Advancing the professional learning of science teachers through engagement with research

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Teaching as disciplined enquiry

- ‘Teaching, in its fullest sense, requires ongoing study of oneself in order to be sensitive to learners, ongoing enquiry as to the sense that learners are making, and ongoing enquiry into the subject matter of the discipline.’

- Mason, J. (2009). Teaching as disciplined enquiry. *Teachers and Teaching: theory and practice.* 15(2), 205-223.

Teachers and research

- In this lecture I argue that teachers' professional learning can be advanced by engagement with research, but this can take different forms as suited to individuals and circumstances.
- I will focus on different kinds of engagement, drawing on many years of experience of working in science education research and teacher education.

Overview

- Professional learning – what does it mean?
- Funded research projects – teacher-researcher partnerships.
- Action research- the role of teacher inquiry.
- Professional learning through masters and doctoral study

Professional learning – what does it mean?

- Initial teacher education – the beginning of the learning journey
- Going beyond survival and basic skills – understanding ‘teaching for learning’
- Personal learning
  - As teachers become more experienced their professional learning needs become more complex and diverse as their knowledge, beliefs and values develop in individual ways.

Teachers' Professional Development (Bell and Gilbert, 1995)

- Personal
  - Seeing a problem with what you do
  - Changing how you see yourself, becoming empowered
- Professional
  - Wanting to try out new ideas
  - Developing practice, initiating other activities
- Social
  - Being isolated is problematic
  - Valuing collaboration, initiating collaboration

Professional growth

- ‘teachers as active learners shaping their own professional growth through reflective participation in professional development programs and practice’ p948
- ‘teacher growth is constituted through the evolving practices of the teacher, which are iteratively refined through a process of enaction and reflection’ p 955.
- Clarke & Hollingsworth (2002)

