Situating the Scholarship of Teaching and Learning in University Physics

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Introduction

Working from the perspective that university teaching is essentially about making learning possible (Ramsden, 2003) and that the Scholarship of Teaching and Learning (SoTL) is essentially about making transparent how such learning is, or has been, made possible, the work presented here details the start of an exploration into the way in which the "disciplinary style" Taylor Huber and Morreale (2002) of university physics shapes the scholarship of teaching and learning.

Recent work in SoTL has begun to explore the nature of how SoTL manifests itself across disciplines (in the mainstream scholarship of those disciplines). The variation of manifestation of SoTL has become known as *disciplinary style*. This notion of disciplinary style incorporates physics discourse, methods, concerns and values, and the ways of understanding connections between practice, student learning, and teachers themselves as individuals and as part of a discipline-based community. A disciplinary area not yet explored for such disciplinary style is the university physics teaching and learning environment, which principally consists of higher level physics lecturing, problem-solving and conceptual exploration tutorials, and laboratory work. This report describes the beginning of such a disciplinary style exploration. We do this by describing and discussing an exploratory investigation into the kind of relationship that there may be between what we have called the *crafting of practice* in university physics and what Ashwin and Trigwell (2004) have called the levels of *pedagogic investigation* that teachers may undertake in relation to personal, local and public knowledge profiles. Our notion of *crafting of practice* is used to capture the guiding *conceptual framework of praxis* that is situated in how university-physics learning is considered to be best made possible. The kinds of *pedagogic investigation* profile categories we have drawn on have been used to characterize broad attributes of *purposes of investigation*, *verification of evidence gathering process*, and *knowledge-level outcome*. In this way we have utilized these categories to represent dynamics of physics lecturer's transparency-making of how learning is, or has been, made possible. The relations that we envisage between *teacher knowledge*, *teacher action* and *student learning* draws on the work of Trigwell and Shale (2004) and Prosser and Trigwell (1999). In particular these relations draw on Trigwell and Shales' (2004) notion of *pedagogic resonance*, which represents that part of what students' experience in the act of teaching that contributes to their potential to learn – a metaphorical teacher-learner bridge that attempts to capture what takes place within the dynamics of successful interactive teaching. These relations for our work are outlined in Figure 1.

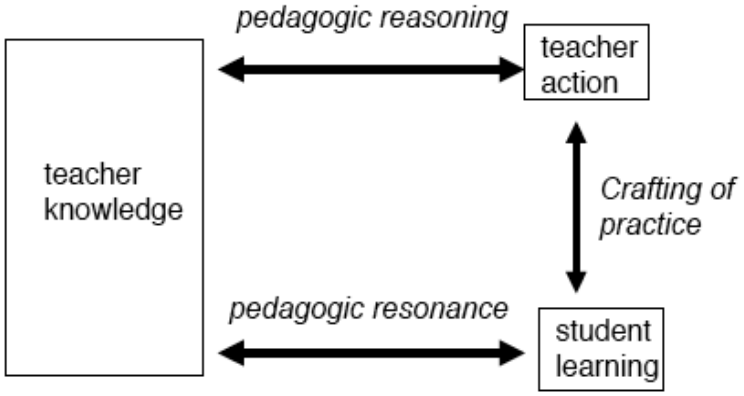

Figure 1: The relations between teacher knowledge, teacher action, and student learning in terms of *pedagogic reasoning, pedagogic resonance* and *crafting of practice*.

Results

In the spirit of the discussion so far, we have used categories of *crafting of practice* and categories of *pedagogical investigation* as a way to start capturing insights into the ways in which the disciplinary style of university physics shapes the scholarship of teaching and learning We begin by giving an overview of these categories and then discuss their use and outcome based upon a more recent classification of interviews with 9 physics lecturers drawn from two Swedish universities and one South African university.

