



Reflection: Issues related to improving professors' teaching and students' learning

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Abstract. We describe here the outcomes of our research on the reflection of six professors considered exemplary in their teaching. For instance, we found that they all held and used considerable knowledge about learners, as groups and as individuals, and used this knowledge in reflecting on the impact of their teaching. We use this information to elaborate on the role of reflection in the construction of teaching knowledge. Lastly, we address how the model of reflection we developed helps us understand the factors influencing one's ability to effectively reflect on teaching.

Keywords: reflection, post-secondary, teacher knowledge, teacher thinking

Introduction

There are different traditions in reflective practice that influence how one conceptualizes the role or emphasis of reflection in the life of the teacher (Zeichner, 1994). An academic orientation focuses on the organization of subject matter, a social efficiency orientation on how well practice matches what research says, a developmental orientation places priority on understanding students' thinking, a social reconstructionist orientation sees reflection as a political act, and finally the generic orientation is one in which any reflection is good because teachers can then be more intentional and deliberate in their thinking about teaching.

Our orientation currently could be characterized as the last. We would agree with Neufeld and Grimmett (1994) that growth can result from reflection on "the ordinary day-to-day experience of instructing students in classrooms ... (which) ... elevates the activity of instruction from the level of mundane drudgery to one that has the potential to educate practitioners, thereby changing and improving their practice".

What we want to do first here is describe the outcomes of our research on reflection. We have documented and analyzed in detail the reflective processes of six successful university professors¹ in their day-to-day plan-

ning, instructing and evaluating of learners. The result is an empirical model which represents how reflection operates as a metacognitive process for evaluating and improving teaching. We have also developed a coding scheme that operationalizes the process of reflection. Both provide a language for describing reflection and therefore a way to think about how to improve teaching. Carrying out this research has not only provided some answers, but has also raised a number of issues explored here. Specifically, we elaborate on the role of reflection in the construction of knowledge about teaching: how we see these two inextricably linked. Then, we go on to explore the relationship of reflection to teaching development, which we conceive of as a conceptual change process. Last, we address the relevance of linking reflective teaching to student experience of learning and describe our goal in researching this little explored area.

The process of reflection

Although reflection was a term used by Dewey, the recent interest in reflection was stimulated by Schön (1983) who highlighted the value of reflection in helping professionals learn about and improve their practices. Although reflection can be useful in learning from any experience, our interest is on how reflection serves as a mechanism for turning experience into knowledge about teaching. Ongoing use of the process of reflection is essential for building knowledge, and increasing knowledge increases one's ability to use reflection effectively and to develop as a teacher.

The process of reflection can operate in different spheres or arenas. We use the term sphere to designate these different arenas of reflection since the word does not suggest levels that must be achieved or transcended in a particular order. Diverse schema have been suggested to differentiate this varying nature of reflection (e.g., Carr & Kemmis, 1986; van Manen, 1977). From our perspective, practical reflection focuses on improving actions in a particular course or class. Strategic reflection involves an attention to generalized knowledge or approaches to teaching that are applicable across contexts. Epistemic reflection represents a cognitive awareness of one's reflective processes, as well as how they may impede reflection and enactment of plans. Although in our research we documented instances of strategic and epistemic reflection, the focus of our inquiry and the bulk of the reflection we documented was in the practical sphere, in which the focus is improving actions in a particular course or class.

Reflection can also occur prior to, concurrent with, and retrospective to instruction. That is, reflection may occur asynchronously when considering future actions (reflection-for-action) in light of past experience (McAlpine

et al., 1991); this is distinct from planning, although related, since planning need not draw on previous experience. Reflection can also be continuous and synchronous with teaching, in which case it is concurrent or reflection-in-action (Schön, 1983, 1987). Reflection may also occur asynchronously at some point after class, and thus be disconnected from teaching actions. We think that retrospective reflection-on-action (Schön, 1983, 1987) represents the most common conception of reflection. We also believe reflection-on-action provides the opportunity for dramatic, extensive structural changes, and is more likely to take place in the strategic or epistemic sphere. Concurrent reflection-in-action and retrospective reflection-on-action were about equally represented in the reflection we documented. We have not yet completed the analysis of the data that will enable us to understand reflection-for-action done prior to instruction.

Despite the extensive discussion of reflection in the literature, there is, in fact, little research that has been theory-based, or has attempted to operationalize the term (Kompf & Bond, 1995; Kremer-Hayon, 1988). We believe our work does both; it draws from theory, and then operationalizes these concepts. We began with constructs from the literature (i.e., reflection, metacognition, domains of knowledge) and developed an initial model of the cognitive processes that are linked to improvements in teaching, a process in which one evaluates the relation between one's intentions and the impact of actual teaching actions, and makes adjustments to teaching as appropriate (e.g., Alexander et al., 1991; Chi et al., 1988; Kagan, 1992; Nelson & Narens, 1990; Shulman, 1986). Based on these theoretical constructs, we used the actual reflections of successful university teachers to verify, refine and elaborate the major constructs of our representation of the metacognitive process of reflection.