Clarke & Hollingsworth (2002) model

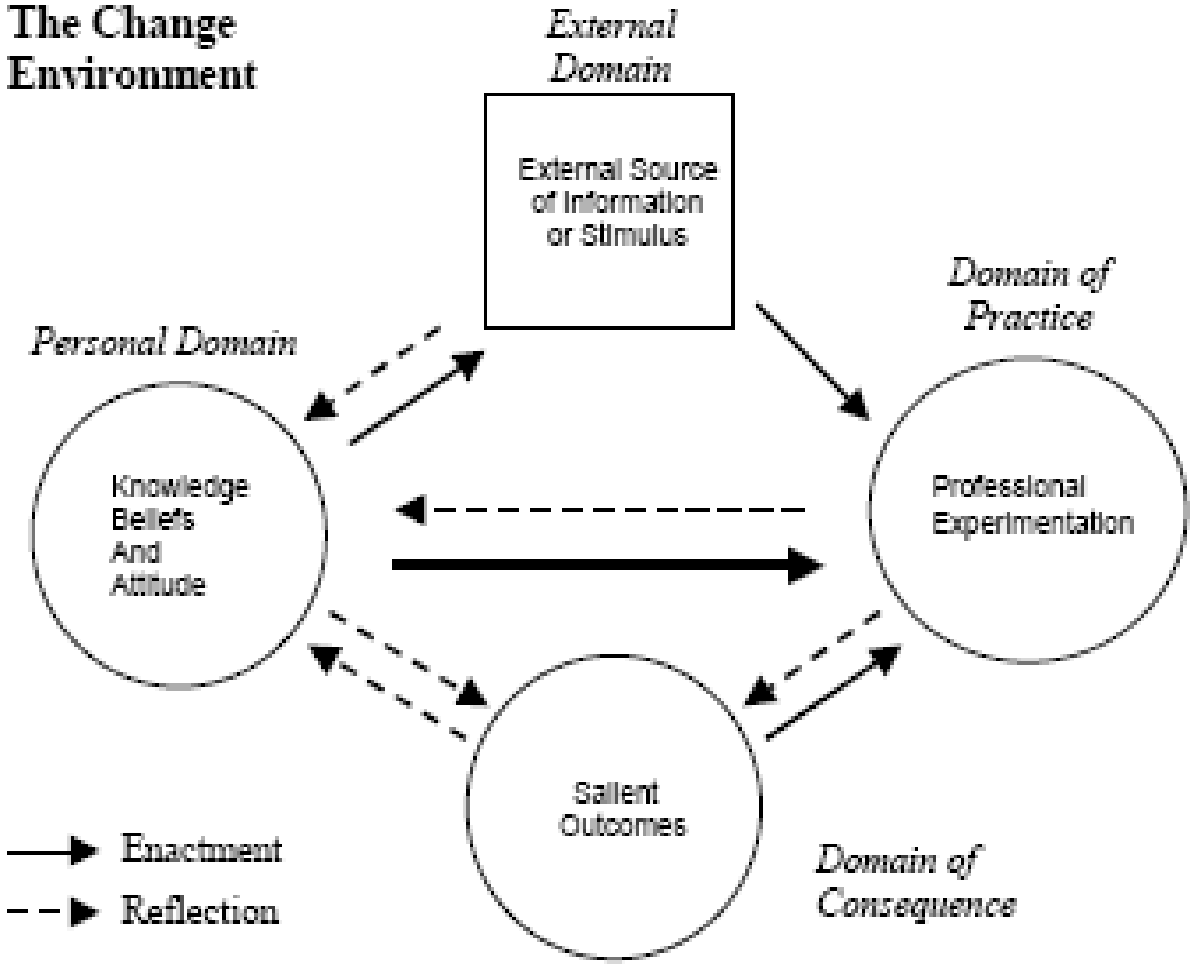


Fig. 3. The interconnected model of professional growth.

The stimulus to change and develop can come from research

- Activities
- Theories
- Alternative values

The importance of valuing what you do

- If teachers perceive that they are not achieving valued outcomes, they are stimulated to learn and try new practices.
- Engagement in research can provide the means for analyzing and understanding practice that can extend values and provide a source for learning.

Research informed professional development projects – teacher/researcher partnerships

- Cognitive Acceleration in Science Education
- Assessment for Learning
- Argumentation

