A curriculum innovation: Focusing on student teachers' developing conceptions of good science teaching

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Introduction

This article describes a curriculum innovation which is being carried out by science educators at The University of Hong Kong in form of an action research. Using a sample of video data on exemplary science teaching collected in an earlier project[1] funded by HKSAR Government's Quality Education Fund, this curriculum innovation aims to elicit data from our student teachers regarding their conceptions of 'good' science teaching. It aims at investigating prospective teachers' conceptions of 'good' teaching from a developmental perspective and the factors that have been shaping their conceptions over time.

[1] Teaching shown in the videos was perceived as exemplary by the participants of the project. They included science educators, curriculum planners and practicing science teachers with diverse backgrounds.

Why this curriculum innovation?

This curriculum innovation has been mounted in response to the issues raised in the University Grant Committee's Report on the Second Teaching and Learning Quality Process Review (TLQPR) of our institution. This project addresses, in particular, the issue of teaching effectiveness by undertaking a curriculum innovation of using classroom videos of exemplary science teaching to extend our student teachers' learning beyond the normal class contact hours. More importantly, the data gathered from students' assignments (in form of their personal reflections on their own development in the area of conceptions of 'good' science teaching and the factors that they think have influenced and change their conceptions) will constitute an important pool of data upon which we can evaluate the effectiveness of this innovation and to further refine it. On a longer term basis, this pool of data will also provide some baseline data for future longitudinal studies by following the same group of prospective teachers through the different stages of their professional development.

In short, this project will provide our team with valuable information upon which we can evaluate our program and to improve it so as to better prepare our student teachers for their future career. Though the context of study for this project is science teaching, its findings will have implications beyond this context. This is because many of the features of good science teaching are generic in nature; they are not unique to science teaching but are common to teaching in all other subjects. The effectiveness of the use of exemplary classroom teaching videos as a reflective tool for prospective teachers should also throw light on the applicability of such an intervention in the training of teachers in other subject areas. Lastly, this project is also a timely response in the light of recent education reforms which demand new types of teaching. Changes are clearly required in teachers' conceptions of teaching and learning. By engaging prospective teachers in commenting 'good' teaching, and probing into factors that have been shaping their conceptions, this project will contribute to the process of change.

Theoretical considerations underpinning our project design

The importance of examining prospective teachers' preconceptions about teaching has been brought up by Clark (1988) for more than a decade already as he put it:

> Students begin teacher education programs with their own ideas and beliefs about what it takes to be a successful teacher. These preconceptions are formed from thousands of hours of observation of teachers, good and bad, over the previous fifteen or so years. Undoubtedly, students' conceptions of teaching are incomplete...With this in mind, a thoughtful teacher educator might ask: What are the preconceptions about teaching and learning held by our students? (p.7)

Central to Clark's argument is that each prospective teacher brings with him or her into teacher training a set of preconceptions about teaching and learning which needs to be carefully analyzed and understood from a developmental perspective. Not only is this an important topic in its own right, we concur with Clark that it is also a professional obligation on the part of a thoughtful teacher educator.

As influenced by Schon's (1983) work, while being thoughtful on the part of ourselves, we would also like our student teachers to take up a similar stance in their course of professional learning. Thus we have incorporated into this curriculum innovation the element of reflection. Indeed, recent research efforts have shown the usefulness of reflection as a tool for understanding science teacher thinking and development (e.g. Abell, Bryan & Anderson, 1998).

In order to facilitate our student teachers' reflection, they will be provided with videos of exemplary cases of science teaching as one of the reflection prompts. They will be asked to base their reflections on personal perceptions, observations, experiences, readings and discussions of the major topics throughout the teacher training program. Our use of exemplary cases in this curriculum innovation is informed by findings from Black and Atkin (1996) who arrived at the following suggestions after examining 23 educational reforms in science, mathematics and technology education in 13 countries:

- Exposure to other ideas broadens teachers' awareness of possibilities for change and fosters a sense that alternatives are available.
- Existence proof of new methods under normal classroom conditions gives moral support to teachers and challenges them.
- Demonstration of actions, reflecting the new ideas, in a real context deepens teachers' understanding. Also, such modeling strengthens the proof of existence.

Indeed, exemplary cases of teaching have been found particularly appropriate in preparing teachers for reform-based teaching like the recent call for teaching science using the investigative approach (Putnam & Borko, 1997). This is because the opportunity for teachers to experience workable alternatives to conventional practice in actual classroom settings otherwise is likely to be quite limited. This notion of 'existence proof' is particularly helpful to pre-service and beginning teachers who often have the difficulties of breaking free from the modalities of teaching they have been exposed to in their own schooling.