Method and data sources

Six professors recognized for their teaching excellence participated in the inquiry: three at McGill University in Montreal, Canada and three at Queen's University in Kingston, Canada. Three, trained as teachers, were in Faculties of Education; we call them math educators. Three, not trained as teachers, were in Faculties of Science; we call them mathematicians. There were two women and four men, all at least 45 years of age. All were experienced professors having taught in universities a minimum of ten years.

They were chosen based on the following criteria: recognized for teaching excellence (awards, positive student course evaluations, peer recommendations), and teaching a course they had taught before. The fact they were acknowledged for their achievements in teaching over a period of time by a

variety of different sources can be interpreted as a mark of expertise (Ericsson & Smith, 1991). Exemplary teachers were chosen because research suggests that experts tend to exhibit more metacognitive activities than nonexperts and are better able to articulate them (e.g., Chi et al., 1988; Scardamalia & Bereiter, 1986). In this way, we could hope to document 'best practices'. Teaching a class they had taught before meant they would be familiar with the instruction related to the course and the nature of the students, and would thus be better able to display their expertise. The classes varied in size. Three were around 25 students and three were between 80 and 100.

During the delivery of the course, each professor was videotaped in one third of each of the 39-hour courses. The professors were interviewed pre and post class for each of these videotapings. The postclass interviews included a viewing of the videotaped class sessions which stimulated recall about their reflections during teaching. The verbal data were transcribed and then verified by the professors.

The analysis of the data consisted of coding the transcripts, drawing on constructs from the literature and constructs that emerged from the data (code book available from the authors). This analysis expanded and refined our understanding of how the professors reflected. When we had finished the analysis we held a symposium with the six in order to present to them the results and the model representing our understanding of the metacognitive process of reflection. Their overall reaction supported our interpretations. Although none of the professors had previously attempted to articulate what it was they were doing, by the end of the symposium, they were using the language of the model to discuss how they went about evaluating their teaching (see McAlpine et al. (1999a), for a full description of this research).

The model of the metacognitive processes of reflection

Reflection as we define it is anchored in experience, in teaching *action*. Teaching actions are *monitored* in terms of external cues in order to track the achievement of *goals*, prior to, concurrent with and retrospective to instruction. Monitoring may lead to *decision-making*, decisions to modify teaching actions, dependent on where cues fall in relationship to the *corridor of tolerance*, a mechanism for explaining why only some cues lead to decisions to change. Ongoing use of the processes of monitoring and decision making are essential for building *knowledge*. Each of these components of the model (Figure 1) will now be described in detail.

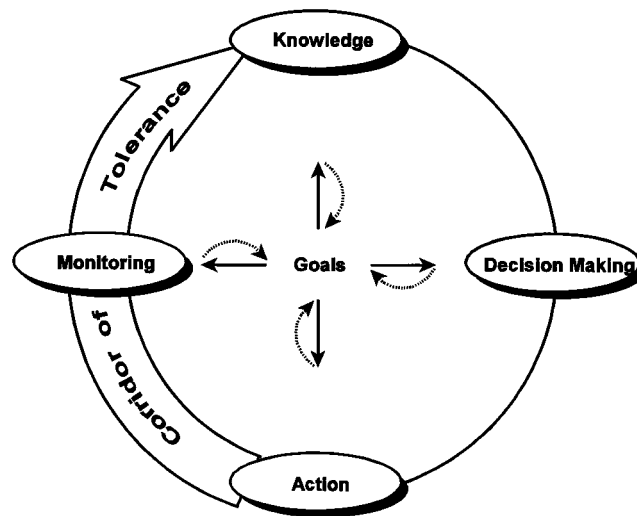


Figure 1.

Teacher actions – Experience

What is apparent but not often made explicit in discussions about reflection is the critical importance of having actual experience upon which to reflect. Reflection is the vehicle for turning experience into learning (Boud et al., 1985; Sternberg & Horvath, 1995). Webster's dictionary (1961, p. 800) defines experience as "direct observation of or participation in events: an encountering, undergoing, or living through things, in general, as they take place in the course of time". For instance, going to a baseball game is an experience of baseball since it involves external engagement in events whereas reading about a baseball game is an experience of reading.

Experience enables us to become skillful, e.g., in driving, teaching, cooking, managing. However, experience alone may not be sufficient to become skillful. As noted by Chi et al. (1988) and Ericsson & Smith (1991), one must distinguish practice from mere exposure to experience; specific long continued practice is important to develop skill. We concur and believe that multiple, repeated observations and interactions with the phenomenon in particular contexts may be necessary. Further, we believe that it is the analysis of these multiple experiences through reflection which enables one to detect patterns that then lead to knowledge. "Practice is about increasing your repertoire of ways to recover from mistakes" (Gutin, 1999, p. 108) since "learning [in our case about teaching] requires feedback in order to be effective" (Ericsson & Smith, 1991, p. 27). In other words, turning experience

into knowledge may be dependent on the ability to use reflection to recognize patterns in the multiplicity of variables in experiences.