(1) Overview of *crafting of teaching* categories

Using those parts of the phenomenographic research approach (Marton & Booth, 1997) that focus on capturing the variation in experiencing phenomena, that is bringing out the qualitative variation, we conducted 13 interviews with physics lecturers drawn from two Swedish universities. During these discussions we looked for characteristics of pedagogic reasoning and pedagogic resonance to explore with the interviewees. We did this exploration by situating the discussion around actual physics teaching episodes and the lecturer's broad teaching and learning insights and concerns. During these interviews we explored how the lecturers formulated, and how they reflected on and put into practice the conditions that they felt made learning possible. They were also asked to describe how they saw their students' learning take root and grow, how they saw themselves as teachers, and how they thought that their students saw them as teachers. Issues such as goals and what motivated certain thinking and teaching initiatives were also discussed. These interviews were recorded and transcribed verbatim. The analysis to obtain the variation in meaning involved an iterative, but non-algorithmic data sorting process to group and re-group different pieces of the data until saturation was achieved. The final outcome was the formulation of five qualitatively different categories of ways of crafting university-physics teaching practice. These are outlined below and a summary of the variation characterized by the categories -- the structure and meaning of the categories -- is given Table 1.

Way of crafting (A): *Practice founded on techniques for presenting*

The focus of this category is on *teaching techniques* and on *systemizing the discipline* as the way to make learning possible. The orientation is towards the lecturers themselves and how well *they* master the technique to present the key concepts and practices of physics. Issues like

what kind of equipment is most powerful to show the audience interesting phenomena are considered teacher-valuable.

Way of crafting (B): *Practice founded on presentation of the content*

Here the discipline and the content to be taught for a course are of central importance to the crafting of practice. The most important part of teaching is the transmission of the discipline values and how to interpret the discipline content – to describe these as simply as possible for ease of learning.

Way of crafting (C): *Practice founded on intrinsic gratification*

Here the *crafting-of-practice* is fundamentally based on the need to formulate a "nice person" teacher whom the students can relate to and feel able to ask questions. To achieve this formulation the approach is about creating perceptions of a self-development atmosphere, both in personal terms and coming to know the discipline of physics and the content of physics.

Way of crafting (D): *Practice founded on shaping of classroom environment*

Still within teaching of concepts and practices of physics, the focus in this category changes from that in previous categories, which were lecturer focused towards a more student centered orientation. The category is also characterized by an approach built on an intention to direct the classroom social environment towards "friendliness". An environment, sometimes contrived, where students will feel less inhibited to actively participate in class, to more freely pose questions and arguments and to get a discussion going.

Way of crafting (E): *Practice founded on student engagement*

The experiences making up this category are centered around coming to know the ways students become *engaged* in the intended learning, and how different situations may affect approaches to learning, "learning-styles" and learning outcomes. This "knowing the students as learners" opens the way to maximize student-learning possibilities. This kind of practice is based upon an epistemological belief that students best can learn from interactive teaching, in two different ways.

The first emphasizes efforts to create situations that are learning-valuable but also a bit chaotic. The aim of this approach is to encourage the students to formulate and explore their own knowledge and consequent worldview.

The second recognizes individual differences in how students' learning takes place. Students all think, conceptualize and argue differently. It is important to get to know students in this way in order to maximize the possibility of learning.

Table 1: Analysis of variation of how university lecturers of physics craft their practice

How is practice construed in relation to presuppositions about students as learners?				What is the intention of the practice?
Category of description – Practice founded on	**Background to description**	**What descriptions focused on**	**Orientation**	**Meaning**
A: Techniques for presenting	Professional job	Technical aspects of presenting information	Self	Being competent in presentation
B: Presentation of the content	Discipline knowledge	Enactment of knowledge creation	Students as observers	Formulating good images to represent knowledge for transmission
C: Intrinsic gratification	Pedagogical content knowledge	Personal development	Students as consumers	Gaining more content knowledge, about the discipline, and students
D: Shaping of classroom environment	Pedagogical content knowledge from lecturers' perspective	Formulating a positive and interactive learning environment	Students as people	Creating a positive learning experience
E: Student engagement	Pedagogical content knowledge from students' perspective and knowing students	Formulating a range of learning engagements	Students as learners	Creating a positive learning engagement

(2) Overview of level of pedagogic investigation categories

The pedagogic investigation categories were derived from Ashwin and Trigwells' (2004) "Levels of pedagogic investigation" description. We took their 3 levels --

Level	Purpose of investigation	Evidence gathering processes will be	Investigation results in
1	To inform oneself	Verified by self	Personal knowledge
2	To inform a group within shared context	Verified by those within same context	Local knowledge
3	To inform a wider audience	Verified by those outside of that context	Public knowledge

