HOW AN EXPERIENTIALLY PRESENTED LABELLED-FRAMEWORK APPROACH TO PROFESSIONAL DEVELOPMENT AT A DISTANCE CAN INFLUENCE TEACHERS' PRACTICE

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Twenty-eight years ago The Open University initiated experientially-based PD courses for teachers at a distance. Video and mathematical tasks were used to provide experience which was commented on using constructs derived from the literature. Here we report on a study to find out what roles the constructs had played in people's subsequent professional life. Data consisted of some 300 responses from former students to an on-line questionnaire and 15 follow-up semi-structured interviews. Findings suggest that a labelled framework experiential approach has led to teachers changing and developing their approach to teaching using constructs encountered in the courses.

BACKGROUND

Since 1981, the Centre for Mathematics Education in the Open University has been offering courses in mathematics education to be studied at a distance (two have had associated week-long face-to-face events: one in 1981-1986 and the other 2006-present). The style of the courses has from the beginning been phenomenological in the sense that emphasis has been on provoking recall of personal experience through students engaging in mathematical tasks and engaging in observational tasks in their professional situation, together with trying out modifications of tasks encountered in the courses or from their own situation. The content of the courses has always been research-based in the sense of selecting potent psychological and social constructs and pedagogical strategies from the literature which are then presented in the course as labelled frameworks for making sense of recent and past experience (Floyd *et al* 1981, summarised in Mason & Johnston-Wilder 2004 and briefly described below). Being richly linked to experience, these framework-labels were intended to support appropriate actions coming to mind in the future in the midst of practice.

In 1982 we pioneered the use of classroom video, not to analyse a specific lesson, task, teacher or students, but to provide a common shared experience through which to bring to mind similar situations in the experience of those studying the materials. The course materials were written around the video rather than the video being chosen or produced to illustrate previously chosen themes. Over time our courses have become more overtly research-based, with a density of references to the literature and calls upon students to refer to the literature in their assignments according to the level of course offered: from introductory diploma level to masters.

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During 1981-1996 we offered undergraduate-level courses to serving teachers who wanted to obtain an undergraduate degree consonant with the government's policy of an all-graduate profession. These were also available to students studying for an undergraduate degree in order to then become teachers as well as to teachers with one or more degrees who could take one or more courses as professional development with or without qualifying for a diploma. Since 1996 we have offered a course forming one-third of a masters degree (other modules are not in mathematics education). Most of the frameworks devised to inform teacher choices and presented in the earlier courses are summarised in materials for the masters courses (Mason & Johnston-Wilder 2004). Since 2004 we have offered a suite of courses leading to a diploma but also useable as undergraduate courses in mathematics and mathematics education, qualifying the student for PGCE or other equivalent induction into teaching.

THEORETICAL FRAMES

Teachers have for generations complained about the theoretical nature of academic courses for teacher preparation. One response has been to develop experiential approaches, in which participants engage in mathematics for themselves, observe videos of lesson fragments, and then, having sought resonance or dissonance with their own experience, consider implications for classrooms (Floyd et al 1981, Watson & Mason 2007). John Dewey (1938) argued that the nature of experience consists of two elements: an active part, where experience means *trying* and a passive part, where experience means *undergoing*:

> When an activity is continued *into* the undergoing of consequences, when the change made by action is reflected back into a change made in us, the mere flux is loaded with significance. We learn something. (Dewey, 1938, p139)

The description of experiential learning given by Kolb (1982) was very close to what we developed independently for ourselves as a sensible way to enact PD. We went further, however (Mason 1999) to developed the claim that people don't often learn from experience alone, and that to learn to act responsively rather than reacting to cues out of habit involves more than Dewey's two aspects of experience and more than Kolb's well known cycle of activity, because it is necessary to prepare so as to encourage actions to come mind in the future. Carefully chosen labels can act as a core around which sharp relevant experiences can gather, forming a rich base for recognising similar situations in the future. This is elaborated in the *discipline of noticing* (Mason 2002) which draws on three thousand years' of Eastern and Western psychological insights into how people change their behaviour.