In terms of the model, experience is the base upon which the process of reflection is grounded. It represents the external actions of the teacher, the arena in which teaching is enacted, as cognitions are transformed into behaviours. Reflection is visualized as the continuous interaction between actions related to teaching and knowledge. In our research, we did not analyze teacher actions, but rather the professors' cognitions about their actions.

Goals

Goals are the component around which the process of reflection takes place since goals represent the teacher's expectations or intentions about what is to be accomplished in terms of instruction and form the basis for actions to be taken in order to achieve these. It is for this reason that they are placed centrally; they both direct and constrain the other features of the model. Although goals remain relatively constant (based on our research), feedback from the other components may lead to a change in the goals. Thus, the interaction between knowledge and action occurs related to specific goals. In our study, we found that the professors attended most to goals related to instructional methods (33%), next to student understanding (26%), and then to content (24%). The attention addressed to teaching goals (i.e., method and content) by these professors was expected and natural. What was of particular interest to us was the extent to which goals related to learners and their learning. The professors tracked learning goals (e.g., understanding, participation, ability) a third of the time.

Monitoring

We visualize monitoring as a uni-directional mechanism that links action to knowledge, although directed and constrained by goals. Monitoring of cues in the environment provides information about what is happening during teaching. During monitoring, this information about the relationship between teacher actions and the learners as well as other aspects of the external environment is compared with the internal plans that have been constructed in knowledge.

Knowing what cues to evaluate and knowing how to evaluate them are critical skills in reflection. The most striking finding regarding the former was that all professors frequently attended to and evaluated cues from the students. Regardless of size of class, more than 70% of all cues monitored were related to students, such as verbal and non-verbal cues. Regarding the latter in this group of professors, most of the evaluations were neutral (37%)

or positive (32%) which we interpret to mean that they were monitoring on an ongoing basis, irrespective of whether the teaching seemed problematic, and that generally they felt their teaching was acceptably progressing towards their goals. Cues were evaluated negatively much less frequently (see McAlpine et al. (1999b) for more detail).

Decision making

Decision making is also a uni-directional mechanism, one that allows knowledge to be used to influence action. Knowledge provides options or alternatives so that the outcomes of actions better match the intended goal(s). That is, the function of decision making is to maintain, initiate, adjust or terminate actions as a result of monitoring or feedback from action.

Results from the study showed that frequently more than one decision might be made to modify instruction in response to monitoring. Overall, most modifications were made to instructional methods (52%) and to content (43%). We contend this concentration on concurrent adjustments to method and content (combined with the earlier finding that the professors were tracking similar goals) may be linked to the direct and immediate impact these aspects of instruction have on learning. As well, these are factors of instruction that can be changed relatively easily during a class or course. It may also be a feature of the professors' interest in fine-tuning their teaching. In other words, since they were skilled teachers and had a large repertoire of strategies and content to call upon, they may have enjoyed using this knowledge to feel more effective.

Modifications to objectives and evaluation were extremely low (1% and 2% respectively). Our hypothesis is that since these aspects of instruction frame a course (and, in fact, form the basis of the contract between student and professor), they may be difficult to change while a class and course is in progress since they have more impact on the total course. At the same time, these professors were not ignoring the evaluation of student learning; there was much ongoing informal assessment, as noted in the monitoring of student cues.

Most decisions to make modifications to teaching occurred during class (65%), as opposed to those made outside of the particular class (during the next class or the next course). (It should be noted that we have not analyzed aspects of the data which may provide evidence of much more retrospective reflection.) Their concurrent decision making may result from their strong teaching ability as well as their experience in teaching the particular courses. Whatever the source of this ability, it demonstrates flexibility, and a willingness to take risks by moving beyond their original pre-class plans as a result of their assessment of cues.

Corridor of tolerance

The corridor of tolerance is a mechanism to explain why monitoring may not always lead to decisions to change. It is an initial explanation which will need further exploration in later research. The corridor is premised on the idea that many aspects of teaching are not modified as long as the cues being monitored fall within what the individual deems to be acceptable bounds. If, however, what is being monitored moves outside the corridor of tolerance, decisions lead to adjustments in action. We postulate the corridor of tolerance does not have a constant size or shape, and that the diameter and the permeability of the corridor will vary depending on a range of factors, such as the extent to which: the teaching experience is novel or routine, the standards of performance are refined or less well defined, the classroom variables can be controlled by the individual, the decision making strategies are available and familiar.

Generally, the evaluation of most cues fell within the corridor of tolerance (70%). The professors decided to change their actions only one third of the times they monitored. Modifications followed negative evaluations more frequently than positive evaluations. It was a surprise that modifications followed neutral evaluations almost half the time, suggesting that changes are not always the result of teaching being perceived as a problem. We are seeking explanations for these professors' willingness to make changes following neutral evaluations. We hypothesize that these neutral evaluations fall on the perimeter of the corridor; by making changes, the professors' intentions would be to move the evaluations towards the center of the corridor.