Nonetheless, we are cautious of the possible caveat of providing student teachers with *concrete* and *practical* examples of how to realize some of the goals of the recent curriculum reform by introducing them to these exemplary cases. We agree with Wilson and Berne (1999) that "teacher learning ought not be bound and delivered but rather activated" (p.194). In other words, the goal of teacher professional development should

be to increase teachers' awareness of the potential for learning rather than to present them with a prepackaged set of new pedagogical strategies. Thus, we hope that the student teachers can make use of the exemplary cases:

- as a source of models of practice to apply and *test* in their own classroom;
- as examples of practice that can be *compared* to their own practice; and particularly,
- as a set of ideas to be *debated* upon and to act as a springboard to *reflection* on their existing practice.

It is acknowledged that definitions of 'exemplary' teaching can depend upon one's world-view, for example, one's epistemological position. However, this would not limit the value of the proposed study as our objective is *not* to draw up a consensual list of criteria for identifying exemplary teaching, but make use of the videos of classroom teaching to elicit teachers' conceptions of 'good' teaching. In fact, there is no need for total agreement on whether the lessons in the videos demonstrate good teaching or not. The viewers can identify with the good practices shown in the videos or otherwise. In offering their explanations on why they think certain teaching practices are good or not, they are implying in their answers the corresponding conceptions of 'good' teaching. In short, the 'exemplary' lessons in the video serve as a stimulus to elicit teachers' conceptions of 'good' teaching. Such a methodology is considered to be useful in helping teachers to articulate abstract concepts such as 'conceptions of teaching' (Gao & Watkins 2002).

We also concur with the view that video is a more superior medium than print materials as a reflection tool for teacher professional development (see, for example, van den Berg, 2001; Louden, Wallace & Groves, 2001). First, videos offer a lasting record of the lessons which can be analyzed from many different perspectives. We believe that the classroom is an extremely intricate social environment, and thus attempts to study classroom processes from a single viewpoint are bound to misrepresent important processes. Regardless of how good an example of teaching, ambiguities and contradictions are present. We believe that there is no perfect way, and each way has its strengths and weaknesses depending on the particular context and purpose. We hope that our student teachers can generate and evaluate many different alternatives during their reflection. By examining the potential consequences of those alternatives, beliefs and assumptions, their own beliefs and assumptions are more likely to be challenged. Second, unlike live observations, videos allow for multiple and repeated opportunities to re-play, analyze and re-analyze the same instance. It also provides the opportunity to study the fast-paced, complicated world of classroom teaching and reflect on it. This reflection can take place in the form of repeated viewing of a certain video segment and through fine-grained analysis of it. All these are made possible only through the video technology.

As evident from the above discussion, the nature of the reflection require of the participants in this project can be characterized as (1) in depth, (2) iterative and repeated, and (3) peer/socially constructed. That is, it is repeated and dialectical in nature - occurring frequently, and in more depth with each iteration of reflective thinking on the issues of good science teaching. Also, this reflection is shared and discussed with peers, and hence deeper understandings of good science teaching are socially constructed.

What is our plan and what have we achieved so far?

Stage 1 - Production of the relevant teaching resources

A CD-ROM comprising a series of video clips (a total of one-hour duration, selected from more than 100 hours of raw footage from an earlier QEF project), showing teaching segments of exemplary lessons of Integrated Science taught by competent practicing teachers, has been produced and used as the major tool to elicit our student teachers' views on what is good science teaching. The sampling of video clips to be included in the CD-ROM was guided by Kember's (1997) framework of the five dimensions of conceptions of teaching, namely

- the essence of learning and teaching
- the roles of the student and teacher
- the aims and expected outcome of teaching
- the content of teaching, and
- the preferred styles and approaches to teaching.

Accompanying each of the selected clips is some background information about the lesson in the video. This is to facilitate the viewers to make sense of what is going on in the lesson before they can comment and reflect on it.

Interview protocols have been designed for use in two semi-structured interviews with each of the student teachers on two different occasions i.e. Entry Interview and Exit Interview (see Tasks 2 and 7 below). The purposes of the interviews are to clarify and follow up with student teachers' written responses in the assignments that they have submitted prior to the interview (see below for details about the assignments)

Stage 2 - Data Collection

Data collection, in form of assignment submissions by student teachers (as seven

different tasks to be submitted at different times of the course) are detailed below. To date, the first three tasks have been satisfactorily completed.

Task 1: Entry Conception - "What is Good Science Teaching?"
Before the program of Postgraduate Certificate in Education (PCEd) formally started, student teachers were briefed on the nature of this project, the various tasks, the timeline and the assignments involved. In this briefing session, student teachers were asked to list out features of good science teaching in their own opinion on a task sheet.

