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Professors' Post-Class Reflection:

A Case Study

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Thesis submitted in partial fulfilment of the requirements for the degree of

Ph.D. in Educational Psychology

Abstract

The topic of teacher reflection has been gaining greater attention in the education literature. Nevertheless, teachers' reflective processes have not been well understood. This study attempted to describe characteristics and content of professors' post-class reflection. More specifically, it attempted to determine whether professors engage in the reflection process consciously and ways in which this process can be characterized. Eight professors, representing two levels of teaching experience, teaching a lecture or seminar undergraduate class in humanities or engineering, participated in this case study. Interviews, classroom observations, and instructional plans and materials comprised the data sources. Transcripts of the interviews were analyzed thematically, using QSR NUD*IST 4. Findings indicate that professors' post-class reflection became a routine: it happened at different points of time, mostly right after the class, and as a continuous process. Their reflection involved a mixture of having intuitive feelings about the class as well as thinking logically about how the class unfolded. They reflected intentionally and for two major purposes: to get ready for the next class and to improve teaching in general. They were either unable to characterize their way of reflecting on the class or were very clear that their reflection was more an intuitive process than a rational one. They reflected mostly on their teaching performance, on the content covered in class, on the students, and on instructional contexts. Based on the results, a conceptual framework is proposed that describes professors' post-class reflection as interrelated with rational and non-rational information processing. The study contributes to a better understanding of the complex process of teacher thinking and informs the design of faculty development interventions that aim at promoting reflective practice.

Résumé

La réflexion chez les enseignants est un sujet auquel les écrits accordent une attention croissante. Néanmoins, les processus liés à la réflexion des professeurs ne sont toujours pas bien compris. Cette étude tente de décrire les caractéristiques et le contenu de la réflexion qui prend place après la classe chez des professeurs. Plus particulièrement, on tente de déterminer si les professeurs s'engagent consciemment dans un processus de réflexion de même que de caractériser ce processus. Huit professeurs, répartis selon deux niveaux d'expérience en enseignement, ont participé à cette étude de cas. Ils enseignaient les sciences humaines ou l'ingénierie à des étudiants du premier cycle universitaire dans le cadre de cours magistraux ou de séminaires. Les données recueillies sont constituées d'entrevues, d'observations en classe, de plans de cours ainsi que de matériel de classe. L'analyse thématique de la transcription des entrevues a été facilitée grâce à l'utilisation du logiciel QSR NUD*IST 4. Les résultats indiquent que la réflexion qui fait suite à une classe tend à s'inscrire dans une sorte de routine. En d'autres termes, elle prend place à différents moments — la plupart du temps immédiatement après la classe — et se caractérise par un processus continu. La réflexion présente à la fois une dimension intuitive inspirée par la classe ainsi qu'une dimension plus logique liée au déroulement de cette même classe. Les professeurs réfléchissent consciemment et principalement pour deux raisons: afin de se préparer pour la prochaine classe de même que pour améliorer leur enseignement de façon générale. Certains n'arrivaient pas à caractériser leur démarche de réflexion relative à la classe alors que les autres étaient très conscients que leur processus de réflexion était davantage intuitif que rationnel. Leur réflexion portait la plupart du temps sur leur performance d'enseignement, sur le contenu présenté en classe,

sur les étudiants ainsi que sur les différents contextes d'enseignement. Un cadre conceptuel fondé sur les résultats obtenus est proposé. Il décrit la réflexion qui prend place après la classe chez des professeurs comme un le traitement d'informations rationnelles et non-rationnelles intimement liées. Cette étude contribue à une meilleure compréhension du processus complexe qu'est la réflexion des professeurs. L'étude apporte également des éléments d'information pertinents pour le design d'interventions pédagogiques auprès de professeurs chez qui l'on souhaite favoriser une pratique réflexive.

Acknowledgements

This thesis could not have been accomplished without help and support of many people. First and foremost, I would like to extend my profoundest gratitude to my thesis supervisor Dr. Alenoush Saroyan for her continuous support, encouragement, and guidance throughout the doctoral program. Her insight and foresight have led me to the completion of this study and will guide me in the future. I also thank her for including me in a wide range of research programs and faculty development activities and for introducing me to the Canadian and international education research communities. Participation in these activities has greatly expanded my perspective on education research. I am deeply indebted to her for the mentorship she has so willingly given me.

I sincerely thank my committee members Dr. Cynthia Weston and Dr. Myron Frankman for reviewing this study. Particularly, I thank Dr. Cheryl Amundsen for her continuous help and support for this study. In addition, I thank Dr. Lynn McAlpine for sharing her ideas of research on teacher reflection. I would like to extend my gratitude to the eight participants whose willingness to share their thoughts and devote their time made this study possible. Through their eyes, I have come to a greater appreciation of the complexities of teacher reflection. I thank my colleagues: Dr. Brian Denison and Dr. Danielle Gryspeerdt for sharing ideas on the study; Josée Bouchard and Stacey Knight for assistance in the study, particularly in establishing the interrator reliability of coding.

Finally, this thesis is dedicated to my wife, Li Xiang, and my daughter, Cao Jian-Qin, for their steadfast love, support, and encouragement throughout of my doctoral study and to my father, Cao Chang-Ming, my mother, Peng Hua-Zhi, and my sister, Cao Xiao-Ling, for their strenuous love and believing in me.