Knowledge

Knowledge represents broad and in-depth cognitive structures accumulated through a combination of training and experience (Houston & Clift, 1990). Relevant knowledge, learning accumulated from experience about the subject area and teaching/learning, provides options or alternative strategies that can be used in the creation of goals and plans. These provide the framework for the mechanisms of monitoring and decision making that make up the process of reflection. As well, knowledge enables the professors to know what cues to monitor, how to evaluate them, and what options there are for decision making.

The professors drew most heavily on pedagogical knowledge (34%) to articulate their rationales for monitoring and decision making as well as knowledge of learners (20%). These were followed by pedagogical content knowledge and content knowledge. The professors were nearly always able to describe, often in great detail, the rationale, the knowledge they used, in

monitoring and decision making. This ability indicates the accumulation of considerable declarative and procedural knowledge about teaching even for those without pedagogical training. We suspect that their knowledge has been developed through repeated reflection on their teaching experience.

The only difference we saw between the groups was that the mathematicians (those without pedagogical training) named previous personal experience (e.g., “I did it that way last time and it worked”) rather than an instructional principle (e.g., “providing examples is helpful for student learning”) more than did the math educators (those with pedagogical training). It makes sense that the mathematicians would draw more on previous personal experience since they had not received formal training in pedagogy. As well, there were instances for all professors when feelings alone were the basis for decisions. Lastly, there were times when professors could not name the knowledge being drawn upon.

Summary of the model

In the process of reflection we documented, experience is the anchor, both the grounds on which the reflection is based and the *action* that results when decisions resulting from reflection are enacted in teaching activity. We found that these professors *monitored* their teaching actions to achieve their *teaching* and *learning goals*, prior to, concurrent with and retrospective to instruction. When monitoring they attended to and evaluated a multitude of *cues*, the most salient being student responses to their teaching. We contend that this attention to student cues results from their recognition of the link between their instruction and the learning process and that external student cues are the primary vehicle for assessing what is happening in terms of student learning. When *decision-making*, professors were deciding in relation to their goals to adjust or modify teaching actions dependent on where the cues fell in relationship to the *corridor of tolerance*; such changes were mostly to method and content. Ongoing use of the processes of monitoring and decision-making link knowledge and action, and are essential for building and accessing *knowledge*. Increasing knowledge increases one’s ability to reflect effectively and develop as a teacher.

The role of reflection in the construction of knowledge

As a result of our work, our understanding of knowledge has been expanded. We think we have strong evidence for the contention that reflection is a mechanism for the construction of knowledge from experience. For this reason

we elaborate in particular on the knowledge component of the model of reflection.

Types of knowledge

Polyani (1966) distinguishes between two types of knowledge: explicit and tacit. We see explicit knowledge as that which exists in discourse, is propositional, and can be discussed and examined relatively easily. We see tacit knowledge as that which may not yet be at the level of perception or cannot yet be described or verbalized, and may be related to feelings. Both types are important in our understanding of knowledge, and the relationship between them is where we believe reflection plays an important role.

One way that explicit knowledge about teaching has been represented in the literature is as different knowledge domains. Shulman (1986, 1987) suggests seven, four of which are commonly used to describe the nature of teachers' knowledge (e.g., Fennema & Franke, 1992; Grossman, 1990). Content knowledge refers to the subject matter per se. General pedagogical knowledge refers to broad general principles and strategies of classroom management and organization that transcend subject matter. Pedagogical content knowledge refers to the ways particular subject areas are formulated to make them comprehensible to learners. Knowledge of learners includes knowledge of the characteristics that students of different ages and backgrounds bring to the situation.

In our study we found that all professors drew on these knowledge domains. This was evident in the rationales they provided for their monitoring and decision making that revealed explicit principled pedagogical knowledge, pedagogical content knowledge, content knowledge and knowledge of learners. This is remarkable given that three of the professors had no pedagogical training. We will return later to how they might have constructed such knowledge.

The results of our study give particular substance to knowledge of the learner. Although this domain is rarely referred to in the literature, it was the second most frequently drawn on domain of knowledge by the professors during reflection-in-action. Shulman (1987) described this domain as including knowledge of the "conceptions and preconceptions that students of different ages and backgrounds bring to most frequently taught topics" (p. 8). Based on the cues these professors attended to, we concur with this definition. However, based on the data we analyzed, we would expand the definition to also include attention to students' experience of learning during instruction, more concretely, specific concern towards particular students in their classes. In the data, we found many episodes in which the professors

demonstrated the extent to which monitoring and decision making were based on attention to individual students. This knowledge came from direct personal contact, overhearing conversations among students, and from assignments. There appears to be some corroboration in the literature for this expanded definition of knowledge of learners. A recent study (Rahilly, 1997) surveyed a large number of professors about the knowledge they drew on in teaching, using as the basis for the analysis a critical teaching incident. One aspect of the knowledge he documented professors using was what he termed current knowledge of learners; it appears comparable to this second aspect of knowledge of learners that we found. In other words, knowledge of learners includes attention to the characteristics of the group, but also detailed attention to specific characteristics of individual students.

