaning is dependent on context**.**

- **Semantic Density** - the degree to which meanings are condensed within practice

- By separating context dependence from complexity, I was able to analyse the curriculum narratives designed by teachers

- SG+ = context dependent (concrete), SG- = context independent (abstract)

Flipping the curriculum narrative of a chemistry unit

"There are three main topics of interest that the students must know.

- *The evolution of the atmosphere from the Earths inception until the modern day. (A)* SG-
- *Climate change, causes, issues, and solutions (B)* SG+
- *Pollution of the atmosphere, their effects and some ways humans mitigate this pollution (C)* SG++

This topic has been traditionally taught in this order, as it logically follows from the perspective of a science specialist to start from the beginning of time (for the planet) then move onto human activities which are more recent.

'Instead, why not start from a place of familiarity instead? Beginning with what the modern atmosphere is composed of as a baseline, and then human effects and then going back in time to how we have achieved the current modern day atmospheric composition.'

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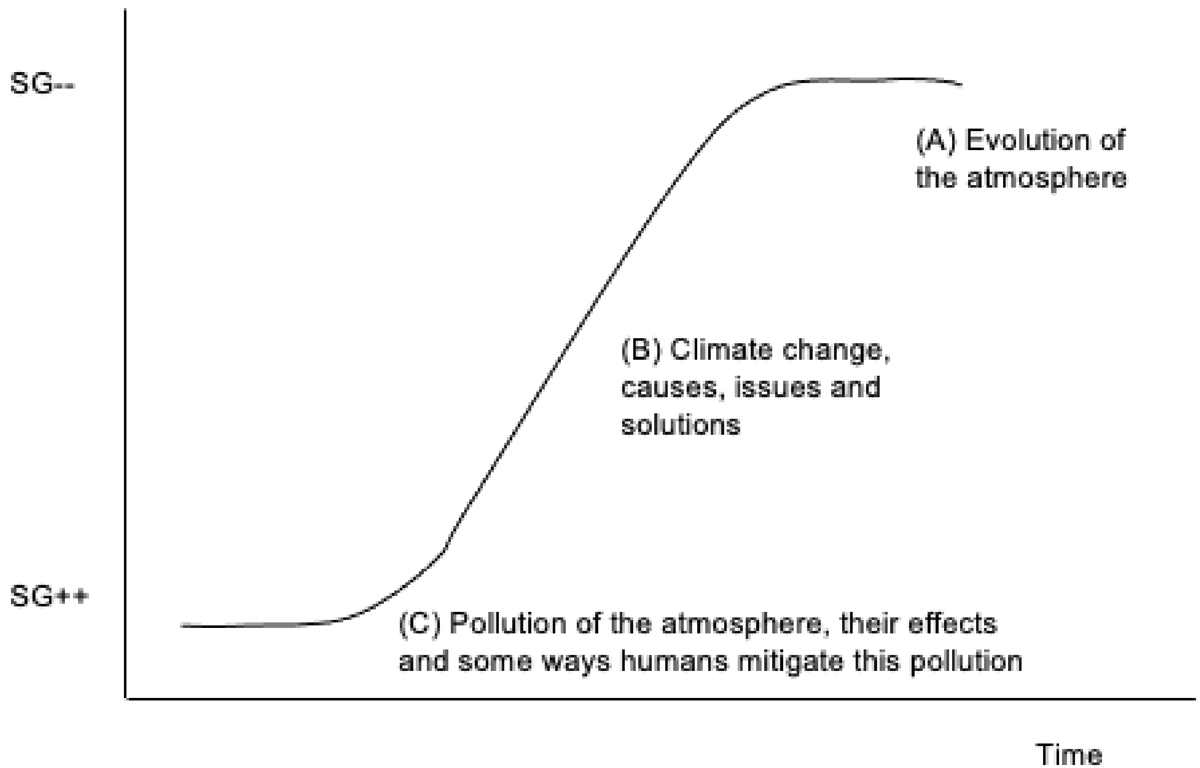
Flipping the curriculum narrative of a chemistry unit

…begin with recognisi
humans have had son
climate. …global warn
requirements…
However! We have als
sustainable solutions t
…several pollutants w
have negative effects
organisms and the ecc
environment around u

Finally, …the modern-
we end up here? Was
Answer: NO! …learn h
changed and developed into what it is today,
and that over long time periods it has changed
significantly due to the geology of the earth
and development of the first organisms."