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Chapter I

Introduction

The study reported here was a collective case study consisting of eight profiles of professors' post-class reflection. Using a qualitative perspective, this case study research attempted to discern characteristics and content of professors' post-class reflection with a view of contributing to the current understanding of teacher thinking. More specifically, the study attempted to determine whether professors engage in the reflection process consciously and ways in which this process can be characterized.

Since the mid-1980s, teaching has been reconceptualized as a complex cognitive process (Anderson, 1982; Berliner, 1986). Together with this paradigm shift from focusing on teacher behavior to teacher cognition is a change in the metaphor from teacher as a technician (National Institute of Education, 1975) to teacher as a reflective professional (Schön, 1983). Describing teachers as reflective practitioners communicates the complexity of the teaching and learning process more accurately and acknowledges the dynamic nature of the teacher-thinking process. Since this shift, teacher reflection has been discussed in a variety of contexts, including learning (Boud, Keogh, & Walker, 1985), teacher thought processes (Calderhead, 1996; Clark & Peterson, 1986), teacher education (Russell & Tom, 1992; Zeichner & Liston, 1987), adult education (Mezirow, 1990), and professional development (Brookfield, 1987; Schön, 1983; 1987).

Despite the popularity of the construct of teacher reflection, the empirical research in this area is still limited. Studies investigating teacher reflection have been carried out mostly at the primary and secondary education levels. It is not yet known to what extent the findings from this body of research are applicable to higher education. Current

literature indicates that the context of higher education differs from that of primary and secondary education (Buchanan, 1993; Kember, 1997). First, the roles and expectations of instructors at these levels vary in specific ways. Professors see themselves as members of a discipline or as experts in the subject (Becher, 1989 cited in Kember, 1997). Apart from classroom teaching, professors have a greater variety of responsibilities in conducting research and governance of the institute (Centra, 1993). They perceive teaching as less of a priority than research (McKeachie, 1994; Smith, 1991).

Second, classroom environments of higher education differ from that of primary and secondary education. Higher education offers more complex formal courses with greater variation in scope and depth. Professors focus more on development within areas of specialization rather than on pedagogy. Students in higher education are usually older, more focused with an academic area, and have different needs, abilities, and backgrounds than pre-university students (Merriam, 1987). Without a prescribed curriculum as at the other levels, professors are more independent in teaching and evaluation. Compared to teachers at other education levels, professors' teaching is less supervised and supported by the university. Finally, training in pedagogy is different in higher and lower education. Although professors have a higher level of post-secondary education, few of them have formal pedagogical training (Ramsden, 1992; Zuber-Skerritt, 1992). Since subject matter expertise is no guarantee of good teaching (Clarridge, 1990), professors have to draw on their existing knowledge of teaching which is primarily based on their own experience as students and their teaching experience gained on-the-job (Fenstermacher, 1994; Kagan, 1992). Reflection on their own teaching experience thus becomes a major means for professors to learn how to teach and to improve teaching (Shulman, 1987).

Recent theoretical developments in the area of teacher growth support the assumption that reflective teaching practice relates to teaching improvement in higher education (Cranton, 1994a; 1996; Kugel, 1993; Ramsden, 1992). However, relevant factors involved in teacher reflection in higher education need to be empirically determined. Focused studies that articulate specific aspects of the cognitive process of teacher reflection form the crucial step in clarifying the actual meaning of teacher reflection in the context of higher education. This effort can verify the validity of theoretical frameworks of teacher development in higher education and assess the applicability of the empirical work carried out at the other education levels to higher education.

Teacher reflection is an elusive construct. While there is no agreed-upon definition of teacher reflection (Clift, Houston, & Pugach 1990; Grimmett & Mackinnon 1992), there are different theories that have the potential of defining teacher reflection. Although these theories originate from different epistemological foundations and offer different approaches to reflection, they support the same assumption that reflection is a complex phenomenon and a worthwhile component in advancing human thinking and practice. Providing empirical evidence that contributes to a better understanding of teacher reflection is of great significance theoretically and practically. The following discussion is organized under three categories corresponding to the current thinking on teacher reflection: (a) teacher reflection as rational and analytical inquiry, (b) teacher reflection as spontaneous knowledge and action, and (c) teacher reflection as critical thinking.

Teacher Reflection as Rational and Analytical Inquiry

Cognitive psychology focuses on the human mind as an object of inquiry and treats "thinking process as concrete phenomena that can be studied scientifically" (Resnick, 1985, p. 124). This line of argument can be traced back to Dewey's conception of reflective thinking as a rational and analytical process. He defines reflection as "active, persistent, and careful consideration of any belief or supposed form of knowledge in light of the grounds that support it and the further conclusions to which it tends" (Dewey, 1933, p. 9). This definition characterizes reflective thinking as an inquiry in which individuals collect observable evidence and reason through the problem. Dewey (1933) suggests that reflective thinking consist of five phases.

Phase one, suggestions, refers to ideas or possibilities that spring to mind when one is initially confronted by a puzzling situation. Phase two, problem or intellectualization, is when the puzzle is seen as a whole rather than as small or discrete entities on their own. Phase three, hypothesis formation, is when a suggestion is reconsidered in terms of what can be done with it or how it can be used. Phase four, reasoning, is when the linking of information, ideas and previous experiences allows one to expand on suggestions, hypotheses, and tests, and to extend the thinking about and knowledge of the subject. Finally in phase five, testing, the hypothesized end result is tested (Dewey, 1933). This description highlights reflective thinking as hierarchies in which the five phases inform each other, link reflective thought units together, and bring forth a sustained movement toward solution of the problem.