Examples of course construct-frameworks

Bruner (1966) distinguished three modes of (re)presentation: *enactive-iconic-symbolic*. We developed this into three worlds of mathematical experience, and extended his distinctions into a spiral or recursive format: something is *enactive* when it is confidently manipulable; *iconic* when it overtly (for the learner) presents what

they are thinking about or have been manipulating; and *symbolic* when it is freshly standing for a condensation (Freudenthal 1973) or underlying structure. Thus symbols like '3' and '*x*' can become familiar and consequently confidently manipulable. We added the construct of a spiral of *Manipulating–Getting-a-sense-of–Articulating – Manipulating–...* to remind teachers that they and learners could, when stuck, backtrack to more confidently manipulable entities in order to get a sense of underlying structural relationships from which to re-generalise for themselves. In order to support movements along the spiral we introduced the construct *Do–Talk–Record* as a reminder not to push too quickly: doing gives something to talk about which supports the doing, and recording both supports and is supported by doing and talking. These and other psychological constructs are complemented by distinctions between mathematical actions such as doing & undoing, specialising & generalising, conjecturing & convincing, imagining & expressing (Pólya 1962, Mason et al 1982).

RESEARCH QUESTIONS

The questions which drove our study were

1) Did any or many students actually recognize course constructs and use, develop or extend them in their immediate and subsequent practice?

2) What do the students think the framework labels for *constructs* do for their thinking and their professional practice?

METHOD FOR DESIGNING THE SURVEY AND INTERVIEW QUESTIONS

Since the Discipline of Noticing (Mason 2002) was an elaboration of and theoretical justification for the practices we used in the development of our early courses, we drew upon it in the construction of our questionnaire and follow-up interviews. Because we believe that our survey itself makes a contribution to the probing of CPD effectiveness, we list here just a few of our questions to show how they began rather generally and then became more and more specific.

- Which courses had they taken (and which if any had they tutored)
- Whether they are aware of fresh possibilities for action coming to mind associated with Open University Mathematics Education courses: frequently; occasionally; at one time but no longer; never.
- Whether different components such as particular tasks, theoretical ideas. encountering mathematical ideas in the course(s), task design principles; ways of working and forms of interaction with students benefitted their own mathematical thinking, their pedagogical thinking or their thinking about the curriculum as a whole to some extent (5 point Likert scale).
- Whether they do or do not recognise, recall making use of, still use, or have either developed or use something similar to, constructs and strategies such as *enactive-iconic-symbolic modes of representation*, *do-talk-record*;

manipulating-getting-a –sense-of-Articulating; *conjecturing*; *specialising & generalising* and so on (some 25 such).

The survey ended with more general questions about experience of specific components in our materials and an indication of what they were now doing professionally ranging from head of department or subject specialist, to educational consultant. The aim of the interviews was to obtain brief-but-vivid descriptions of incidents in which respondents have been aware of their actions being informed by course constructs, pedagogic strategies or other ideas. They also served to check validity of self-reports forming the survey.

Method for conducting the enquiry and profile of the respondents

We found that some 3000 people had completed study of some 10 000 mathematics education courses between them over the span of 28 years. Only some 2000 email addresses were listed on the University's student database, but no indication of whether these email addresses were still correct. An invitation email to take part in the survey, with a link to the survey webpage, was sent out to these 2000 email addresses. There were 336 replies, of which 292 were useable (due to some people answering more than once or incompletely).

While acknowledging that most people willing to take 10 or 20 minutes to respond to a questionnaire are likely either to have had a positive experience or an intensely negative one, we think that under the circumstances a response of 10% is remarkable given the time delay for many. Although one might expect respondents to be predominantly from the most recent courses, as indeed they were, a significant number of people taking the earlier courses also responded which we put in 4 groups.

