

Knowing how to teach what in environmental education: A tool to help teachers

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Overview

- Knowing how to teach what - PCK
- What do we know about PCK in EE?
- What are CoRes and how could they help?
- How did we use a CoRe?
- What did we find?
- What might it mean?
- Issues in researching teacher PCK?

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2

Knowing how to teach what – Pedagogical Content Knowledge

- PCK can be thought of as effective ways to teach certain content to particular learners (Shulman, 1987).
- It is personal, highly specific, responsive and flexible, with both static and dynamic dimensions
- An educator's PCK can be viewed as the result of a *transformation* of other forms of knowledge (including subject matter knowledge, pedagogical knowledge and contextual knowledge)

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3

What is PCK?

An educator's PCK can encompass 5 components:

- orientations towards teaching (knowledge and beliefs about their subject, and how to teach it)
- knowledge of curriculum (what and when to teach)
- knowledge of assessment (why, what and how to assess)
- knowledge of learners' understanding of the subject
- knowledge of instructional strategies

(Magnusson et al., 1999)

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What is the nature of PCK in EE?

- What do you think?
- Is Magnusson et al.'s framework applicable?
 - orientations towards teaching (knowledge and beliefs about their subject, and how to teach it)
 - knowledge of curriculum (what and when to teach)
 - knowledge of assessment (why, what and how to assess)
 - knowledge of learners' understanding of the subject
 - knowledge of instructional strategies

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What do we know about PCK in EE?

- Pre-service teachers develop subject matter knowledge and pedagogies to teach this through both theoretical and practical learning (Corney & Reid, 2007)
- Fieldwork has been shown to enhance PCK, at least in field-based pedagogies (Dickerson, 2007)
- Pre-service teacher education can help develop PCK and hence confidence to implement EE (Kennelly et al, 2008)
- Development of student action competence is linked to teacher PCK (Alvarado, 2010)
- Specific content knowledge is important in PCK development (Skamp, 2009)

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What are CoRes?

- Developed by Loughran, Berry and Mulhall in the early to mid 2000s
- Content Representations – analytical or conceptual tools
- Link content, teaching and learning in explicit frameworks
- Portray an holistic overview of expert PCK in a topic
- Create a matrix of content ideas and pedagogical question/prompts

Loughran, J., Berry, A., & Mulhall, P. (2006). *Understanding and developing science teachers' pedagogical content knowledge*. Rotterdam The Netherlands: Sense Publishers.

Loughran, J., Mulhall, P., & Berry, A. (2008). Exploring pedagogical content knowledge in science teacher education. *International Journal of Science education*, 30(10), 1301-1320.

A CoRe

	Big Idea	Big Idea	Big Idea
What you intend the students to learn about this idea?			
Why is it important for students to know about this?			
What else you know about this idea (that you do not intend students to know yet)?			
Difficulties/limitations connected with teaching this idea.			
Knowledge about students' thinking which influences your teaching of this idea.			
Teaching procedures (and particular reasons for using these to engage with this idea).			

Using CoRes

- Some research into PCK e.g. in science ed., and only little in EE.
- Emerging research into use of CoRes in science ed., but little in EE that we know of
- Our project this year in PCK in action-taking in a secondary school
- Is a CoRe a valid tool for exploring teacher PCK in EE?

Research context

- A city-based secondary school in NZ
- Two Year 12 teachers
- Work with the teachers using a CoRe to develop their PCK
- Teachers teaching the action-taking achievement standard Efs 2.1
 - planning, implementation and evaluation of a personal action (individual or group) that will contribute towards a sustainable future.

Research questions

- How do experts in content and pedagogy work together with teachers to develop a CoRe for EE?
- How do secondary teachers in Efs use a collaboratively-designed CoRe in their planning?
- What are the student outcomes from a unit in EE that was informed by an expert-informed CoRe?
- How does a collaboratively-designed CoRe influence the PCK of secondary teachers in EE?