Dewey's conception of reflection as a rational and analytical process has profoundly influenced current thinking about reflection (Cranton, 1994a; 1994b). In the

area of learning, Boud, Keogh and Walker (1985) present a model of how reflection can turn experiences into learning. They define reflection as a rational process in which individuals recapture, analyze, and evaluate experiences to reach new understanding or behavior change.

Similar to Dewey's inquiry process, Boud et al.'s model (1985) describes three stages of reflection in the learning process. The first stage, returning to experience, enables the learner to replay the initial experience in the mind or to recount the features of experience of others. The second stage, reflective processes, attends to one's feelings as they relate to the experience with a tendency toward utilizing positive feelings and removing obstructing ones. The final stage, outcomes, involves re-examining experience in the light of the learner's intent, relating new knowledge to the learner's conceptual framework, which in turn leads to adapting the new knowledge into the learner's repertoire of behavior. Like Dewey, Boud et al. (1985) highlight the interrelationship between the three stages of reflection. They view reflection as a rational analytical process in which individuals observe facts, analyze cognitive and affective aspects of the experience, and reconfigure personal knowledge as well as make decisions for action.

In addition to the cognitive aspects, Boud et al. (1985) highlight the importance of the affective dimension in the process of reflection. They argue that reflection is a complex process "in which both feelings and cognition are closely interrelated and interactive" (p. 21). Attending to feelings can provide reference points to recapture and elicit the relevant experience and thus facilitate the reflective process. On the other hand, acknowledging and "removing obstructing feelings" (p. 27) can eliminate emotional and psychological barriers in the process of reflection. This argument adds an affective

dimension to the description of the reflective process and expands Dewey's definition of reflection.

In the area of teaching, Dewey's theory of reflection has been used to describe teachers' thinking processes. Shulman's (1987) model of pedagogical reasoning incorporates Dewey's conception of reflection as an inquiry process and Boud et al.'s (1985) emphasis on feelings. Shulman defines reflection as "what a teacher does when he or she looks back at the teaching events, the emotions, and the accomplishments. It is that set of processes through which a professional learns from experience" (Shulman, 1987, p. 19). This definition reflects Dewey's conception of reflection as a rational and analytical process. First, it views teacher reflection not merely as a disposition or a set of strategies, but also as a process that uses particular kinds of analytical knowledge that teachers bring to bear in their work. Shulman specifies that "central to this process will be a review of the teaching in comparison to the ends that were sought" (1987, p. 19). He suggests that teacher reflection involves "reviewing, reconstructing, reenacting and critically analyzing one's own and the class's performance, and grounding explanations in evidence" (Shulman, 1987, p. 15). This description typifies reflection as a reasoning process that helps teachers examine their experience and develop insights into teaching (Valli, 1992; 1997).

Second, Shulman highlights teacher reflection as "cognitive processes that depend on retrospection" (Munby & Russell, 1989, p. 76), underscoring teachers' cognitive processes in recalling, reviewing, and learning from their teaching experience. This perspective aligns Shulman with Dewey and distinguishes teacher reflection from

teachers' on-site decision-making processes, as suggested by the conception of reflection-in-action (Schön, 1983).

Theories advocated by Dewey (1933), Boud et al. (1985) and Shulman (1987) follow the empirical and analytical tradition and view teacher reflection as a rational and analytical process of inquiry. They highlight the central role of cognitive processes in reflection. Despite this common epistemological base, these theories approach reflection from different angles and operate at different levels. Highlighting reflective thinking as a generic human capacity, Dewey (1933) defines reflection as a chain of purposeful thoughts that arise when solving a perplexing situation. In comparison, Boud et al. (1985) delimit reflection in the context of human learning from experience. They also include the affective factor as an important component in the reflective process whereas Shulman capitalizes on the cognitive aspect by defining teacher reflection as a reasoning process in which teachers gain insights from their experience.

Teacher Reflection as Spontaneous Knowledge and Action

Although Dewey (1933) started discussion of reflection several decades ago, it is the work of Schön (1983; 1987) on reflection in professional practice that has made this construct popular in the education literature. Despite sharing a pragmatic approach to reflection with Dewey, Schön's epistemological perspective differs from that of Dewey. Dewey follows the empirical-analytical tradition and views reflective thinking as a rational and analytical process of problem solving, whereas Schön follows a phenomenological approach and conceives of reflection as spontaneous knowledge and action.

Schön started his theory of reflection by negating Technical Rationality--"the Positivist epistemology of practice" that "leads us to think of intelligent practice as an application of knowledge to instrumental decisions" (1983, p. 50). Based on case studies of professionals in practice, he concluded that Technical Rationality is incapable in informing professional practice that is "full of uncertainty, uniqueness, instability, and value conflict" (1983, p. 42). He suggests epistemology of practice--"knowing-in-action," that is, knowledge created by practitioners themselves in practice--as an alternative. Schön (1983) believes that practical knowledge is more relevant and important than theory in explaining and guiding professional practice.