Based on the findings from our study, we found evidence for another type of explicit domain knowledge, which we have tentatively called experiential knowledge. All professors referred explicitly to previous experience as their basis for monitoring or decision making (e.g., "I did it that way last time and it worked"). We see parallels between this domain of knowledge and what Connelly & Clandennin (1985) have termed personal practical knowledge. We consider experiential knowledge a domain as this knowledge is used explicitly to provide rationales for monitoring and decision making. However it is not yet principled knowledge in the sense of Shulman's domains.

We also found evidence of tacit knowledge being used as the basis for monitoring and decision making during teaching. For the professors in our study tacit knowledge represented instances when they monitored or made decisions for a reason not based on a principle or a prior experience. For instance, there were times when their rationale was a feeling (e.g., "I feel as though I'm over the hump"), and other times when the rationale could not be expressed ("I just did it, I don't know why").

The depth and breadth of these various forms of knowledge influence the ability to construct goals, to create plans, to monitor, and to make decisions to change.

Construction of knowledge

The experiential and tacit knowledge professors relied on may represent knowledge that can and may be transformed into principle based knowledge. We hypothesize that feelings and ideas in these repositories of knowledge may at some point become part of one of the explicit domains pertaining to instruction. In the case of experiential knowledge, individuals through reflection may begin to see patterns across multiple experiences and begin to extract principles. Similarly, reflection on tacit decisions might facilitate,

for example, a more conscious linking of feelings (e.g., “I don’t feel good about how this class is going”) to cues being monitored (e.g., “I noticed a lack of energy in the room”), and from there to a more principled basis for interpreting the meaning of student cues, as an aspect of pedagogical knowledge.

Thus experience and feelings are one essential basis for constructing knowledge, and reflection on these provides a mechanism for learning by relating them to future action and application. Our study provides some evidence for this contention. As noted earlier, the three math educators had pedagogical training and the three mathematicians did not, yet all provided rationales for their decisions and actions that revealed principled knowledge about teaching, so those without pedagogical training have likely developed knowledge about teaching largely through experience and reflection. The mathematicians drew upon experiential knowledge more than the math educators, an indication that their lack of training may lead them to more frequently depend on experience as the basis for knowledge construction. At the same time, there was evidence that the math educators also developed knowledge through experience. All the professors evaluated student cues, and we hypothesize this knowledge must have been developed experientially since it is rare that a teacher education program teaches this kind of knowledge to teacher trainees.

There is some corroboration in the higher education literature for our suppositions. Hativa (1997) surveyed professors to document their perceived sources of teaching knowledge. Of the fifteen items reported, three items appear closely linked to our conception of the construction of knowledge. These are trial and error in one’s own teaching, self-evaluation of teaching, and student feedback. Hativa (1997) notes these three may be linked. We would support this belief, since for us the three represent different aspects of the process of reflection. Trial and error represents repeated experience, specific long continued practice. It is the anchor for reflection (what is described as self-evaluation in the survey), and provides the basis for knowledge construction. Student feedback is represented in the monitoring of student cues, which enables the development of knowledge of the learner through experience.

Transforming experiential and tacit knowledge into principled explicit knowledge about teaching requires, we think, intentional reflection for the purpose of making sense of and learning from experience for the purpose of improvement. In this way reflection requires linking existing knowledge to an analysis of the relationship between current experience and future actions or application. As such, reflection aids in pattern recognition and reconfiguring

knowledge. The outcome of the process of reflection is the building of or expansion of knowledge.

Does better teaching knowledge lead to better teaching?

There appears to be a paradox in the relationship between the process of reflection and knowledge construction. We believe that ongoing monitoring expands one's knowledge bases, and as knowledge develops, one has a richer source to draw on during decision making and a greater understanding as to what bears monitoring. The professors in our study are skilled teachers because through reflection they have developed the knowledge that enables them to be more pointed in their reflection: to monitor and evaluate the responses to their teaching and to make decisions to enhance their instruction.

At the same time, we conjecture that monitoring the results of actions may lead to the construction of new knowledge or a reconstruction of present knowledge. In other words, knowledge is necessary for the process of reflection to be effective, yet the process of reflection enables the building of knowledge. This suggests that without specialized training or support from experienced teachers who can model their own ways of reflecting, inexperienced professors may find it hard to develop their knowledge bases and improve their ability to reflect.

Thus, we would answer the question "does better teaching knowledge lead to better teaching?" by saying, not necessarily. If one builds knowledge about teaching to expand understanding of the discipline, but does not link it to previous experience or future teaching action, then one may not necessarily become a better teacher. In other words, the intentionality of linking knowledge and experience to future action through reflection will likely improve thinking about teaching and carries a greater potential to improve enactment of teaching than does simply knowledge building. But neither carries a guarantee. Practice, and feedback over time are also essential in moving from better thinking about teaching to better enactment of teaching. We move on to this in the next section.