SG-

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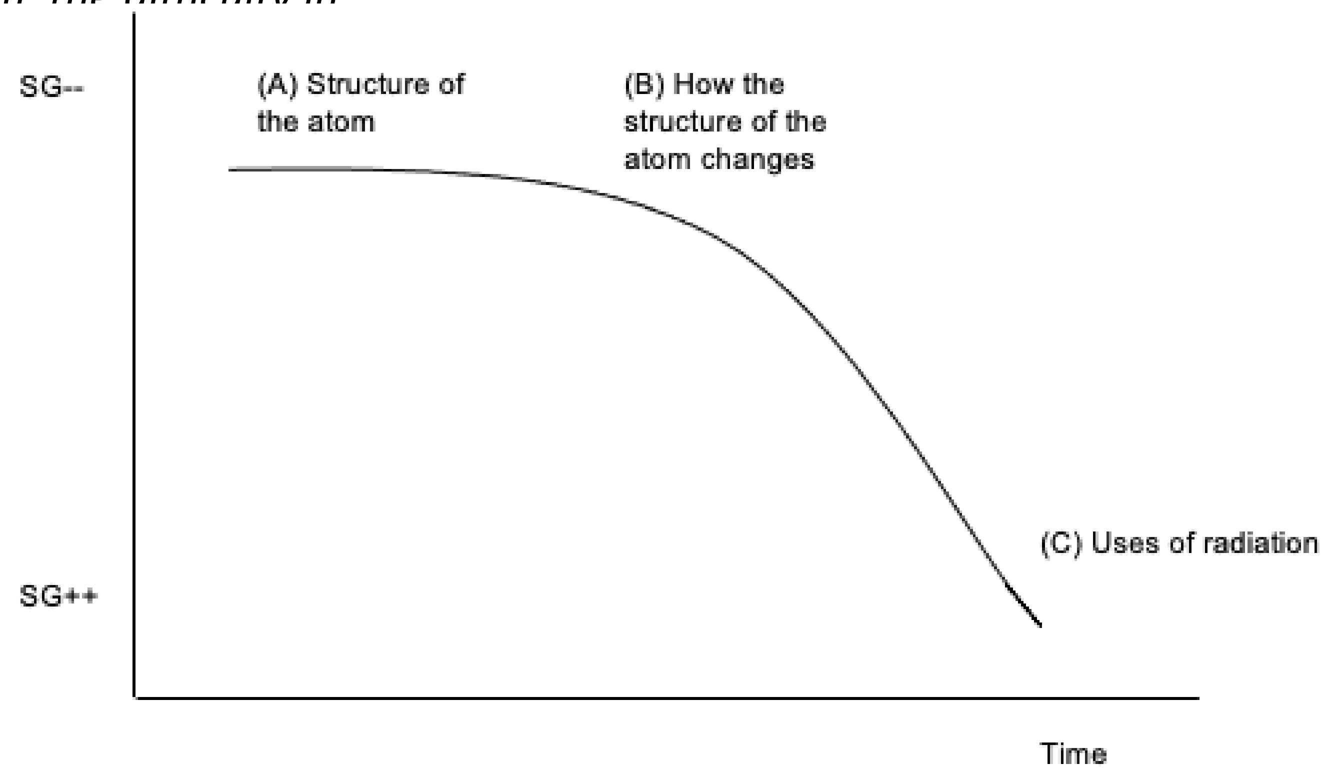
Flipping the curriculum narrative of a physics unit

"If you were creating a narrative in, in radioactivity, um, the difficulty in interacting wit… fundamentally, … the nucleus th… externally.

And so traditio… gone in and be… of an atom to, … the atom chan…

And then you w… and bigger [to … problem is you … that is very, ve… kind of the difficult… abstract, meaning … struggle to transla… further, further out.



So instead, we sort of zoom in and then zoom out.

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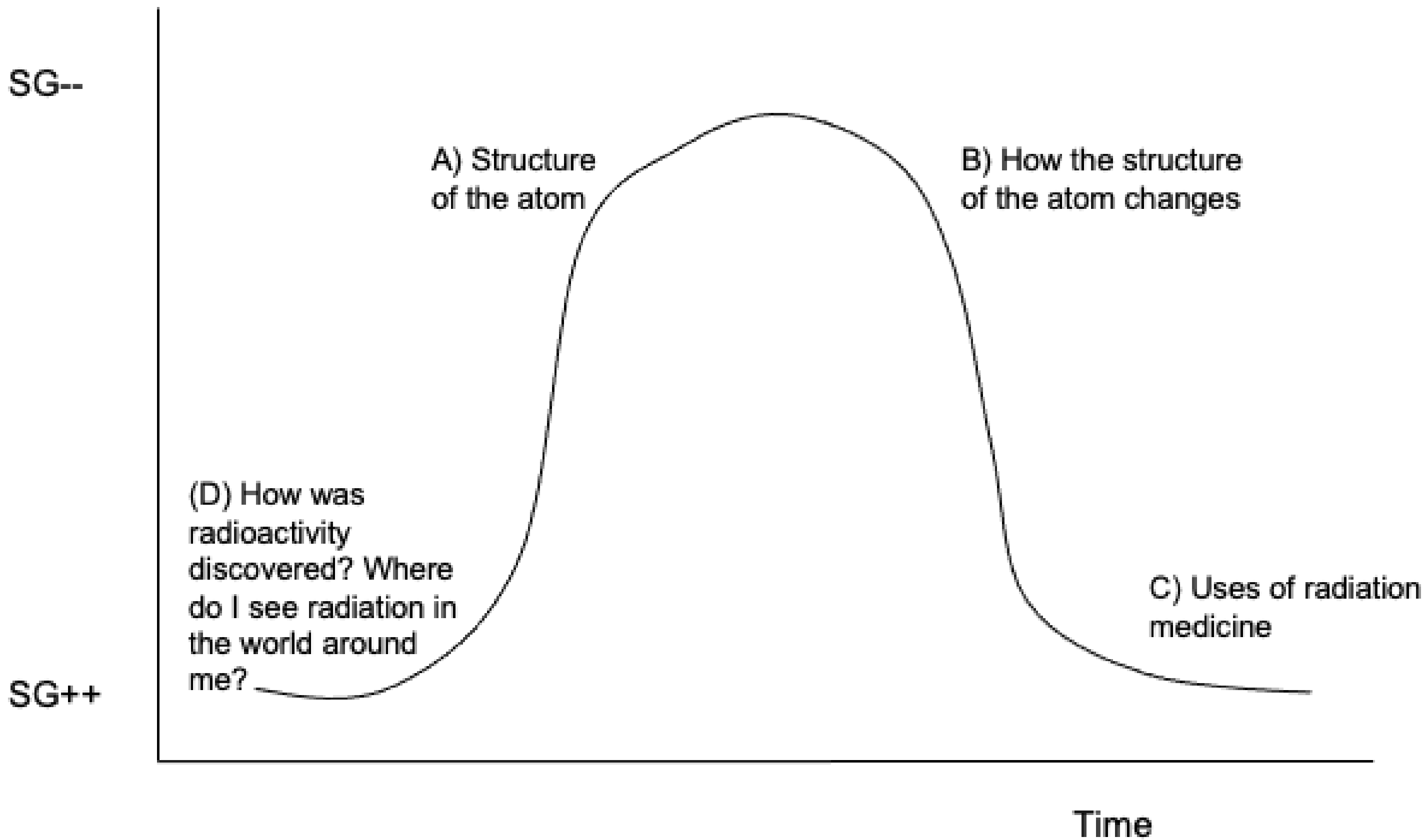
Flipping the curriculum narrative of a physics narrative