	Old Courses 1981-1991	Face-2-Face 1998-present	Diploma 2001-present	Masters
Respondents	91	82	239	79

Given that there were 293 useable responses, this table also shows that some people took several courses: the average was 1.95 courses per respondent, while the most was 8, and includes people who have subsequently tutored courses as well.

Of the 293 respondents some 80 agreed to be interviewed, although amongst the 28 we chosen only 15 actually took place due mainly to the availability of interviewees in a limited timeframe (4 weeks). Interviewees covered a range of time-lapse and construct-recognition. A detailed interview schedule was used and responses were audio recorded, field notes taken and subsequently written up and sent back for amendments and modifications to the interviewees.

METHODOLOGY FOR ANALYSIS OF THE RESPONSES

The data analysis of the on-line survey responses consists entirely of grouping respondents into sets of courses and summarising their responses. The interviews were intended to confirm or challenge the self-reports of influence and were thus approached as offering instantiations of findings from the on-line survey. They were analysed according to their perceived contribution to addressing the following

questions: what do respondents say are the roles of these constructs, i.e. (a) how are these constructs used in professional practice and (b) how do the constructs influence the thinking process of the students?

FINDINGS AND ANALYSIS

In order to leave room for analysis of interviews, we merely summarise a few of our findings from the on-line survey. Over 70% claimed that their current practice has been influenced at least to some extent, and some 34% that it has been significantly influenced. Furthermore, nearly 80% claim that ideas from the courses have been integrated into their practice at least to some extent, and nearly 75% claim that they are aware of possible actions stemming from the courses coming to mind. Of course people may not always be aware of the origins of possibilities that come to mind, nor even be aware of the basis for some of their actions in the midst of teaching. This is in contrast to the claim by Eraut (2007, p 12) that while 'Nearly all the taught components of professional and vocational education are intended for future use at work', 'the evidence that this happens as intended is often disappointing'.

Amongst those taking one of the masters courses, five of the many constructs used in the course were recognised by over two-thirds of the respondents, and eleven of the constructs were said to come to mind or to have been developed in some way for themselves by over one-third of respondents.

Amongst those taking the recent diploma courses, six of the twelve constructs we listed were recognised by over two-thirds of the respondents, and eight of the constructs were said to come to mind or to have been developed in some way by over one-third of the respondents.

Amongst those reporting on older courses, while only four constructs were recognised by over half of the respondents, at least six constructs were claimed to come to mind or to have been developed by one-quarter of respondents. Given the time lapse since the courses were taken, and, from analysing the responses, the evident difficulty in recalling which constructs were in which courses, this suggests some long term influence. For many of the respondents we would conjecture that constructs have been integrated into their thinking and are no longer associated with the OU courses as a possible source.

Instantiations from the interviews

In contrast to the observations of Eraut (2007, p 12) that 'Nearly all the taught components of professional and vocational education are intended for future use at work; but the evidence that this happens as intended is often disappointing' we noted that respondents were able to provide quite specific details of such evidence.

The responses offer instantiations of the influence of constructs on professional practice and of students moved to adopt a questioning stance to practices. The data also gives some tentative insights into the effect of the use of these labelled frameworks on the thinking process of the students, even after as much as 20 years.

The data offered many descriptions of how constructs were used, often regularly, in professional practice, ranging from using similar tasks and examples to those offered in the courses, to adaptations of such tasks:

> I use material involving [the construct] Do Talk Record and other ideas from the OU course material as examples in my work.
>
> I continually refer back to the section from [course] on Dimensions of Possible Variation in task presentation when I am planning something new.
>
> I regularly weave [the construct of] Doing and Undoing into tasks and extensions because it is so important.
>
> Bruner's Enactive, Iconic, Symbolic is something I now regularly use as a construct for my lessons.

