

A questionnaire for monitoring social constructivist reform in university teaching

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As university teacher educators working in the field of science and mathematics education we are committed to reforming the transmission-style of epistemology evident in many university lecture theatres and tutorial classes. In this paper, we present a new learning environment questionnaire for use by university teachers wishing to monitor their development of teaching approaches based on a social constructivist perspective on learning. The questionnaire was trialled in the postgraduate classroom of one of the authors who teachers in accordance with a social constructivist perspective. It was found to generate a plausible account of a range of students' experiences.

Introduction

Traditionally, universities have been exemplars of the *transmission of knowledge* paradigm characterised by crowded lecture theatres in which a single perspective is dominant - that of the university teacher. In these forums, knowledge is regarded as a commodity which, metaphorically speaking, can be transmitted from the teacher's mind to the passive minds of the mass of students in attendance. Consequently, learning is rendered as little more than the memorisation of uncontested facts and, especially in science- and mathematics-related fields, the memorisation of standard problem types. It is our firm belief that, unless this university teaching paradigm is transformed, students will remain trapped in an unhealthy culture of uncritical, unreflective and reproductive learning that is intellectually and emotionally disempowering. An alternative epistemology promises a richer and more rewarding set of learning experiences for university students.

A Social Constructivist Perspective

Constructivism is an epistemology, or theory of knowledge, that views knowledge as being 'constructed' (or generated) within the learner's mind as she draws on her existing knowledge to make sense of perplexing new experiences (Hardy & Taylor, in press; von Glasersfeld, 1995). This view contrasts markedly with prevailing objectivist views of knowledge as an independent commodity of unquestionable truth status that can be conveyed through language from mind to mind.

Reflecting on Knowing

From a constructivist perspective, the learner constructs knowledge from experience in two ways. First, as she attempts to make good sense of her new learning experience she constructs her ideas or understandings from and in relation to her existing network of concepts. This process of conceptual *assimilation* involves incremental knowledge growth and only a small degree of perplexity for the alert and motivated learner with the appropriate background knowledge. One of the challenges facing a good teacher is, therefore, to provide learning experiences that enable students to appraise critically the quality of their background knowledge because, without this foundation, the connection with and between new ideas and understandings is likely to remain tenuous or shallow.

If the uniqueness of the student's newly developing ideas or understandings resists assimilation and if she remains engaged purposefully in resolving her perplexity, she will then start a process of *accommodation* in which she restructures key aspects of her existing knowledge in order to make the new understandings 'fit'. This process is sometimes known as a 'paradigm shift' and occurs when the learner persists with the higher-order task of making sense of a counter-intuitive, or perplexing, idea that resists her ordinary sense-making attempts. Such is the case, for example,

when students who are well-versed in Newtonian mechanics try to make sense of relativistic phenomena in quantum mechanics. The process of accommodation yields deep understandings when the learner reflects critically on the problematic relationship between her newly constructed ideas (that don't 'fit' or don't make sense) and her existing knowledge that, until now, was assumed to be adequate. Critical self-reflection results in a restructuring of relationships between major concepts in her background knowledge. Needless to say, the challenge for a good teacher is to find ways of engaging students in the emotionally uncertain experience of sustained critical self-reflection, evaluation and reconstruction.

This constructivist model of cognition raises questions about how university teachers can engage students in learning activities designed to enable them to go beyond simple surface-level understandings (e.g., memorisation and recall of 'facts' and standard problems) to develop deep understandings that challenge their established ways of making sense of the world. What, then, is the source of the 'magic touch' of successful university teachers who engage their students in a love of inquiry and a willingness to sustain the emotional challenge of resolving trenchant perplexity? From a constructivist perspective, the solution lies in university teachers adopting an educational interest in their students as learners, an interest that transcends their fascination with the discipline and their concern with the delivery of course content. Such an interest lies behind the willingness of good teachers to transform continuously their teaching in response to the following question.

"How does my teaching influence students to construct both their disciplinary knowledge and themselves as learners?"

Communicating to Know

In responding to this question, a university teacher needs to take account not only of the self-regulated cognitive activity occurring in students' minds but also the social influences shaping students' expectations and beliefs about what it means to be a learner in a university. Learners are inextricably linked with others, especially their teachers and fellow students, by means of language which they use to convey (and unwittingly reinforce) shared assumptions and beliefs about their social roles and learning practices. Within the university classroom, whether it be a crowded lecture theatre or an intimate tutorial, the quality of the knowledge constructed by students can be influenced strongly by the social environment. Research has shown that the quality of both classroom discourse and interpersonal relationships amongst teachers and students has a direct impact on the quality of the knowledge constructed (Bauersfeld, 1988; Cobb, Wood & Yackel, in press; Tobin, 1994; Brekelmans, Wubbels & Creton, 1990). A social constructivist approach to university teaching aims, therefore, to create a supportive classroom environment that engages students in both *communicative* and *reflective* learning activities.

In lecture theatres and tutorial classes, a learning environment that provides communicative and reflective activities promises benefits for both the university teacher and her students. By asking questions of students, the teacher creates opportunities to enhance the relevance of her teaching by injecting into it students' perspectives, life experiences, and aspirations. She also enhances her ability to assess the adequacy of students' background knowledge and monitor the qualitative development of students' new understandings. Most importantly, by becoming a communicative and reflective educator, the university teacher can evaluate continuously the efficacy of her teaching strategies and work towards creating an ambience of care and concern for students' ideas and their growth as learners.