"So we start with an understanding of
...how radioactivity was discovered and
understanding
this thing whe
happening, it's
radiation. Yea
Where do I se
around me?', w
when I talk ab
that I meet in

And then we w
think, well, like
scale that star
observations?
think, okay, w
happen, When
applications? Like, I dunno, like,
medicine."



SG++

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Curriculum narrative tentative suggestions

- Suggest that the ’traditional’ way of sequencing units in science tend to start with the more abstract and move towards the concrete.

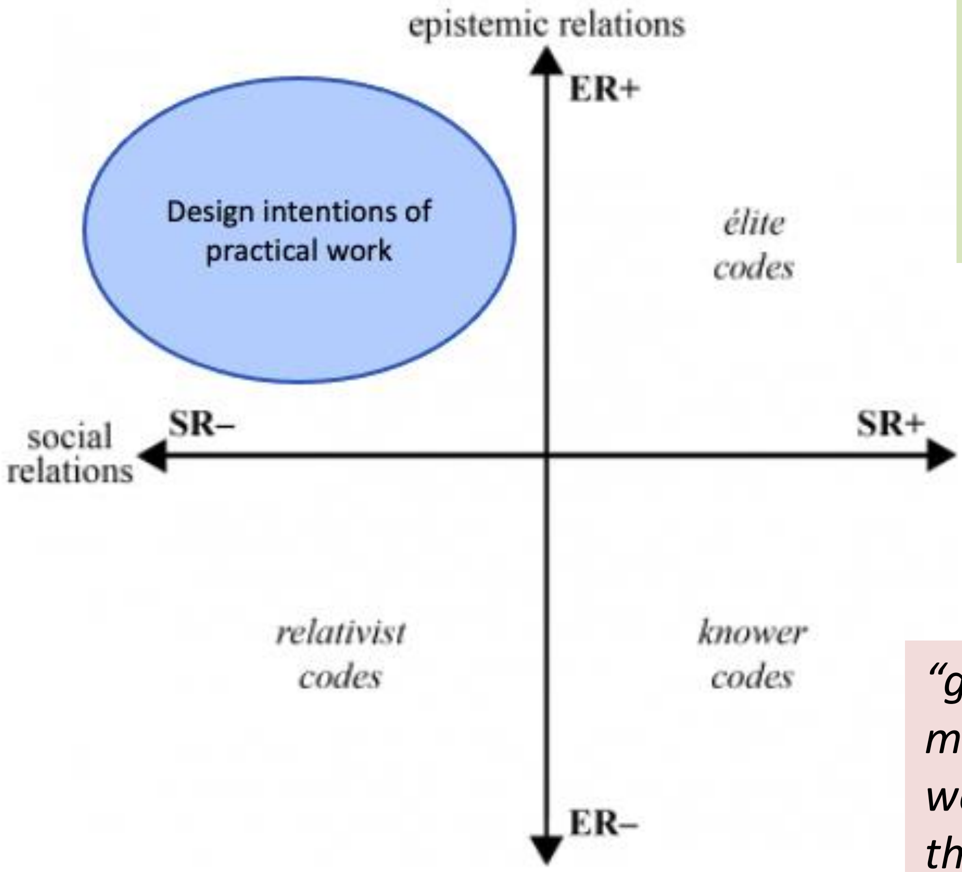
- This is can leave the curriculum without explicit upshifts.

- Instead, I suggest flipping the narrative and starting with the concrete may be beneficial for students’ knowledge building.

- This make explicit the upshifts and starts the unit with stronger student engagement (SR+).

- Finally, I suggest that it may help teachers to consider a semantic wave when thinking of a developing curriculum narratives. Thus, the unit contains both upshifts and downshifts.

Practical work



"It said on the scheme of work to do experiment 3.1 So I did it. What did the kids learn about it? Actually, I hadn't really set them up properly for it. Wasted time probably."

"It's just another way of engaging with something conceptually, uh, like one of the concepts for the lesson."

"got some dry ice in and just gave 'em 20 minutes of great demonstrations about what we can do with dry ice. And, you know, they, they will remember that for, you know, years to come. Um, the nuances of the science, probably not, but you know, that's, that's not always what every minute of the lesson has to be."

But this does not go far enough

“If, we are looking at a teacher, really planning carefully and thinking about what they're doing in the class with their students, we start at the end and we say, what do we want the student to learn? Is it, um, the observation? Is it the skills against the observation? Is it understand a little bit more about the theory underlying that? What do we want them to learn? Define those two or three key things and then work backwards and say, which practical, uh, is useful here?”