On the basis of the epistemology of practice, Schön (1983) characterizes reflection as an important vehicle for the acquisition of professional knowledge. His concept of reflection includes two processes: reflection-in-action and reflection-on-action. Reflection-in-action refers to individuals' thinking "about what they are doing, sometimes even while doing it" (Schön, 1983, p. 50). This process can be understood through "phrases like 'thinking on your feet', 'keeping your wits about you', and 'learning by doing'" (Schön, 1983, p. 54). Schön (1983) further suggests that reflection-in-action contain two dimensions. One dimension focuses on making sense of a problematic situation, and the other attends to reflecting on understandings that have been derived from action. Reflection-in-action thus involves experimentation with a situation in which individuals go through multiple times of "framing" and "reframing" in "setting the problem" (Schön, 1983, p. 40).

Schön (1987) highlights the tacit and non-logical nature of the process of reflection-in-action. He suggests that in reflection-in-action, an individual does not

depend on the categories of established theory and technique, but constructs a new theory of the unique case. This iterative process of thinking and doing allows one to define means and ends interactively as one frames a problematic situation. It is this dynamic nature that enables reflection-in-action to proceed in uncertain situations. Also, this feature suggests that reflection-in-action is "a process that is prompted by experience and over which we have limited control" (Munby & Russell, 1992, p. 3). Knowledge produced from this process is "dependent on tacit recognitions, judgements, and skilful performance" (Schön, 1983, p. 50). This knowing-in-action denies description of adequate criteria, rules and procedures, which are consciously used in research theories and techniques (Schön, 1983).

While reflection-in-action focuses on the processes that practitioners engage in experimenting with a problematic situation during action, reflection-on-action refers to the reflective processes after action. Schön suggests that:

> Practitioners do reflect on their knowing-in-practice. Sometimes, in the relative tranquillity of a post-mortem, they think back on a project that they have undertaken, a situation they have lived through, and they explore the understandings they have brought to their handling of the case. They may do this in a mood of idle speculation, or in a deliberate effort to prepare themselves for future cases. (Schön, 1983, p. 61)

This description of reflection-on-action bears similarities to as well as differences from Dewey's (1933) notion of reflective thinking. The two notions are similar in that both focus on the retrospective process of reflection that takes place after action, and both

delineate reflection as having similar stages of recalling past enactment, gaining insight from experience, and bearing implication on future action.

However, these two concepts grow from different epistemological roots, and point to different contents and purposes of reflection. Dewey's reflective thinking suggests a process of returning to observable facts, generating hypotheses, reasoning, and testing hypothesis. This rational and analytical process entails the operational process of reasoning through a problematic situation and finding solutions to a defined problem. In contrast, Schön's reflection-on-action explores and verifies new knowledge developed during the process of reflection-in-action. Schön specifies that "Reflection-on-action occurs in the medium of words. It makes explicit the action strategies, assumptions, models of the world, or problem-settings that were implicit in reflection-in-action. It subjects them to critical analysis and perhaps also to restructuring and to further on-the-spot experiment" (Schön, 1995, pp. 30-31). This argument indicates that reflection-on-action bears a metacognitive nature and is complementary to reflection-in-action. It describes reflection-on-action partly as a process in which one reflects upon his/her reflection-in-action. The purpose of reflection-on-action is to sharpen one's knowledge in order to understand a problem better rather than to find solutions to the problem.

Schön (1983) follows Dewey (1933) in conceiving reflection as inquiry that aims at producing "actionable and generalizable" theory in the interaction of thinking by attending to the tacit knowledge generated in practice, and by highlighting the spontaneous aspect of thinking when professionals are in action. Schön's reflection-in- and reflection-on-action provide an alternative view of professional practice creating "a

new level of discourse about professional knowledge and reflection" (Munby & Russell, 1989, p. 75).

Teacher Reflection as Critical Thinking

The current perspective on teacher reflection as critical thinking has two theoretical underpinnings: the epistemology of inquiry (Dewey, 1933) and critical philosophy (Habermas, 1971). This critical perspective draws on Dewey's notion of reflective thinking and defines reflection as an inquiry process. Mezirow, a major advocate of critical reflection, indicates that his theory of critical reflection "builds upon his [Dewey's] concept to formulate a definition, analysis, and interpretation of the nature and function of reflection in transformative learning and the problem-solving process" (Mezirow, 1991, p. 100). This description indicates that critical reflection follows the hypothetical-deductive tradition by emphasizing "identification and formulation based on feedback from research" (Mezirow, 1991, p. 101).

Second, critical reflection accentuates reflection as a critical process. Mezirow points out that reflection, as defined by Dewey, does not end by formulating a solution to a problem. It "also involves a review of the evidence supporting the conclusion. This review process results in formulation of the premises upon which the assertion rests" (Mezirow, 1991, p. 101). Reflection thus involves an "examination of the justification for one's beliefs, primarily to guide action and to reassess the efficacy of the strategies and procedures used in problem solving" (Mezirow, 1990, p. xvi).

Critical reflection thus entails "a transformative learning process" in which individuals become critically aware of presuppositions that constrain their understanding of the world, reformulate these assumptions to permit a more appropriate perspective, and

make decisions upon these new understandings (Mezirow, 1990). The transformation process helps individuals to move "beyond the acquisition of new knowledge and understanding, into questioning our existing assumptions, values, and perspectives" (Cranton, 1996, p. 76). This critical inquiry is central to one's personal and professional growth (Clark, 1993).