Argumentation in science

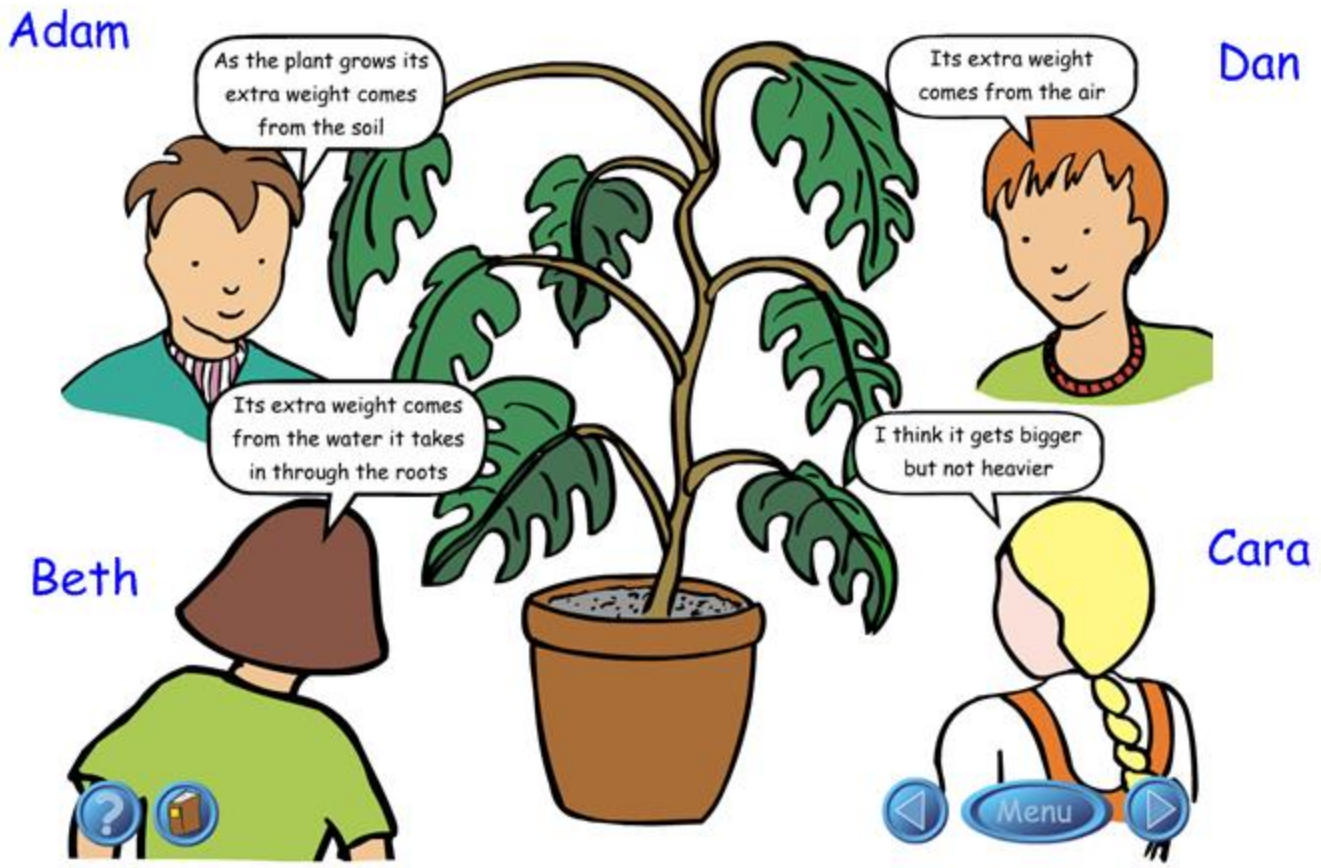
- Affords opportunities for students to engage in peer discussion of alternative ideas and their justification, which has been shown to lead to enhanced conceptual understanding (Venville & Dawson, 2010).
- Argumentation activities can help children to develop and articulate their reasoning and advance their understanding of science by providing opportunities to take stances they justify with evidence, and to evaluate evidence that is used to support or refute different scientific claims.

Argumentation activities

- Concerned with discussion and debate based around **evidence**
- Support the development of **scientific knowledge**
- Provide children with opportunities to take **stances justified** with evidence, and to **evaluate** evidence
- Consider why the wrong idea is wrong as well as the justification for the scientific idea
- Provide children with a better insight into the nature of scientific inquiry.
- Can be challenging.

Argumentation activities

- Activities can be designed to provide a range of opportunities for taking stances and justifying with evidence:
- Competing theories
- Concept cartoons
- Making decisions with evidence cards
- Predict-observe-explain



Heavy Plants

Axolotls have soft, moist skin	Axolotls have a vertebral column
Axolotls have a tail	Axolotls cannot internally control their body temperature
Axolotls have gills	Axolotls have four limbs
Axolotls have lungs	Axolotls have legs with toes
Axolotls can obtain oxygen from water and air	Axolotls eggs are soft and jelly like

Teaching argumentation

- Learning to teach argumentation involves practicing small group discussion and interacting with students to scaffold certain processes, which can be challenging for many teachers (Simon, Erduran & Osborne, 2006; Sampson & Blanchard 2012).
- Designing or adapting resources for argumentation involves complex interpretation of the purpose of an activity, the science content and possible modes of implementation (Simon & Richardson, 2009).

Argumentation pedagogy - key features for developing practice:

- The management and organisation of group work to afford productive discussions (Evagorou & Osborne, 2013; Sampson & Clark, 2008)
- The role of the teacher in a lesson structure that includes scaffolding argumentation processes whilst introducing argumentation, having small group discussion and providing a plenary (Simon et.al. 2006; McNeill & Pimentel, 2010)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Argumentation pedagogy

- There are three key aspects of teaching that would benefit from tasks and video material that can support teacher learning. These are:
  - The planning and organisation of groupwork.
  - The teacher's role and interactional strategies in introducing argumentation, sustaining small group discussion and conducting a plenary.
  - The design and interpretation of resources within the curriculum.
- Analytical reflection between colleagues working together collaboratively.