The role of reflection in teaching development: Conceptual change requiring practice, feedback, time

If we are concerned with enhancing student learning (as were the professors whose reflection we documented), then we need to know how professors develop knowledge about how students learn (which we explored in the previous section). We also need to know what impact knowledge about

student learning might have on how professors think about teaching. There is a literature that addresses this concern, and it is this that we turn to now.

Representations of teaching development

The public school literature (e.g., Berliner, 1988; McCormick & James, 1989) and that in higher education (e.g., Ramsden, 1992) represent teaching as a developmental process in which one can move from less sophisticated ideas and abilities to more integrated thinking and skills. In higher education, Ramsden (1992), Fox (1983) and Sherman, Armistead, Fowler, Barksdale & Reif (1987) among others provide theoretical models which describe the transitions that occur as a professor becomes more sophisticated in teaching. These different representations all focus on professor cognition: changes in thinking about what learning is and the role of the student and instructor in this process. All recognize that these shifts lead to a reconceptualization of subject matter. A brief description of two of these models provides more detail.

Ramsden (1992), for instance, has suggested that professors operate within different theories of teaching which represent developmental change, shifts over time to more sophisticated views of teaching and learning. Theory 1 describes teaching as telling or transmission, primarily of content and procedure, and focuses on teacher actions rather than on students. Theory 2 describes teaching as organizing student activities and techniques designed to ensure student learning. The focus moves from professor actions towards student actions. Theory 3 focuses on the students and describes teaching as making learning possible through the professor working cooperatively with students to help them change their understanding. Professors operating more within Theory 3 will focus more on student learning than those operating within Theory 1 (focus on teacher activity) and Theory 2 (focus on learner activity).

Sherman et al. (1987) describe a four stage theory of acquiring teaching excellence in higher education. In the first stage, teaching as telling, professors do not recognize that students learn by manipulating information. Thus, they believe they have little influence on student learning. In the second stage, teaching is leading and hoping that the students will learn. Professors bring students into intellectual contact with the content, however the students work alone. In the third stage, teaching as transmitting knowledge (this term is used differently from Ramsden), professors believe that instruction can influence learning if student characteristics are considered. There is a shift from concentrating on the content alone to how and why students might learn the content. In the fourth stage, teaching is a complex interaction of students,

content and teacher actions. The professor realizes that learning comes from significant mental actions on the part of the student.

Similarly, in other articles in this issue, you will find a shared belief in this notion of teaching development. For instance, Hativa and also Kember and Kwan conclude that fundamental changes to the quality of university teaching and learning are unlikely to happen without changes to professors' conceptions of teaching.

We too share this belief in learning about teaching being a developmental process. However, we struggle with several issues. What does development mean? Is it a slow incremental process, a gradual accretion of knowledge that enables us to be more effective? If it is, then perhaps this would explain the individual who values and becomes a very good lecturer, and rarely if ever uses approaches other than this. Or is development a process in which one shifts dramatically one's way of perceiving students, teaching and subject matter? If so, then is it the case, as is implied in most representations of teaching development, that a learner centered conception is better? While reminding ourselves that the choice of instructional strategy isn't necessarily indicative of the underlying conception of teaching, how do we explain that some teachers who do not appear to be student centered are perceived to be excellent teachers? We do not propose to answer these questions, but merely to remind ourselves and others that these conundrums exist. We recognize a dichotomy between the perceived effectiveness of teachers (as reported anecdotally by students, through course evaluations, and teaching awards) and the literature on teaching development which highlights criteria for excellence that are perhaps different. So, despite our efforts, we in higher education are still left with the question of how we know that any particular kind of teaching is good.

Reflection and teaching development

Based on our understanding of the conceptual change literature, our perceptions and interpretations of experience are influenced by our assumptions, beliefs, existing knowledge structures, and conceptions of teaching. That is, the lenses we use within each conception of teaching are qualitatively different as to subject matter, teaching and student development (Entwistle & Walker, in this issue) and may limit or preclude our being awakened to different ways of thinking.

Thus, we and others have come to understand the evolution of expertise in teaching as a complex process requiring experimentation, practice, feedback and time (e.g., Ho, 1998; Kember, 1997; Saroyan et al., 1997). We conceive reflection as an essential mechanism since it is a process for making sense of

experience and for developing one's knowledge (e.g., McAlpine, 1993) and later having a richer source of knowledge to draw on during action.

What relationship do we see between teaching development as conceptual change and the process of reflection? We answer this question by returning to the findings from our research and applying them to Ramsden's (1992) conception of teaching development. Although we conjecture that the professors in our study may have been operating in all three theories, we focus specifically on how their reflection on goals, cues and knowledge relates to Theory 3.