In terms of forms of critical reflection, Mezirow suggests that, although reflection includes critical assessment of "the content, process, or premise(s) of our efforts to interpret and give meaning to an experience" (1991, p. 104), it is the "premise reflection," a process that challenges "the validity of presuppositions" that defines critical reflection. He specifies that premise reflection "addresses the question of the justification for the very premises on which problems are posed or defined in the first place" (Mezirow, 1990, p. 12). Instead of dealing with the what (content or description of a problem), as in content reflection, and the how (strategies and procedures), as in process reflection, premise reflection is concerned "with the why, the reasons for and consequences of what we do." (Mezirow, 1990, p. 13) He argues that content and process reflection lead to reinforcement of one's existing belief, whereas premise reflection entails transformation of one's belief systems, and that it is through the challenge of one's belief systems that one becomes critically reflective (Mezirow, 1991).

Mezirow's theory develops a different discourse for discussing reflection. He defines reflection as problem posing, as opposed to Dewey's notion of reflection as problem solving and Schön's characterization of reflection as problem setting. Mezirow specifies that "premises are special cases of assumptions. The critique of premises or presuppositions pertains to problem posing as distinct from problem solving. Problem

posing involves making a taken-for-granted situation problematic, raising questions regarding its validity" (Mezirow, 1991, p. 105). Attending to perspective transformation process in reflection expands Dewey's notion of reflection and identifies a dimension that is missing in current thinking about reflection (Mezirow, 1991).

The theories discussed above provide different perspectives on different dimensions of reflection. Each of these theories provides a valid yet different perspective that has enriched current thinking about reflection. Collectively, they lead to a holistic understanding of reflection.

Theoretical Framework of the Study

This study draws on two theoretical sources. First, it draws on Dewey's (1933) notion of reflection as a rational and analytical process. This conception casts teacher reflection as a deliberate and purposeful endeavor in contrast to habitual and routine ways of thinking. It depicts teacher reflection as a series of conscious cognitive processes, which are involved after teaching, and distinguishes it from spontaneous on-site decision making during teaching. Second, this study draws on Shulman's (1987) characterization of teacher reflection as a retrospective cognitive process. This perspective focuses on the post-active phase of teacher thought processes (Clark & Peterson, 1986). Current literature shows that teachers' post-active thinking is qualitatively different from their interactive thinking (e.g., Calderhead, 1996; Clark & Peterson, 1986; Crist, Marx, & Peterson, 1974; Jackson, 1968). With this focus, Shulman's theory provides a structure that supports the effort to study teachers' post-class thought processes.

This study examines characteristics and the content of post-class reflection. The next chapter reviews the recent empirical studies on teacher reflection.

Chapter II

Review of the Empirical Literature on Teacher Reflection

Research on teacher thinking has been growing rapidly over the last two decades. It has become "a substantial area of inquiry" (Resnick, 1981) within research on teaching (Calderhead, 1996; McKeachie, 1990; Mitchell & Marland, 1989). One important area within the teacher-thinking research pertains to teacher reflection: that is the way teachers look back at their teaching and gain insight from thinking through the experience (Dewey, 1933; Posner, 1989). In this review, teacher reflection refers to written or spoken comments that teachers make when they (a) evaluate their own teaching, with or without the aid of stimuli; (b) analyze their experiences as observers or as teachers in classrooms; or (c) recall preactive and interactive decisions (Kagan, 1990). This review discusses recent empirical studies that focus on teachers' post-class reflection. It also draws on reviews of teachers' thought processes (Clark & Peterson, 1986); teachers' beliefs and knowledge (Calderhead, 1996); teachers' pedagogical thoughts, judgements, decisions, and behavior (Shavelson & Stern, 1981); taxonomies used to evaluate teachers' self-reflection (Kagan, 1990); and elements of reflection (Sparks-Langer & Colton, 1991; Valli, 1997).

Since research on teacher reflection in higher education is limited, the scope of this review includes studies carried out in the primary and secondary education settings, and discusses the possibility of applying the research findings to higher education. Although focused on studies investigating teachers' post-class reflection, this review also includes a broader range of studies that relate to teachers' reflection in the preactive and interactive phases (Clark & Peterson, 1986). Four categories of studies are included in

this review. First, studies which focus on teachers' cognitive processes in the preactive, interactive, or post class phases of teaching (Jackson, 1968). Second, those that represent a particular method to investigate teacher reflection and include detailed descriptions of data collection and analysis procedures. Third, studies which represent a particular tradition of conceptualization of teacher reflection. Finally, studies which demonstrate current problems in research on teacher reflection.

The review is organized into three major sections. The first section discusses studies of teacher reflection that belong to different epistemological traditions: (a) teacher reflection as cognition, which includes teacher reflection as rational thinking as well as spontaneous knowledge and action, and (b) teacher reflection as critical thinking. The second section includes studies that investigate different methods used in promoting teacher reflection. This section discusses (a) teacher reflection through story telling and (b) other methods that promote teacher reflection. The third section discusses applications of research on teacher reflection in (a) pre-service teacher education and (b) in-service teacher development. The intent of this organizational structure is to provide a more unified picture of what is already known in the area and to identify gaps in the research.