The 4-K model: The epistemic plane

- Explore the different knowledge code practices.
- The epistemic plane ‘highlights that practices may be specialised by both what they relate to and how they relate’ (Maton, 2014, p175)
- Ontic relations (OR) – ‘what’
- Discursive relations (DR) – ‘how’

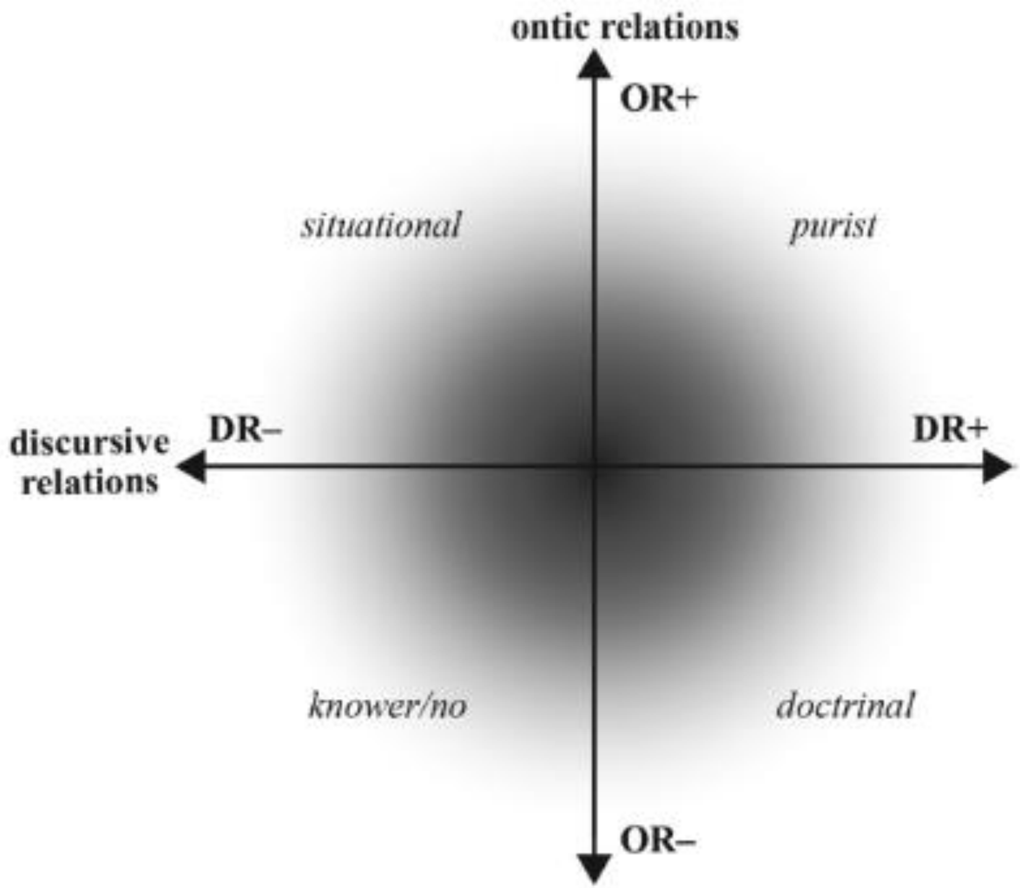


Figure 2. The epistemic plane (Maton 2014, 177).