Website project with Paul Davies, Jillian Trevethan and 8 teachers

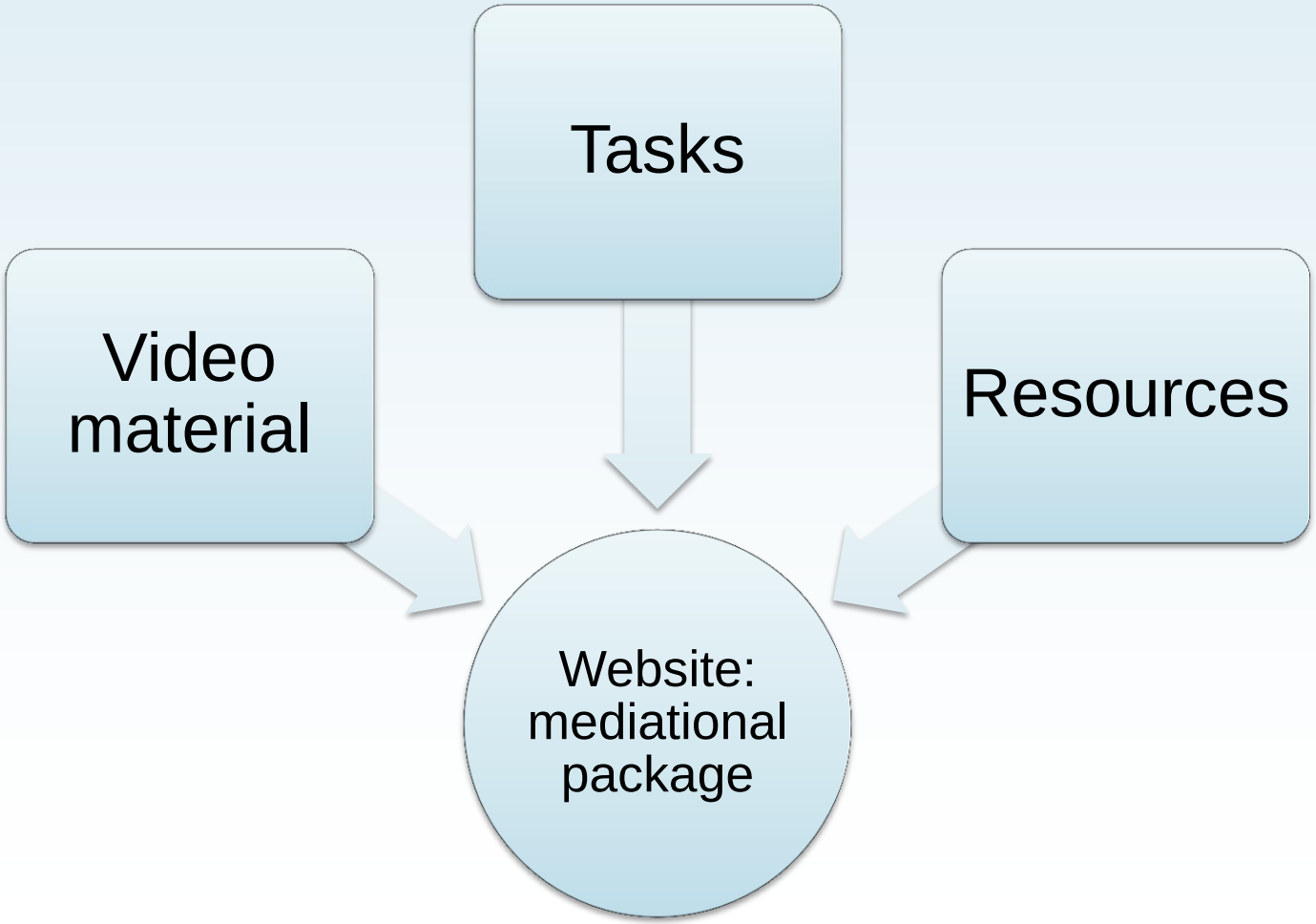
- Produce good quality video material that will be accessible via a website and that will be supported by specific professional development tasks.
- Plan three web-based CPD units
- Trial the units in a local teachers' centre with a cluster of teachers from primary and secondary schools in the area.
- Evaluate the impact of the workshops using questionnaire, evaluation surveys, shared feedback, flip camera personal recordings and follow-up interviews.