Research design – Phase 1

- Phase 1 – facilitated CoRe design workshop with two teachers and content and teacher experts (5 participants and two researchers/facilitators)
- Data collection – observations of CoRe design process, and end of workshop focus group interviews with teachers and experts

Taking Action

	Action taking must be informed and requires skills	Action taking requires collaboration	Action taking requires planning
What you intend the students to learn about this idea?	Knowledge of the issue, its cause(s), and a range of possible ways of acting for this issue	How to work with other people for a sustainable future	How to plan an action using SMART. Actions do not always succeed.
Why is it important for students to know about this?	Effective action is intentional and achievable	We want a shared vision and actions for a sustainable future	Effective action is well planned

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Research design – Phase 2

- Phase 2 – involved the teachers implementing the unit in their classrooms
- Data collection – included student pre and post questionnaires, end of unit student focus group interviews, classroom observations and pre and post focus group interviews with both teachers

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Data analysis

- Using an interpretive approach through content analysis
- Case study of teachers working with a CoRe
- Some use of an activity theory framework to make sense of the data

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Findings – developing a CoRe

- Teachers and content experts worked well together
- Teachers contributed ideas about content and pedagogy from their experiences
- Experts contributed theory about action-taking, theory about EFS in general, and the requirements of NCEA

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Findings – developing a CoRe

- All participants felt contributions were shared and valued
- The teachers reported:
 - Gaining a strategy for teaching achievement standards
The day was very productive and has given me a strategy for tackling other standards (Teacher interview)
 - Appreciating the time and expertise available to debate the topic and clarify knowledge, pedagogies and purpose for teaching
[I gained] a more in-depth and detailed understanding of what it means to take action (Teacher interview)

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Findings – using a CoRe

- The teachers saw value in using the CoRe in their teaching in a variety of ways.
- In general, the CoRe itself was used as a reference point during the planning and teaching of the unit, rather than a prescription for what and how to teach
- The process of designing the CoRe had elicited reflection, sharing of ideas and a clearer recognition of the school constraints to be overcome to teach well
- Observations of teacher lessons showed evidence of connections to the big ideas in the CoRe. Use of video and scenario appeared to engage students well, as did clarity around specific actions to take

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Findings – student outcomes

- Responses to questionnaires administered before and after the unit (n = 37):
 - Students felt they gained a clearer idea of what a sustainable future looks like after the unit
 - Students believed more strongly that any environmentally-friendly actions they take would benefit the environment after the unit
 - Students believed more strongly that they should take action according to their attitudes and values after the unit
 - Students agreed more that they wanted to contribute to a sustainable future after the unit

Findings – student outcomes

- One student reported learning about taking action:
Most difficult thing for me was approaching people to sign and have them say no, and then to try to persuade them to sign. Realising that people can have different views to us, hard to accept their view. Especially when you feel you have more knowledge than they do (Final student interviews)

Findings – student outcomes

- One student reported the teacher's enthusiasm helped motivate the students:
Teacher helped us by purchasing a bird nectar feeder for our project. She provided a lot of enthusiasm, which helped motivate us (Final student interviews).

Findings – developing PCK

- CoRe discussions helped the teachers:
 - see more clearly the big picture of what they were trying to teach
 - learn from other's ideas and problems
For me it was so useful to just look at the big picture. I always do that at the start of a topic, I have a scrappy piece of paper, I do a big picture brainstorm. But to actually put them into words with other people and really think carefully about what those key concepts and messages that we want those students to come away with at the end, that was a really useful process and I was just so grateful for the time to have it, with not just having to do it by myself at my desk but with other people (Teacher interview)
 - develop content knowledge
 - see how students' backgrounds and experiences were important in developing their action-taking abilities
 - have more confidence in being able to assess student achievement in action-taking

Conclusions

- CoRe construction involving teachers and 'experts' developed teacher content knowledge, knowledge of students, and confidence to teach and assess
- The process of designing the CoRe, with its discussion and reflection elements, was perhaps more important than the final CoRe product itself
- The big ideas (content knowledge) in the CoRe were referenced more by the teachers than the pedagogical elements
- The CoRe did help the teachers focus more clearly on what they were wanting the students to achieve
- Both teachers said they would construct other CoRes for other topics/subjects they teach

Issues for discussion

- Could CoRes help all environmental educators?
- Would a CoRe designed by some, be usable by others? Or is involvement in the CoRe design process itself critical?
- Is the CoRe structure applicable across EE? Are the right questions/prompts being used to interrogate and make PCK explicit?
- How else could PCK in EE be explored and/or developed?

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