More extensive accounts were given about what such lesson would look like. For example, one teacher described how she used the construct of Do-Talk-Record:

> The painted cube … I used the construct Do-Talk-Record with a group of teaching assistants ... I can picture a particular participant … whose strategy was to collect the data for different sized cubes and from these come up with a generality. I diverted her attention from this to building the cubes and then looking at the structure and how it was growing, what was the same and what was different between successive cubes. She found this hard to do at first, but suddenly she saw it and understood what I was trying to get her to do. She also realised that this could be a powerful means to enable the pupils she worked with to access and understand the mathematics.

Other teachers talked about how they used the construct of specialising and generalising:

> An example of specialising and generalising: An introduction to Trigonometry through using ratio ... They started with a plane sheet of A4 and I asked them to draw an angle of 30 degrees … We were going from the concrete to the concept through using particular cases and generalising. Through talking we came to answers.

These truncated accounts at least indicate facility with the constructs and substantive use of them in planning, conducting and reflecting upon lessons.

Accounts were given of how constructs were used for analysing occurrences in the classroom:

> Thinking in terms of Do-Talk-Record is in marked contrast to some of the teaching I have observed which can, on occasions, reinforce a dependent culture, as exemplified by 'do this, this way, and you will get through the exam'.
>
> I was watching two pupils working together last week and thought about one, 'you are a grasshopper', and then noticed his partner was being 'an inchworm' [both constructs from courses]. Each was working from their own position to bring the other round to see 'that this must be the case'.

Other examples indicate how constructs aid in informing ways of working with, questioning and assessing students

> I watched a teacher collect data from a class (how many people live in the same house as you), put it on the board and then set them the task of finding the mean number of people in the represented houses. Chaos ensued. I thought about [the construct] Manipulating – Getting a sense of - Articulating and that without first organising and ordering the results how are the pupils going to have any idea what the mean (or median) is about. I quietly worked with some pupils helping them to get their results into some order and was really happy to notice these pupils talking to the neighbours, explaining what they now understood about the problem and what an average might be about.

The interview responses also offered some tentative insights into how constructs influence cognition. Some people mentioned explicitly that constructs help to make the transition from theory to practice by translating awareness into action.

> It is very simple to say, but translating that awareness into action is what I am working on. The labels from [course name] I find to be an invaluable tool in working on translating awareness into action.
>
> The course raised awareness and recognising of this awareness (awareness of awareness). The label helps it become an action.

The theory is that constructs offer a vocabulary and thinking framework for reflection:

> [the construct] invariance in the midst of change enabled me to look at shape in a new light and realise that it is constraints that produce common properties. This for me also had the wow factor, for example ... It moved my thinking from focusing on differences to focusing on commonalities. … I have continued to pursue this theme.
>
> Using Manipulating-Getting a sense of-Articulating (MGA) as a label helped me to think about what I was going to do in a lesson. It was the key to getting much more enthused in working with manipulatives. ... I have since asked myself why I didn't see the importance of starting with something to manipulate, even if it is in the mind. One of the things that unlocked my thinking was having access to the labels from the course.

Conclusions

We were always aware that the survey would involve self-report and that this may not be entirely reliable. We anticipated that the act of responding might amplify opinions either way, and not all responses were positive in all respects! However negative comments tended to be for a range of technical reasons such as course timing not fit teaching times or courses not aimed at tertiary level teaching. Despite such caveats, it is clear from the range of responses that a considerable number of students had a strong recall of at least a few course constructs and pedagogical strategies, and that they claim that these continue to come to mind during their practice. Our findings matched Dewey's notion quoted at the beginning that change made by action is reflected back into a change made in us, so that the mere flux is loaded with significance. As Kolb puts it, 'knowledge results from the combination of grasping and transforming evidence' (Kolb, 1984, p41). It seems that carefully chosen labels can indeed assist that grasping as claimed in Mason (1999) through reflection in and on action (Eraut 1994, Schön 1983, Mason 2002).

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