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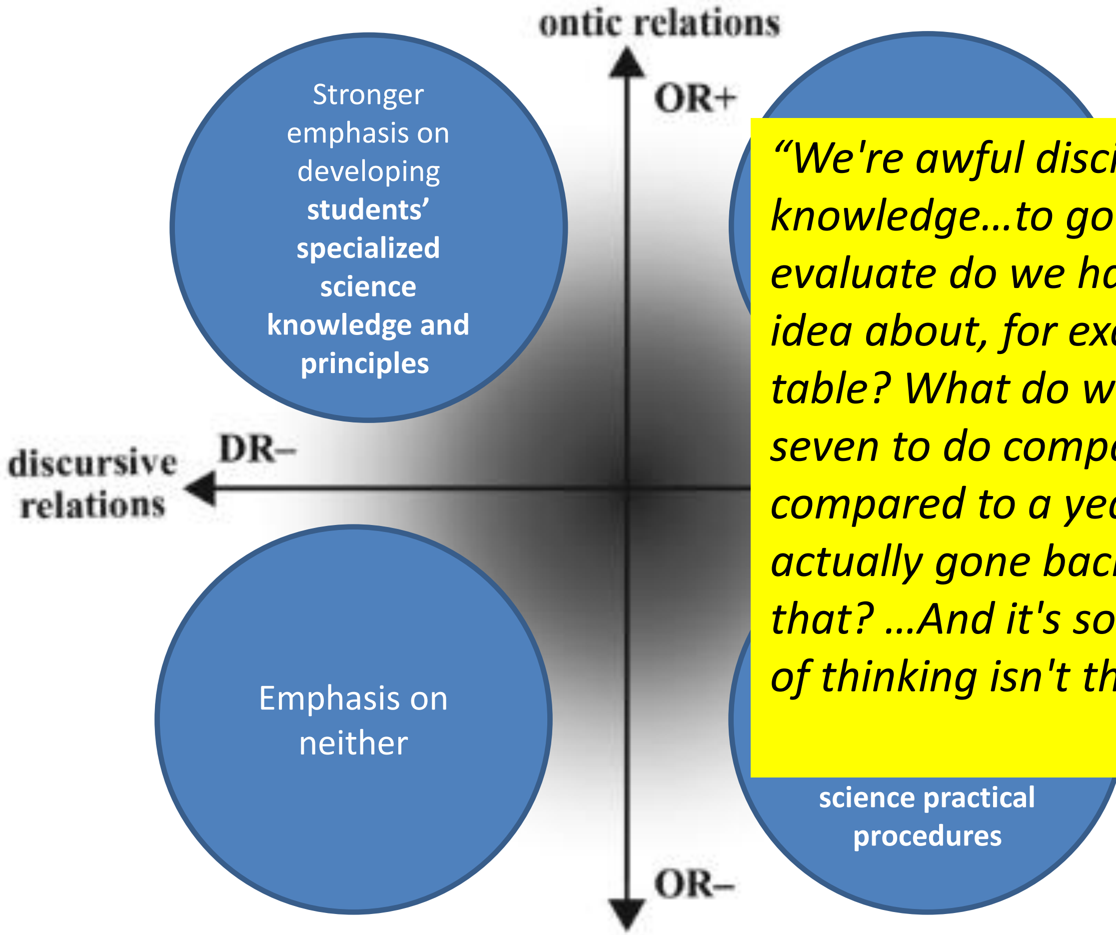
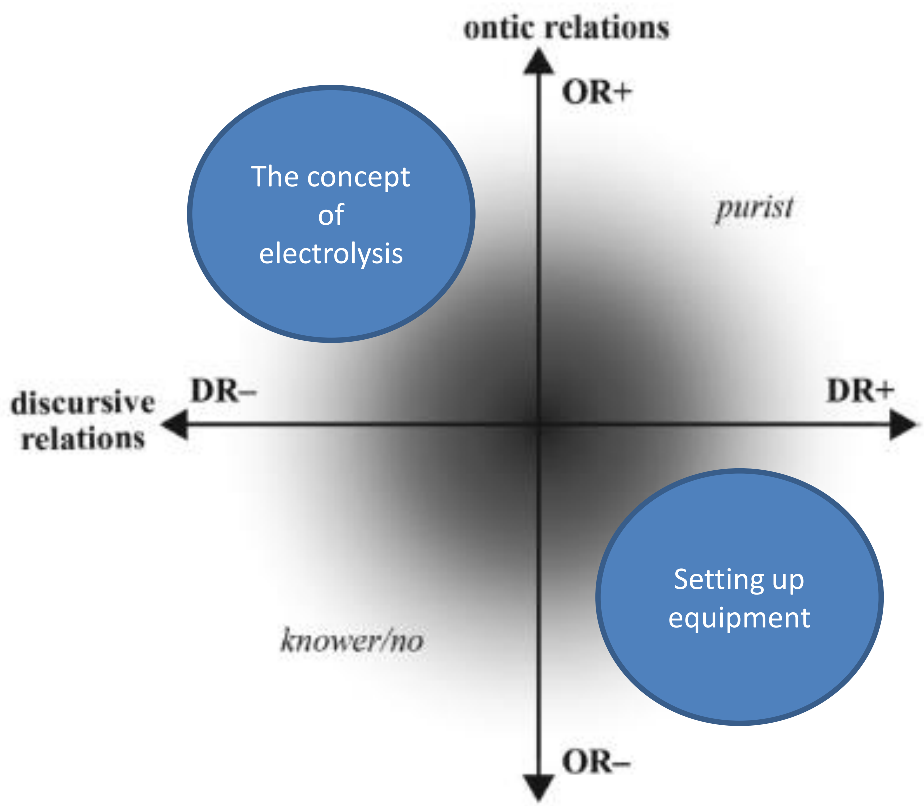
Findings mapped to the epistemic plane



"We're awful disciplinary knowledge…to go back and re-evaluate do we have a really clear idea about, for example, drawing a table? What do we expect year seven to do compared to year eight compared to a year nine? Have we actually gone back and looked at that? …And it's sort of is that depth of thinking isn't there yet."

Figure 2. The epistemic plane (Maton 2014, 177).

Designing more effective practical work
1: Understanding what's ineffective



. The epistemic plane (Maton 2014, 177).

So electrolysis of solutions ... It's quite a complex bit of kit ... And it's really fiddly. It takes quite a while to set up. It's messy. The students make the gases and by the end of it, it's like, 'Brilliant! What have you learned?' And they've not learned a lot other than practical work is hard and messy, and they're not quite sure [what the concept they were supposed to learn was]."

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Designing more effective practical work
1: Understanding what’s ineffective

“I think that we possibly lose the sight on why we're doing them [practical work]…a catapult for that was being done by year seven. And the students were making catapults. They were like wonderfully behaved, really excited. But then, you know, the theory of like motion is something that we'd explore in like AS physics. …it was like we jumped, we'd missed so many of those concepts that are required to understand the law of motion. The students, were just like making a catapult and it was great and they got a sense like something flying and like an energy transfer. But for me it was just like, it's a bit of a waste.”