Theory 3 focuses on students and how professors help them change their understanding. There is a multitude of evidence showing the professors in this study operated within Theory 3. They tracked learning goals a third of the time while reflecting, in particular, on student understanding and student participation. In addition and to a lesser degree, they also tracked student general ability (all-around academic skills and capabilities), student knowledge (skill in the particular subject area), and student affect. This is necessary information for the professor to be effective in helping students change their understanding. As noted earlier, they monitored student cues more than any other cue, in fact, 70% of cues monitored. We assume this was a way for them to track their learning goals related to students. As well, when we look at the knowledge drawn on during reflection, they used knowledge of the learner second only to pedagogical knowledge.

We can hypothesize what reflection might look like in someone who was conceptualizing teaching within Theory 1, with a focus on teacher actions rather than on students. We do this by looking at the aspects of reflection that were least frequent in the professors in our study. For instance, the professors in this study attended to content and method goals relatively frequently, and tracked performance goals less frequently. We hypothesize that professors within Theory 1 would track performance goals more frequently because they would focus more on teacher actions. Similarly, the professors in our study monitored cues related to students more than to cues related to teaching (instructional materials, time, management of the course, e.g., such as assignments, schedules, and the classroom environment). We hypothesize that professors within Theory 1 would monitor teaching cues to a much greater extent. Lastly, in terms of knowledge, we would expect the reverse of what we noted in the professors in our study: we would hypothesize that a professor within Theory 1 would draw mostly on content knowledge, perhaps on pedagogical or pedagogical content knowledge, and rather little on knowledge of the learner.

A last point to be made relates to the use of concurrent and retrospective reflection. Nearly half of all the instances we documented were reflection-

in-action when the professors monitored and evaluated mostly student cues as they were teaching in order to make decisions about what and how to change their actions. The development of this cognitively demanding ability may be related to the theory within which a professor is operating. We hypothesize that it is within Theory 3, perhaps beginning with Theory 2, that a desire may emerge to extensively track student cues and concurrently finetune instruction.

Factors influencing the ability to reflect on teaching

Although there is a general belief that reflection is a useful tool for developing and improving teaching, it is apparent that not all teachers appear to reflect, or at least to benefit from reflection. In this section, we explore two questions related to this observation. Why are there some teachers who seem unable to engage in productive reflection about their teaching? Why are there some teachers who engage in reflection but can't seem to use it to improve their teaching?

Teachers who engage in reflection that leads to better teaching

We begin by hypothesizing what the distinguishing features are of those professors who engage in reflection that leads to better teaching. First of all, their reflection focuses on learning from and about their experience of teaching, and then linking it to future action. In other words, the desire or motivation to value teaching and to be good at it is present. Second, expertise is considered to be domain specific (Stepich, 1991). So, university professors, already knowledgeable in their subject matter, would need to recognize that new knowledge bases are required, e.g., pedagogical and pedagogical content knowledge, and be motivated to develop this knowledge through reflection, perhaps supplemented by formal means. Third, undertaking reflection involves cognitive engagement, but it also involves a willingness and an ability to take risks in one's actions, to do things differently. This would suggest that the environment must be one that is perceived to be supportive of risk taking, e.g., trying different ways of teaching does not impact negatively on tenure possibility. Fourth, there must be a minimal number of perceived constraints, e.g., a class size that is not perceived as manageable. Fifth, opportunity for frequent practice would also be essential. Sixth, some minimal knowledge of teaching perhaps gained through formal means would be helpful, as without this, it is difficult for inexperienced professors to begin reflecting on their teaching since they have little knowledge to draw upon. Lastly personality may play a role; we explore this point below.

Teachers who are unable to engage in reflection

Why are there some teachers who seem unable to engage in productive reflection about their teaching? We perceive three factors that might be implicated. One is a lack of motivation, a failure to value being a good teacher. Another is a lack of knowledge about teaching and of the role of reflection. We have referred earlier to this paradox; it is difficult to reflect without having some basic knowledge about teaching to help one know what to monitor, and what alternate strategies one may draw upon to change one's teaching, and yet one develops the necessary knowledge through the process of reflection. Dunkin & Precians (1992) compared award winning and novice professors' verbal reports and found that only 1/3 of novices described making changes on the basis of student feedback (it is not clear to what extent they were monitoring cues). We hypothesize this limited use of student feedback could result from a lack of knowledge about what cues to monitor and evaluate, and what alternate decisions they might make. The third factor is a fear of taking risks; this may be internally imposed, e.g., a fear of losing face with one's students. It could also be a fear related to an external element, e.g., tenure.

Teachers who engage in reflection but can't improve their teaching

Why are there some teachers who engage in reflection but can't seem to use it to improve their teaching? As noted earlier, a lack of experience will be a stumbling block. Without experience it is difficult to have a sufficient knowledge base which is necessary to reflect effectively. For instance, a teacher may be monitoring but not be monitoring the appropriate cues. Or, he/she may see a need to change an instructional strategy but not have a large enough repertoire to provide an alternate successful strategy. This is where, in addition to experience, some formal learning may be helpful in building knowledge (Lampert, 1984). Third, as with those who don't reflect, a fear of risk taking may be a factor; the individual may know what he or she would like to do to feel more effective but perceive there are constraints that prevent this action. A fourth factor may be an inability to carry out successfully the decisions one makes. Ericsson & Smith (1991) note that even if the cognitive process, in this case reflection, is functioning well, "in real-life perceptual motor skills, there exist a wide range of motor movements that can allow [we would add limit] realization of a given goal" (p. 27).