Epistemological Traditions in Research on Teacher Reflection

Research on teacher reflection follows two different epistemological traditions: teacher reflection as cognition and teacher reflection as critical thinking. The former, which is developed in the context of cognitive psychology, views teacher thinking as a cognitive process and emphasizes the importance of teacher knowledge in teacher thought processes (Calderhead, 1996; Clark & Peterson, 1986; Shulman, 1986a). The latter, which is originated in critical philosophy, accentuates teacher thinking as an

emancipatory process in which individuals focus on social and contextual factors when examining their teaching (Zeichner & Liston, 1996).

Teacher Reflection as Cognition

Within the cognitive tradition, teacher reflection is viewed as a complex cognitive process (Sparks-Langer & Colton, 1991) which pertains to teacher thought processes (Clark & Peterson, 1986) and teacher knowledge development (Berliner, 1988). Studies carried out within this tradition fall into three categories: (a) teacher reflection as pedagogical reasoning; (b) expert-novice differences in teacher reflection; and (c) teacher reflection as metacognition.

Teacher reflection as pedagogical reasoning. Since the 1970s, teaching has been conceptualized as a complex cognitive process rather than simply a series of behaviors (Anderson, 1981; National Institute of Education, 1975; Shulman, 1986a). Central to this notion is the concept of pedagogical reasoning: the process of transforming subject matter knowledge into forms that are pedagogically powerful and adaptive to student characteristics (Shulman, 1987). Research on this aspect of teacher reflection focuses on describing knowledge that is involved in developing teachers' pedagogical reasoning skills. Shulman (1986b) and his colleagues (Wilson, Shulman, & Richert, 1987) examined the way in which teachers develop knowledge in the process of teaching. Multiple sources of data, including interviews, observations, structured tasks, and examination of materials, were used in a few case studies to investigate the transformation and developmental processes of teacher knowledge.

As a result, Shulman et al. asserted that there are six categories of teacher knowledge: (a) content, (b) pedagogical, (c) curriculum, (d) knowledge of student, (e)

knowledge of context, and (f) knowledge of educational goals (Grossman, 1990; Shulman, 1986b; Wilson, Shulman, & Richert, 1987). Based on these findings, Shulman (1987) has proposed a model of pedagogical reasoning and action which suggests that teachers engage in a pedagogical reasoning process in which they integrate subject matter knowledge, pedagogical knowledge, and curriculum knowledge into pedagogical content knowledge, a form of knowledge unique to the teaching profession. This knowledge transformation process allows teachers to utilize "pedagogically powerful" knowledge in the instructional processes.

According to Shulman (1987), teachers' pedagogical reasoning involves six interrelated aspects that constitute a cyclical process of teaching. When faced with a teaching task, teachers follow a hierarchical thinking process. They start with making meaning of the content and transforming the content according to student needs and characteristics, the purpose of the teaching, and the instructional environment. During the process of teaching, they adapt the content using various strategies. After teaching, they evaluate the effects of teaching and learning and reflect upon the enactment of teaching to gain insights from the teaching experience. Through this post-class reflective process, they arrive at a new understanding of teaching that in turn directs another round of this teaching process. Teacher reflection bridges teaching experience with knowledge and is a crucial aspect of teachers' pedagogical reasoning process.

The work of Shulman and his colleagues has identified types of teacher knowledge (Grossman, 1990) in addition to describing teachers' pedagogical reasoning process. This research also provides a framework by which reflective teachers can think about themselves, the content, the teaching process, the needs of individual students, and

other related factors. It can help teachers make conscious choices about what to teach and how to teach it based on their background of knowledge and experience. However, this framework is prescriptive rather than descriptive. It outlines what should happen in the process of teaching but not what happens to individual teachers as they teach. Questions such as exactly how each aspect of teachers' pedagogical reasoning process relates to the other aspects, and what teachers think about when they reflect on teaching remain unanswered. Furthermore, it is unclear whether this framework which is derived from the secondary education setting, is applicable to the thinking processes of professors in higher education.

Expert-novice differences in teacher reflection. Research in cognitive psychology indicates that knowledge is a determinant of performance (Ericsson & Smith, 1991) and that experts and novices differ qualitatively in knowledge, thinking, and actions (Chi, Feltovich, & Glaser, 1981). Research on expert-novice differences in teaching suggests that the characteristics of expertise in teaching are similar to those in other complex domains (Berliner, 1986). Expert teachers differ from novices in recognizing and representing problems or situations (Berliner, 1988; Copeland, Brimingham, DeMeulle, D'Emidio-Caston, & Natal, 1994). They understand the classroom events better and make more coherent interpretations and evaluations (Sabers, Cushing, Berliner, 1991). They possess more sophisticated knowledge structures about the classroom and teaching (Berliner, 1987; Peterson & Comeaux, 1987). They are more selective in their use of information during planning and interactive teaching (Borko, Livingston, & Shavelson, 1990), and make greater use of instructional and management routines (Leinhardt & Greeno, 1986). Collectively, this body of literature suggests that expert-novice

differences in teaching are due to different knowledge structures (Borko & Livingston, 1989; Kagan, 1992).

Similarly, research on expert-novice differences in teacher reflection suggests that teacher knowledge is a determinant in teacher reflection. In a multiple case study, Borko and Livingston (1989) compared the thinking and actions of three mathematics student teachers (novice) with the co-operating teachers (expert) with whom they were placed. Participants were observed teaching for one week and interviewed before and after each observed lesson. A cross-case analysis revealed consistent patterns of post-class reflection between expert and novice teachers.