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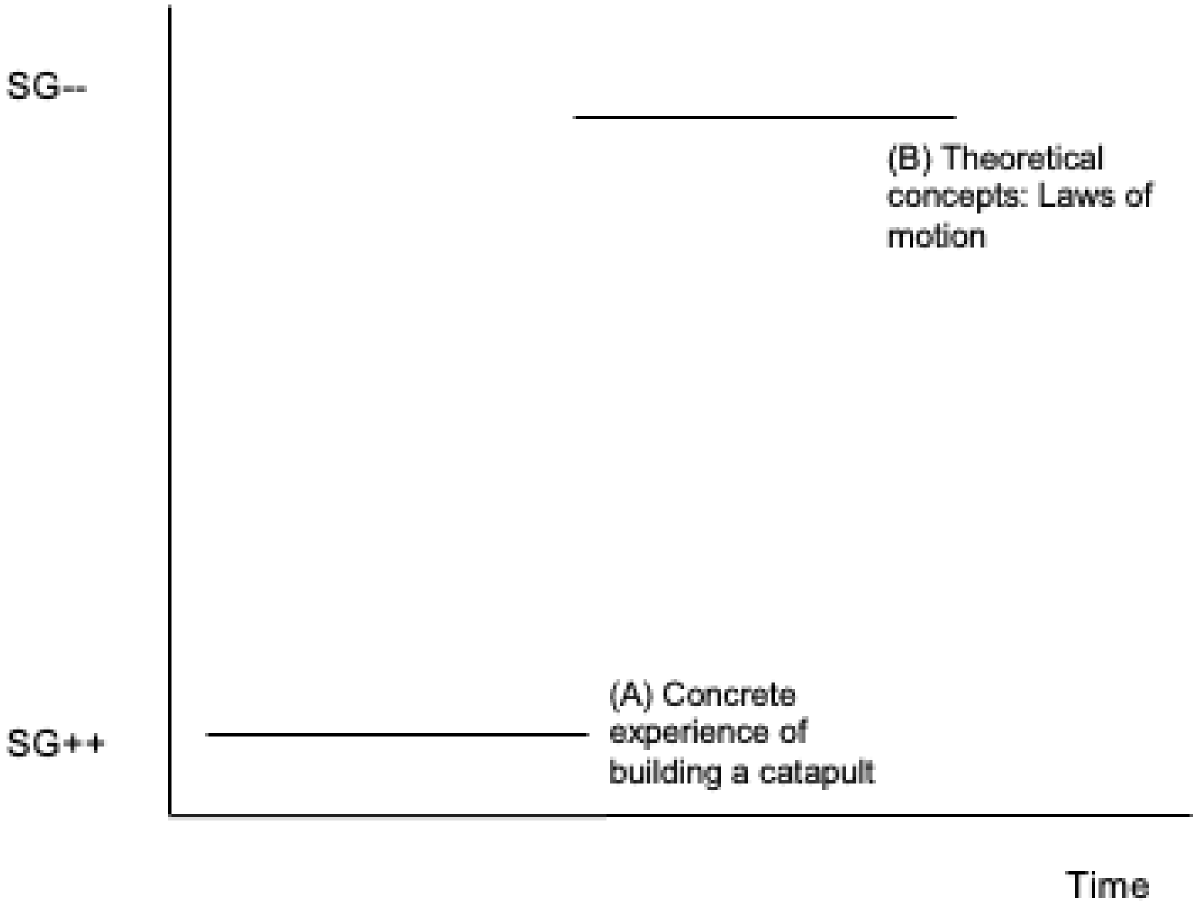
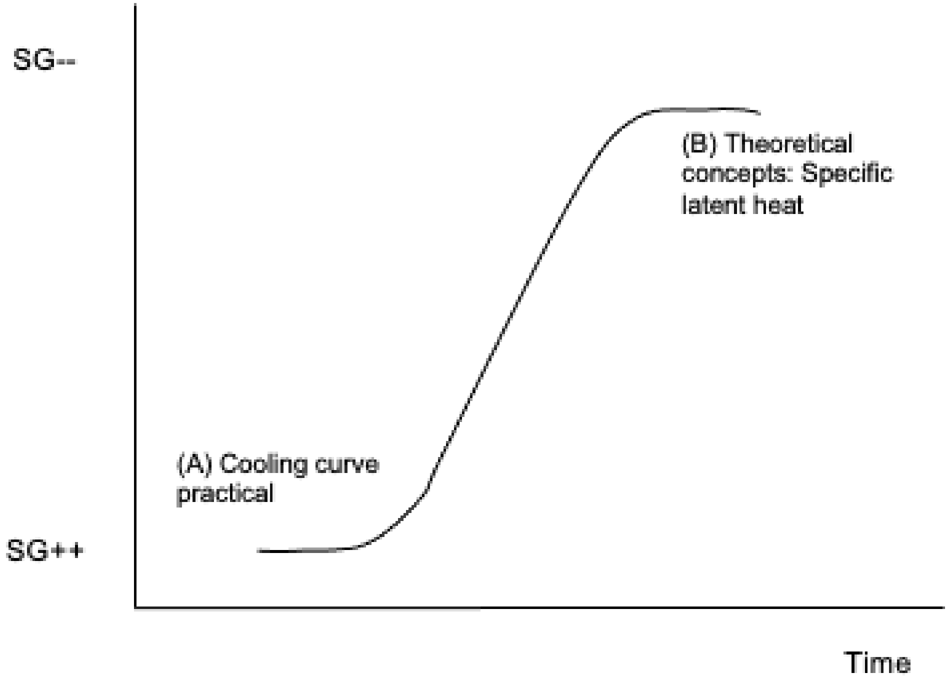
Designing more effective practical work
1: Understanding what's ineffective



Designing more effective practical work



[concept of specific latent heat] …really quite abstract, but it was built on really concrete experiences because we'd just done the cooling curve. We'd seen the changes of state, seen that weird, you know, the flat parts of the graph which was just quite jarring for them. And so it was built on concrete experiences."

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RQ2: What constitutes a professional knowledge base for developing curricula?