The fifth factor we perceive that might constrain successful reflection is a personality characteristic. As Sternberg & Horvath (1995) note, "in the minds of many, the disposition towards reflection is central to expert teaching" (p. 355). The point here is that although all professors gain teaching experience, not all professors develop into expert teachers. One reason for this may be that expertise may be influenced by stable personality traits (Cope-

land et al., 1993), that lead beginning teachers to vary along a continuum in terms of their success at teaching. Bereiter & Scardamalia (1994) suggest an explanation in their description of expert like (EL) and non-expert like (NEL) learning patterns that affect the ways in which novices approach novel situations. These two groups of novices differ in how they go about acquiring new knowledge in the absence of prior knowledge. For instance, they vary in terms of the learning goals they set. EL learners set knowledge building goals whereas NEL learners focus on goals related to task accomplishment. Some professors new to teaching may be more predisposed to EL learning patterns whereas others may exhibit more NEL learning patterns. This would mean that the nature of experience (what one sees and monitors) and the ability to see patterns (a propensity helpful in developing knowledge from experience) will vary between EL and NEL individuals. Bereiter & Scardamalia (1994) have suggested that the EL learning trait makes it easier for some learners to develop knowledge and expertise than others. The corollary, of course, is that the NEL learning trait may make it harder. In other words, moving beyond the influence of contextual factors, lack of knowledge, and internally imposed constraints, we suggest more permanent factors may influence the effective use of reflection.

The point we have been making above is that the process of reflection can fail to be initiated and fail to be completed for a variety of reasons. It can fail to be initiated as a result of both external and internal factors. And, if initiated, it can fail to be completed. It can break down in relation to monitoring in four ways: not knowing what cues are fruitful to monitor, not being able to monitor them, not knowing how to evaluate them, and lastly not evaluating them appropriately. The process can also be disrupted during decision making: not knowing what to change, not knowing how to change it, and not being able to implement the change. In other words, once undertaken, the process of reflection can fail both because of a lack of sufficient knowledge about teaching and because of an inability or failure to successfully implement that knowledge through our actions.

We have returned to an earlier point, that we think reflection links teaching knowledge and teaching action, and that the use of reflection will benefit student learning. In the next section, we explain the value we see in using the process of reflection to link teaching knowledge to better teaching and enhanced student learning.

The relationship between reflective teaching and student experience of learning

What real impact does reflective teaching have on student learning? This is an important question and one we are attempting to grapple with. After all,

reflection is not an end in itself, but a mechanism for improving teaching and hence maximizing learning. Although there is a widely held belief that reflection will improve teaching and that this reflective teaching will improve learning, there is no research that documents a link between teacher reflection and student learning. The research that does link teaching and learning focuses on teacher actions (rather than reflection) and how these relate to student products of learning, such as exams. What is taken for granted and thus not documented in these studies is the cognitive processes of both the teacher and learner that are essential for teachers to teach effectively and students to learn from this instruction.

We now think it is important to explore how reflection on teaching during instruction affects teacher actions, and how these teacher actions are connected to students' experience of learning. We have already defined reflection as a mechanism for the improvement and development of teaching. We define student experience of learning as thinking about and making meaning of instruction. As teachers create goals, set learning expectations, plan and deliver instruction, they reflect on their teaching. In other words, they evaluate feedback (e.g., student questions or puzzled expressions), and if they feel it is appropriate decide to implement modifications. This reflection process is enacted through teaching behaviours which are then experienced by their students. We think we are most likely to see any relationship that may exist by documenting professors' reflections on teaching and students' concurrent experience of learning during teaching enactment. It is this that we are focusing on in our current research.

Closing

We began our work on reflection by situating ourselves within the tradition of reflective practice which views reflection as generically good because then teachers can be more intentional and deliberate in thinking about teaching (Zeichner, 1994). While still embracing this orientation, our knowledge of reflection has developed and become more refined. As we have come to understand the importance and role of goals, cues, and knowledge all in relation to the learner, we have been shifting our orientation to one in which a developmental orientation is also present. Such an orientation places priority on understanding students' thinking.

This repositioning in our conception of reflection and in our research is leading us to attempt what we perceive as an extremely difficult task, seeking evidence of a link between teacher reflection and student learning. We are not alone in our interest in this link; the professors in our study were clearly interested in the impact that their decisions about teaching had on student

learning. We hope in our current research to be more able to directly access and understand the nature of the relationship we think exists.

Note

1. 'Professors' in the sense of 'university teaching staff'; not necessarily 'full professors' or professors in the British sense.

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