Consistent with findings of their selectivity in processing and using information in teaching (Carter, Sabers, Cushing, Pinnegar, & Berliner, 1987), expert teachers were fairly concise and focused in post-class reflection. Their reflection concentrated on accomplishment of the overall purpose of the course and on students' understanding of the material and students' active role in generating and solving problems, with little reference to students' behavior or affect. The experts were selective in their attention to specific classroom events and focused only on events that affected the accomplishment of the instructional goals. They rarely mentioned classroom management and offered very little assessment of their own teaching effectiveness. Contrary to experts, the novices lacked a consistent focus in post-lesson reflection. Their reflection was more dependent on the events of the day, ranging from characteristics of the lesson (e.g., scope, content, timing, pacing, and sequencing of activities) to instructional and behavioral management concerns. Novices were concerned with clarity of explanations and examples, use of

instructional equipment, and ability to respond to student questions. They were also concerned with active student involvement in the lesson.

Using a similar design, Borko, Bellamy, and Sanders (1992) extended their study of the expertise of teaching mathematics to that of teaching science. They compared post-class reflection of expert and novice science teachers. Again, selectivity in processing and using information during the three phases of teaching was characteristic of expert science teachers. The experts' post-lesson reflection focused primarily on students' understanding of the material and participation or involvement in the lesson. Experts' assessments of lessons often involved comparisons with expectations based on previous experiences of teaching the same content. In contrast, the pedagogical thinking and actions among the novices were so different that Borko et al. (1992) used abbreviated cases to describe planning, teaching, and post-lesson reflection for each participant, without identifying patterns of thinking among the novices.

Borko et al. (1989; 1992) interpreted the expert and novice differences with the conception of teaching as a complex cognitive skill, emphasizing teacher knowledge as determinant of teaching performance. They asserted that the flexibility and responsiveness of experts' teaching is dependent upon quick access to an extensive, well-developed system of knowledge. This knowledge system, they suggested, provides a framework for determining what information is relevant to their planning and interactive decisions. Borko et al. (1989; 1992) thus concluded that expert teachers' reflection is highly selective because in their reflection, they process only the information relevant to their interactive decisions.

In the context of teacher thinking and decision making, Westerman (1991) examined expert-novice differences during the stages of (a) planning, (b) teaching, and (c) evaluation and reflection. This qualitative study compared five female graduate student teachers from different discipline areas with five co-operating expert teachers. Data collection consisted of four phases: pre-class interview, videotaping during the class, stimulated recall right after the class, and oral self-report while viewing the videotape of the lesson without the sound seven months after.

Using a constant comparative method (Glaser & Strauss, 1967) in data analysis, Westerman (1991) found that expert and novice teachers differed significantly in their thinking and decision making. For the experts, the three stages of decision making (planning, teaching, and evaluation and reflection) were highly related. This integrated view afforded expert teachers a wide range of possibilities during teaching and allowed them to use many types of information to arrive at goals for their lessons. In contrast, the three stages of decision making were not connected dynamically for the novice teachers, due to their lack of content and pedagogical knowledge. Novices lacked a comprehensive view of the classroom and the knowledge to connect components of the lesson to students' prior knowledge. Thus, they could not predict what could happen to their class in their planning and adhered closely to their lesson plans during teaching. When evaluating their lesson, expert teachers focused on how well they had achieved their goals concerning students' needs, whereas the novices evaluated their lessons according to achievement of the prescribed objective and student behavior. Westerman (1991) attributed the differences in expert and novice teachers' thinking and decision making to the differences in their knowledge structures.

Based on these findings, Westerman (1991) developed a model of expert and novice teachers' decision making. The model suggests that expert teachers' reflection builds upon the evaluation of student learning and goal attainment. In turn, this reflection influences their subsequent decisions on teaching and teaching goals. In contrast, the model suggests that novice teachers' reflection pertains only to the selection of teaching methods and that their evaluation concentrates on student behavior and the completion of lesson objectives.

In another study, Rahilly and Saroyan (1995) used the critical incident technique (Flanagan, 1954; Woolsey, 1986) to examine the conception of good teaching held by thirty inexperienced, experienced, and award-winning professors in Arts and Science. In structured telephone interviews, the participants recounted a good teaching experience and a bad teaching experience at a specific time. Protocol analyses of the transcripts indicated that the award winners differed from the other two groups in the process of metacognition and reflection. Award winners made frequent reference to and stressed the importance of both of these processes in the way they taught. This finding supports the expert-novice literature that experts engage in more reflection and metacognition than novices do (Kagan, 1990).

Drawing on the literature that teachers' ability to reflect is central to effective teaching (Sparks-Langer et al., 1991) and that knowledge structures (schema) influence teacher behavior (Leinhardt & Greeno, 1986; Strahan, 1989), Winitzky (1992) investigated the relationship between reflection and schema in the thinking of 15 prospective teachers about classroom management. In that study, reflection was defined as the ability to (a) retrieve appropriate knowledge, (b) apply that knowledge in

perceiving and analyzing causal relationships in classroom management events, and (c) connect such knowledge to larger social issues. The ordered tree technique was used to provide a graphic representation of cognitive structure and a measure of the amount of organization contained in it. Taxonomy of Teacher Reflective Thinking (Sparks-Langer et al., 1990) was used to document teacher reflective thinking captured through an interview.