Potential of **curriculum planning materials** for developing teacher curriculum development knowledge

“I was looking at sequencing curriculum and all the Ofsted, um, you know, focus on a rigorous key stage three and that came in through several Ofsted frameworks. What does a rigorous key stage three look like? What does sequencing and all those questions around curriculum [look like]? So I've had a lot of time thinking about curriculum development.”
(Teacher)

“Actually, looking at well-constructed narratives and incorporating that into your own teaching, I have found incredibly helpful and continued to find incredibly helpful.”
(Teacher)

“And so we made the scheme of work framework, and we then on this basis, we needed some like higher order organizing theme through which staff could start to develop that [curriculum] narrative.”
(Teacher)

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So, what does LCT have to offer teachers?

- Can be used to understand teachers' practice
- Highlight what bad curriculum design looks like
- A language for understanding problems
- A tool to support curriculum thinking – help teachers see how their practice could be different so they can design curricula more mindfully and with mastery
- A tool to enable a shared language between more experienced and less experienced teachers to support reflection and coaching
- Warning: The version of LCT required for teachers may not be the same as the LCT used by education researchers.

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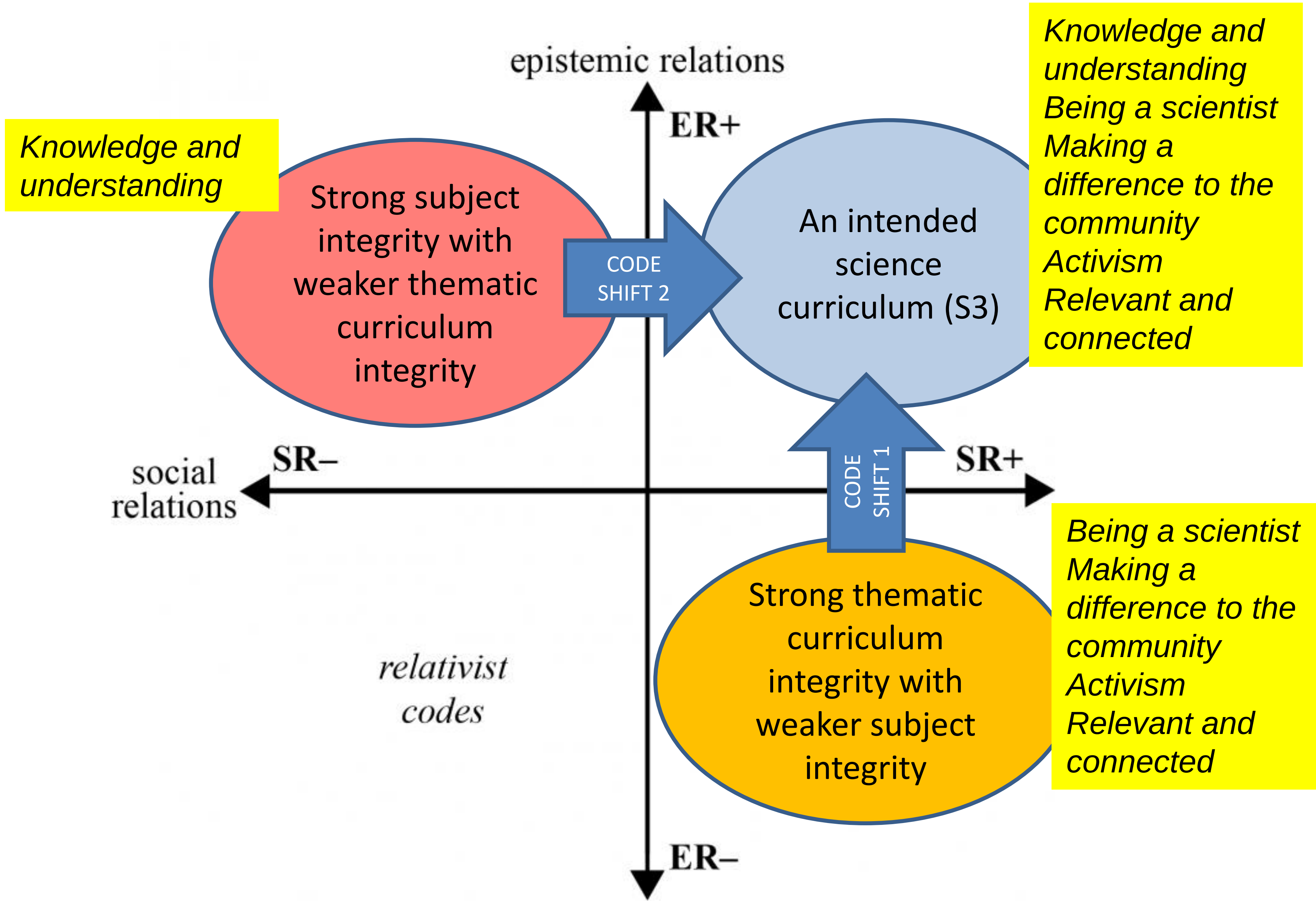
Unpacking a curriculum problem