Task 2: Entry Conception - "Views on the Science Lessons in the CD-ROM"
At the end of the above briefing session, each student teacher was given the abovementioned CD-ROM of exemplary science teaching, but told that they are just ordinary science teaching occurring in schools. They were asked to review the CD-ROM at home and answer questions in a task sheet with questions including what are the good features of the lessons, areas requiring improvement, etc. Questions on what are the factors and how those factors may have shaped their conceptions of good science teaching were also asked in the task sheet. In particular, the extent of the influence of viewing of the lessons in the CD-ROM on their conceptions of good science teaching was also sought.

Task 3: Entry Interview - "What is Good Science Teaching?"
This was to clarify and elaborate on what students have written down in their Tasks 1 and 2 above and to probe further into their conception of good science teaching and factors that have been shaping it. All the Entry Interviews were completed before the academic year started. This was to make sure that student teachers' Entry Conceptions of good science teaching had not been in any way affected by our program instruction.

Task 4: After the First Teaching Practicum-"Views on the Science Lessons in the CD-ROM"
Student teachers will be asked to review the lessons in the CD-ROM again and complete a task sheet similar to that of Task 2. Additional questions on the influence of various components of our PCEd program, including the First Teaching Practicum, on their conception of good science teaching will be asked.

Task 5: After the Second Teaching Practicum - "Views on Science Lessons in the CD-ROM"
Student teachers will be asked to review the lessons in the CD-ROM again and complete a task sheet similar to that of Task 4 above. Additional questions on the influence of various components of the PCEd program, including the Second Teaching Practicum, on their conception of good science teaching will be asked.

Task 6: End of the PCEd Program - "A Personal Reflection: Changes in My Views of What Good Science Teaching Is"
All the task sheets previously submitted by each of the student teachers will be returned to them. They will be asked to identify for themselves if there are any changes in their own views of what good science teaching is and to reflect on these changes, in particular, what are the factors that have been shaping it.

Task 7: Exit Interview - "What is Good Science Teaching?"
This is to clarify and elaborate on what students have written down in their Tasks 4 to 6 above and to probe further into their conception of good science teaching and, in particular, the factors that, they think, have been influencing in shaping their conception, especially those that are related to our PCEd curriculum. All the interviews will be audio-recorded, transcribed and translated. A developmental profile in terms of student teachers' conception of good science teaching will also be made for each of the student teachers.

In short, the purposes of these assignment tasks are two fold. One, to collect data which illuminate student teachers' personal thinking and development as a science teacher; and the effectiveness of various components of the PCEd program in contributing to this goal. Two, these tasks are designed to help student teachers to become a reflective practitioner as well as to keep track of changes in their own view of what good science teaching is.

Stage 3 - Data Analysis

- The various literature-based attributes of teachers' conceptions of teaching will serve as our initial framework for data analysis, bearing in mind that the final framework needs to be fleshed out through an iterative process.
- Data will be first coded into categories related to the student teachers' conceptions of teaching. Over time, the number of these initial categories will be reduced by eliminating and merging categories and by clustering still other categories based on perceived connections. This repetitive process will eventually lead to the construction of qualitatively distinct, conceptual categories.
- The student teachers will also be classified into one of the different categories of description for good teaching in science according to their dominant conceptions of good science teaching (as emerged from the data and perceived by the project team).
- These categories will then be used to determine what relationships exist among the different categories of student teachers' conception of good science teaching and the factors they perceived to be influential in shaping their conceptions, especially those related to our PCEd curriculum.
- Data analysis will be carried out both individually and collaboratively among

colleagues participating in this project. This will provide reliability checks on data coding, analysis and interpretation performed by individual members of the project team.

What we are hoping for?

So far, our student teachers seem to be enjoying watching the videos and most of them find the videos an effective tool for them to reflect on their own conceptions of what good science teaching is. Comparing the amount of written comments that students submitted in their Tasks 1 and 2, it appears that the CD-ROM has proved to be an effective prompt for eliciting student teachers' entry conceptions of what good science teaching is, at least in quantitative terms. We will report on the outcomes and effectiveness of this curriculum innovation more comprehensively in a separate paper in due course. Though our project is still in progress, we believe that we have much to share even at this stage for the innovative model of teacher education with a focus on developing and tracking student teachers' conception of good teaching throughout the course of a teacher education program. We hope by way of this article, we can receive more inputs and suggestions from other teacher educators. This is in line with the action research nature of this project. We would also welcome collaboration with other teacher training institutes which are interested to adopt similar curriculum innovations.

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