By having opportunities to communicate during lectures or tutorials with fellow students and the university teacher, students learn to assign language to emerging ideas, seek clarification of half-formed understandings, and raise questions about the appropriate 'depth' of their new understandings. Students learn also to value admitting to the uncertainty of their knowledge and to engaging in dialogical discourses that hold opposing perspectives in tension and that countenance more than one 'correct' answer to a problem. Of considerable value to students who have for so long been immersed in competitive individualism, communicative relationships enable students to pose collaboratively questions for the teacher's response and, perhaps also, engage in reflective role-play activity.

Teacher's Interpersonal Skills

Of course, a university teacher who wishes to adopt a social constructivist perspective and work towards creating a

communicative and reflective learning environment in her lecture theatre or tutorial classroom will need to develop important interpersonal skills. Dutch researchers have investigated teacher behaviour in classrooms from a systems perspective on communication which assumes that the behaviours of participants influence each other mutually (Wubbels, Creton & Holvast, 1988). The behaviour of the teacher is influenced by the behaviour of the students and, in turn, influences student behaviour.

In order to assess these behaviours the *Questionnaire on Teacher Interaction* (QTI) was developed. When the QTI is administered to both teachers and their students, information is provided about the perceptions of teachers and the perceptions of students of the interpersonal behaviour of the teacher. The information obtained by means of the questionnaire includes perceptions of the behaviour of the teacher towards the students as a class, and reflects relatively stable patterns of behaviour over a considerable period. Research has indicated that interpersonal teacher behaviour is an important aspect of the learning environment and that it is related strongly to student outcomes. For example, understanding, helpful/friendly and leadership behaviours of teachers have been found to relate positively to student attitudes and cognitive outcomes (Wubbels, Brekelmans & Hoymayers, 1991).

The USCLES

The *University Social Constructivist Learning Environment Survey* is a questionnaire designed for use by university teachers interested in transforming their teaching in accordance with a social constructivist perspective on learning. The questionnaire has emerged from recent developments in the combined fields of learning environment research (Fraser, 1989, 1994; Taylor, Fraser & Fisher, in press; Wubbels & Levy, 1993) and constructivist research on teaching (Taylor, in press; Tobin, 1993). The USCLES combines scales adapted from earlier questionnaires - *Constructivist Learning Environment Survey*, *Questionnaire on Teacher Interactions* - that were designed for use in school science and mathematics classrooms and that have been found to be very useful for enabling teachers to plan and monitor major transformations of their own teaching (Brekelmans, Wubbels & Creton, 1990; Taylor, Fraser & White, 1994; Taylor, Dawson & Fraser, 1995; Wubbels, Brekelmans & Hoymayers, 1991; Wubbels, Creton & Hoymayers, 1992).

The scales of the USCLES (see Table 1) have been designed, from a social constructivist perspective on learning, to highlight important psycho-social dimensions of a university classroom environment in which teachers facilitate communicative and reflective learning. The first three scales - *Relevance, Reflection, Negotiation* - are concerned with opportunities provided by the university teacher to engage students in communicative activity and reflective thinking leading to their development of deep conceptual understandings within the discipline. The second three scales - *Leadership, Empathy, Helpfulness* - are concerned with important interpersonal qualities that need to be displayed by a university teacher interested in persuading students to transform their established epistemologies and approaches to learning.

The Classroom Trial

In order to determine the efficacy of the USCLES for generating plausible accounts of university classroom learning environments, we trialled the questionnaire during second semester, 1996, in a postgraduate class taught by one of the authors. Social constructivism is used as a referent for teaching the 15-week Unit 'Science and Mathematics Education Curricula', a core Unit in our MSc(ScEd) course. During the Unit, a major emphasis was placed on facilitating student-centred learning. For example, students were urged to write about their learning experiences in reflective journals, adopt a narrative genre and examine their own educational biographies, identify implicit beliefs that govern their roles as learners and teachers, participate in large-group and small-group class discussions, and report on qualitative changes in their learning goals and processes. During the final class, the 12 students completed two forms of the questionnaire. The 'preferred' form of the questionnaire asked about key aspects of students' ideal or preferred university classroom learning environment. The 'perceived' form asked about corresponding aspects of their perceptions of the Curricula class.

The questionnaire results were combined with data drawn from students' final portfolio reports. We selected a range of students for follow-up interviews, including high and moderate achievers with both positive and critical perceptions of the classroom learning environment. Using an interpretive research approach, we triangulated data from multiple methods. We concluded that the USCLES can be used to generate plausible accounts of university classroom

environments where teaching and learning is being conducted in accordance with a social constructivist perspective.

Table 1: USCLES Scales and Sample Items
(Perceived Form)

Scale	Sample Item
Relevance Perceived relevance of learning to students' own experiences, background knowledge and aspirations.	In this class, what I learn is relevant to my interests.
Reflective Thinking Perceived press for reflecting critically on background knowledge, new ideas and understandings, and role as a learner.	In this class, I learn to think carefully about my understanding.
Negotiation Perceived press for communicating ideas with teacher and other students.	In this class, other students ask me to explain my ideas.
Leadership Perceived leadership qualities of the lecturer, such as, organisation, setting tasks and holding attention	This lecturer talks enthusiastically about his/her subject
Empathy Perceived way in which lecturer is understanding, listens with interest and shows confidence in students.	This lecturer realises when students don't understand.
Helpfulness Perceived extent to which lecturer assists, shows interest and inspires confidence and trust in students.	This lecturer is someone students can depend on.

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