- https://www.pstt-cpd.org.uk/ext/cpd/argumentation/index.php

Website link

The website

Vision for the website: what do teachers notice?

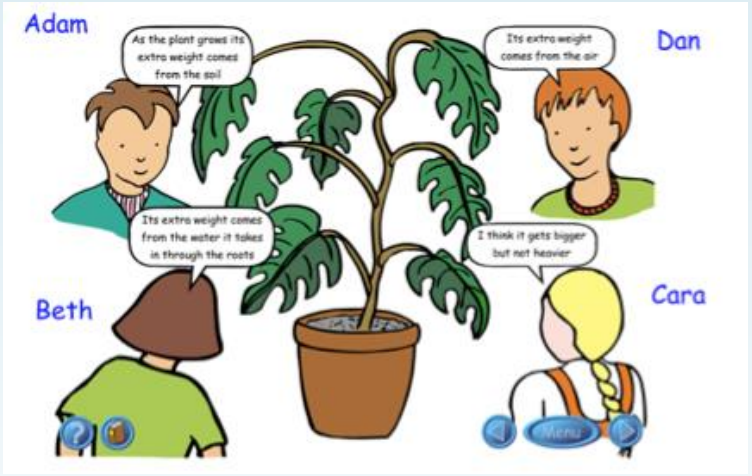


Video material: identifying the focus

Plan lessons → Video lesson → Transcript analysis → Edit

Video clips and sequences to guide focus

Website materials



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Final website

Structuring and managing groups for small group discussion

Start Unit 1

The teacher's role in argumentation activities.

Start Unit 2

Designing activities and creating lesson plans

Start Unit 3

Research project

- How do teachers engage with the videos and tasks developed for the website?
- What choices do they make for implementation?
- To what extent do they collaborate with others, in school and workshops, and reflect on their practice?
- How does their engagement raise their confidence in using argumentation activities and strategies?

Recording your learning

Make a video diary of

- The conceptual area
- The activity and its goals
- The group work strategy you used
- Your reflections on the impact of the strategy and the activity you used on the children's learning of scientific knowledge and understanding and of the skills of argumentation.

Feedback from practice

- Topic
- Nature of activity
- Group work strategy
- What did you do?
- What did the children do?
- What was successful in terms of activity and strategy?
- What could have been better in terms of activity and strategy
- What have you learnt?
- How and what did you disseminate to other teachers?

The value of reflection and collaboration

- It was really nice for me to be in an environment where I could work and share, and learn ideas from other teachers…

- For me it was the discussion and the reflection part of it…to watch the videos and think and reflect on it. For me that was most powerful.

Website project - conclusions

- The programme was built on extensive previous research into argumentation pedagogy
- The research undertaken with participating teachers reinforced the need for:
  - Critical reflection
  - Collaborative working
- Video and tasks embedded within a website provide a source for learning.

Action Research

- In school workshops
  - Introduce approaches to action research, research methods
- Teacher owned projects
  - Inquiry that arises from issues of practice
- Sharing
  - Within the science department, across schools

So what is ‘action research’?

- Teachers striving to understand and to improve their practice.
- Proceeds through a process of planning, action and reflection upon action. This can be thought of as an action-reflection ‘cycle’.
- Involves the gathering of evidence about practice.
- Involves teachers trying to see the effects of planned change in their practice.
- Strives to be systematic and rigorous.
- Analysis and knowledge formation in action research belong to the practitioner.

Doing Action Research in Education

six questions which should help you start your inquiry:

- What is your concern?
- Why are you concerned?
- What do you think you could do about it?
- What kind of evidence could you collect to help you make some judgement about what is happening?
- How would you collect such evidence?
- How would you check that your judgement about what has happened is reasonable, fair and accurate?