-- and developed them into extended levels of pedagogic investigation as follows:

Level	Purpose of investigation	Evidence gathering processes will be	Investigation results in
0	To perpetuate teaching and learning fables	Verified by existing fables	Strengthening belief in fables
1a	To inform oneself	Verified by self	Personal knowledge
1b	To validate oneself through the act of sharing with students	Verified by self	Personal knowledge
2	To inform peers within shared context	Verified by peers within same context	Local knowledge
3	To inform a wider audience	Verified by those outside of that context	Public knowledge

Consideration of this representation of the purpose of pedagogical investigation has SoTL related activity starting to emerge from level 1b and reaching comprehensiveness at level 3. We use this depiction of SoTL activity to categorise how physics lecturers go about attempting to improve the teaching and learning they are responsible for, and how any associated transparency is conceptualized.

(3) Emerging relations between crafting of practice and level of pedagogical investigation

After having constituted our crafting of practice categories the study continued with a further set of 9 interviews with a selected group of physics lecturers (2 female and 7 male), this time drawn from three universities. Insight into emerging relations between the crafting of practice and the level of purpose of pedagogical investigation was sought by cross categorizing the content of these interviews. The objective here being to begin to characterize the kind of SoTL disciplinary style associated with university physics.

The resultant cross categorization profile is given below.

Lecturer	1	2	3	4	5	6	7	8	9
Crafting of practice	A	C	C	D	E	D	D	D	E
Level of pedagogical investigation	0	1	1	2	3	1B	1B and 2	2	3

Here we see a trend emerging for the SoTL activity in terms of crafting of practice. In its broadest terms those teachers who craft their practice towards facilitating interactive teaching (categories D and E) are the ones who tend to engage most readily in SoTL activity.

Discussion

The characterization we have begun to build for the scholarship of teaching and learning disciplinary style of university physics captures elements of physics lecturers' teaching discourse, reflection, how they view their students as learners, and how they may share this knowledge for critique and for further development. To do this we have looked for relations that emerge between what we have captured as *crafting of practice* and an associated level of what Ashwin and Trigwell (2004) have characterised as *pedagogical investigation*.

An interesting outcome to emerge was that lecturers who craft their practice around conceptual frames underpinned by interactive teaching are the ones who appear most likely to engage in some kind of scholarship of teaching and learning activity. Practice that is underpinned by characterizations of teaching technique, ways of presenting knowledge, and intrinsic gratification appear less likely to engage in some kind of scholarship of teaching and learning activity. Yet it is our experience that it is within these same categorizations that recognition for quality university physics teaching is often constituted. In other words we can see a model of university physics disciplinary style starting to emerge that is starting to suggest that the disciplinary style that is embedded in the mainstream scholarship of physics could be a discouragement to the scholarship of teaching and learning activity – the mainstream of the community already "knows" how best to organise teaching. Anecdotal support for this view emerged in the interview of lecturer (2) and (3). They both indicated that they would like to engage in sharing of teaching and learning experiences for critique, furthering their own knowledge, and opening up curriculum development possibilities. However, they also both felt very uneasy at the prospect of initiating or contributing to such discussion, even at a local level such as in the common room.

Another interesting outcome was found in the lecturer (6) interview. Although the crafting of practice for this lecturer was underpinned by the formulation of a positive and interactive learning environment, the sharing of what had been learnt about making learning possible did not go beyond a report back to the students of the next course taught.

This report into the scholarship of teaching and learning disciplinary style of university physics is just a first probe. Much more needs to be done to adequately capture the nature of this disciplinary style. For example, it is our experience that much of the university physics community regards itself as being a highly competent, creative and intelligent academy of scholarship. Consequently, one part of the resultant disciplinary style appears to discourages "admitting" that one is not already doing a good teaching job while another part values new insights and interests associated with any scholarship. Both manifest in the extreme spirit of teaching independence and pride that we see emerging from the mainstream scholarship of university physics. Thus we see our further work in coming to understand the disciplinary style of physics being about exploring the kinds of relationships that may emerge between how physics lecturers see physics as a discipline, themselves as physics researchers, themselves as professional teachers and the kinds of teaching categories we have used for this report.

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