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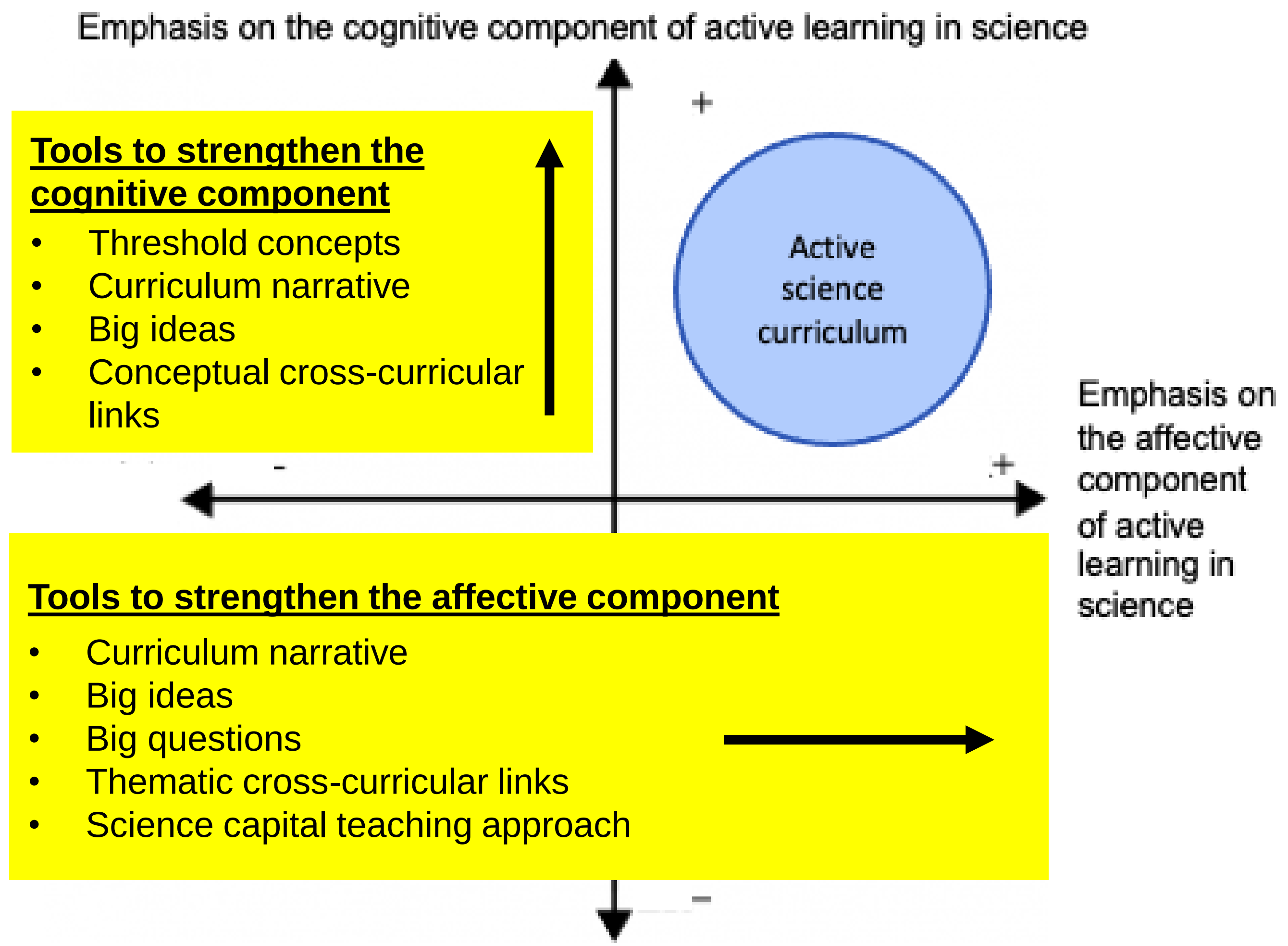
A recontextualized version of LCT for teachers…supporting teachers develop a more active science curriculum?



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Designing more effective practical work

Key questions:

- What form of knowledge is the practical work designed to develop?
- Is the practical designed to emphasise this form of knowledge?
- How can you strengthen the ontic dimension (substantive knowledge) of the designed practical work?
- How can you strengthen the discursive dimension (disciplinary knowledge) the designed of practical work?

A recontextualized version of LCT for teachers…supporting teachers develop more effective practical work?

Substantive knowledge

+

Tools to strengthen substantive knowledge in practical work

- Use simpler equipment
- Ensure students have required prior knowledge
- Link concrete experiences to the abstract concept

Strengthening both

- Not all disciplinary knowledge needs to be taught with every practical. Less is more.
- Instead, select which substantive and disciplinary knowledge can be woven together best.

Disciplinary knowledge

Tools to strengthen the disciplinary knowledge in practical work

- Teach procedures explicitly
- Sequence disciplinary knowledge across year and stage so that disciplinary knowledge builds.

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Dangers of LCT recontextualisation

- Danger of being reductive. Teacher curriculum design by tick-box.
- This is a support for teachers’ curriculum thinking, not a ‘how to’ guide.
- Not an exhaustive list of curriculum principles. The model should allow other curriculum principles to be considered.
- Curriculum is more than the sum of its parts. It is about the relationships between the curriculum principles.
- Application across subjects. The structure of secondary school knowledge in science is different to History.

Questions, feedback and further discussion

- Thank you

The translation device

	Insight	Indicators
Teachers' design of practical work in the science curriculum	Situational OR+ / DR-	Teachers design principles have an emphasis on developing students' specialized science knowledge and principles and developing students' knowledge of science practical procedures is downplayed
	Doctrinal OR- / DR+	Teachers design principles have an emphasis on developing students' knowledge of science practical procedures and students' specialized science knowledge and principles is downplayed
	Purist OR+ / DR+	Teachers design principles have an emphasis on developing both students' specialized science knowledge and principles and developing students' knowledge of science practical procedures
	Knower / no OR- / DR-	Teachers design principles downplay both the development of specialized science knowledge and students' knowledge of science practical procedures