Golden rules for selecting a topic

- Keep it manageable – keep the focus small scale.
- It should be interesting to you – you may need some perseverance to see the inquiry through!
- It should be workable – identify ways in which you might have a go at addressing your question.
- It is not too disruptive of normal routines.

  (Not just your own, but also other students/staff).

What data might you collect?

- Observations
- Interviews
- Questionnaires
- ‘Journals’ (diaries)
- Documents or work samples

Individual teacher projects

- Improving perceptions of BTEC
- Literacy and Numeracy Skills of AS Chemistry Students.
- Increasing success in BTEC
- Applying Literacy in Chemistry
- Does doing a lot of past papers turn students off chemistry?
- Biology Coaching: A student's view of support

Rationale

- Teacher questioned the reasons why students have problems and lose marks in exams. – was it a numeracy issues or literacy issue?
- Inquiry arose from observations of practice, and of thinking ‘logically’ about possible reasons for losing marks.

- Teachers concerned with the attitude that students come into BTEC with and the general negative perception of the course
- Inquiry arose from observations of students and a desire to improve the attitudes towards the subject

Methods

- A google online survey (chosen as the most straightforward) carried out with A-level students.

- Interviews carried out with students in year 12 and 13 and then a subsequent focus group for each year group conducted.

Inquiry findings

- highlighted problems with numeracy, and confidence in using skills (sometimes false confidence)

- Students unaware of the opportunities still available to them with BTEC
- Not enough information given to students at enrollment

Personal learning

- Numeracy - "I learnt about specific needs – e.g. rounding"
- Literacy – I have reflected on *'the precision of my own language'*

- As students progressed through the course, they gained a more positive attitude towards the course as it was more secure than examinations.

Change in practice of others

- “It’s hard to know how much people have responded to my presentation”

- Change in terminology and phrasing used when enrolling onto the BTEC
- Raised awareness of how students feel to other teachers (they had not considered this before)
- Collective improved attitude towards what you can do with a BTEC

Academic Study

- Teachers often seek to enhance their professional learning through higher degree programmes such as master's and doctoral studies that include scholarly activity, and many perceive the benefits of linking research directly to practice through interpreting the literature in the light of experience

Master of Teaching

- Turner, K. & Simon, S. (2012) In what ways does studying at M-level contribute to teachers' professional learning? Research set in an English university. *Professional Development in Education,* 39(1) 6-22.

Interview study with MTeach students

- In her interview, Natasha explained that ‘the professional dialogue thing is very hard in school’ and she affirmed the ‘huge impact’ that encounters with other kinds of ideas had had on her practice:
  - I’ve just enjoyed being around people really who push your own thinking. I think sometimes at school, you can get a bit kind of blinkered and you don’t even use your higher brain in a way; you’re in the day to day and you never really push yourself.

Cont…

- Linda, like Natasha, was also actively seeking exposure to new and different ideas and intellectual challenge:
  - I think being on the MTeach has been very valuable for the intensive progress because I don't feel I have particular outlets at school, especially not at the moment. And also I don't have the kind of talk that I've wanted to have that I have been able to have here with people talking about ideas and theories and it doesn't go on in staff rooms.

Portfolio study with same teachers

- For Fahrin, change in practice is led by a reappraisal of educational beliefs brought about by the re-encounter with socio-constructivist theories of learning:
  - Two years ago, I was under the impression that I taught using the social constructivist model of learning described in Pollard (1997, 129) – with hindsight and through keeping a journal for the Leading Learning module, I have realised that I have often steered quite far away from my ‘preferred’ model of learning due to work pressures.

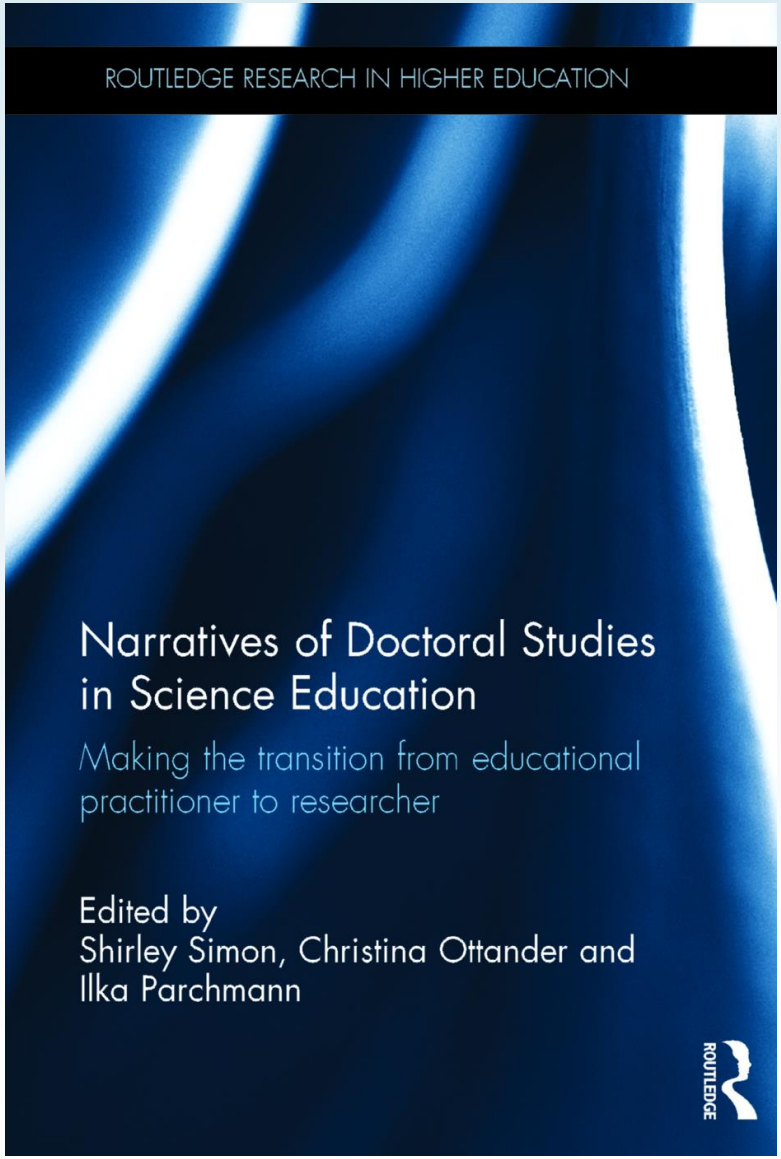
Contribution of M-level to teacher learning

- Our analysis of interviews and portfolios confirms the importance of a source of conceptual input and evidences the value that teachers accorded to ‘talk about teaching’ stimulated by the interaction between theoretical ideas and personal experiences from contrasting contexts.
- Such pedagogic discourse is fundamental to teachers’ sense of professional identity because it is ‘explicitly grounded in the scrutiny of ideas, theories, ethical values and empirical evidence’.

Outcomes of doctoral study

- Narratives of Doctoral Studies in Science Education: making the transition from educational practitioner to researcher. (2016)

- Shirley Simon, Christina Ottander and Ilka Parchmann


ROUTLEDGE RESEARCH IN HIGHER EDUCATION
Narratives of Doctoral Studies in Science Education
Making the transition from educational practitioner to researcher
Edited by
Shirley Simon, Christina Ottander and Ilka Parchmann
ROUTLEDGE

Conclusions

- The analysis highlighted the dilemmas faced by many research students whose task is to create ‘new’ knowledge, which can be a challenge for practitioners who are researching issues arising from their own contexts that may or may not have been studied elsewhere.
- In developing their research from their original concerns these students have learnt how to develop research questions and methodologies that enable their own individual research to make a contribution to some wider understanding/theory.

What have we learnt about teacher learning?

- Teaching is a process of ongoing enquiry involving shifting values
- Collaborative working and critical reflection are important
- Relevant classroom activities, accessible teaching strategies, opportunities for sharing and reflection are essential
- Can be achieved by engaging in research in different ways.

Thank you

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