A positive correlation was found between complexity of knowledge structure and the ability to reflect. Teacher candidates with more organized and complex structures were more able to reflect on classroom management event at all seven taxonomic levels. Winitzky (1992) thus suggested that improving organization and development of teacher knowledge can help beginning teachers become reflective practitioners.

Using different theoretical frameworks and research methods, the previous five studies examined the relationships between teacher reflection and knowledge. They suggest that knowledge provides a basic structure that facilitates teacher reflection and that expert and novice teachers differ in the way they reflect on teaching, a finding consistent with other characteristics of expert and novice differences.

In the literature, these differences have been described in models of teacher development (e.g., Berliner, 1986; Dreyfus & Dreyfus, 1986; Fuller, 1969; Kagan, 1992). For example, Berliner (1988) suggests a five-stage model that describes how novice teachers develop into experts. In the context of higher education, several theoretical frameworks describe teachers' development (e.g., Kugel, 1993; Ramsden, 1992; Ronknowski, 1993). For instance, Sherman, Armistead, Fowler, Barksdale, & Reif's

(1987) four-stage framework outlines the developmental sequence of acquiring expertise in post-secondary teaching.

In general, these models (e.g., Berliner, 1988; Sherman et al., 1987) indicate that teacher development relates to the accumulation of teaching experience and teacher knowledge. Furthermore, a change in teachers' knowledge leads to changes in teachers' conceptions, teaching performance, and teachers' relationships with the students. This perspective is supported by the expert-novice difference research on teacher reflection. While both theory and research provide descriptions of the differences between expert and novice teachers, they offer little advice on how to move novices to levels of expertise.

However, recent research on teacher thinking has started addressing the issue. It emphasizes the importance of explicating "the process by which novices become experts" (Borko & Livingston, 1989, p. 492), and cautions that "student teachers will not become experts simply by being forewarned about the pitfalls brought out by this research" (Westerman, 1991, p. 303).

Teacher reflection has been viewed also as a bridge between knowledge and action (Calderhead, 1991) and as a strategy that helps teachers learn from experience and thus move towards the expert end of the continuum (Westerman, 1991; Zeichner & Liston, 1996). In the context of higher education, professors usually have many years of training in their discipline areas but little training in how to teach. They have to rely on learning from experience. Understanding how professors learn from experience can provide insight into their pedagogical development. Furthermore, research on how

professors reflect can complement the existing literature of expert-novice differences in teacher reflection, which is derived mostly from the primary and secondary settings.

Teacher reflection as metacognition. A third stream of research on teacher reflection in the cognitive tradition focuses on teachers' metacognition. Metacognition generally refers to "what we know about our cognition or thoughts about thoughts, knowledge about knowledge, or reflection about actions" (Weinert, 1987, p. 8). As such, it has two components. Knowledge of cognition refers to what we know about our cognition while regulation of cognition pertains to cognitive processes such as planning, monitoring, and evaluating (Cross & Steadman, 1996; Schraw, 1998). Research on metacognition has expanded from examining students' metacognitive skills in reading (Cross & Steadman 1996) to teacher metacognition in instructional practice (McAlpine & Weston, 1996). Conceiving teacher reflection as part of the regulative processes of teacher metacognition provides an alternative perspective in research on teacher reflection. Although research in this area is still in its infancy, its promise is illustrated in the following studies.

Viewing teaching from a problem solving perspective, Artzt and Armour-Thomas (1998) investigated the components of metacognition underlying instructional practice. They argued that most studies of teaching have paid attention to the importance of teachers' mental attributes but the components of teacher metacognition have been studied in isolation from each other, thereby producing an incomplete understanding of the mental life of teachers as it relates to their instructional practice. Artzt and Armour-Thomas first developed the Teacher Metacognitive Framework (TMF) to address this problem. TMF suggests knowledge, beliefs, and goals as three overarching metacognitive

components that directly influence teacher thinking across three stages of teaching: preactive (planning), interactive (monitoring and regulating), and postactive (assessing and revising).

Using the TMF framework, Artzt and Armour-Thomas (1998) examined the interrelationships among different components of teacher metacognition of seven experienced and seven beginning teachers of secondary school mathematics. The results showed that pre-active, inter-active, and post-active are valid categories to describe the metacognitive components of teaching. Two distinct patterns of teacher metacognition emerged, each reflecting different types of relationships between teacher metacognition and instructional practice. The first pattern was characteristic of Group X, which consisted of four experienced and one beginner teacher. Their thoughts on the postactive stage of teaching focused on evaluating their lessons in terms of student understanding and improving their instructional techniques with the aim of increasing clarity and interest for students. The second pattern was characteristic of Group Y, which consisted of the three remaining beginner teachers. In contrast to the teachers in Group X, the postactive thoughts of these teachers concentrated primarily on content coverage and student behavior. Their suggestions for improvement of the lesson focused on time management and content coverage.

Artzt and Armour-Thomas's (1998) study confirms the findings of expert-novice differences of teacher reflection discussed earlier. More importantly, it looks into the relationships between the overarching components of teacher metacognition and teacher thought process variables in instructional practice. It suggests a more comprehensive approach in research on teacher thinking and action.

In a similar approach, McAlpine and Weston (1996) and McAlpine, et al. (1999) view reflection as a process of formative evaluation and highlight the links between metacognition and reflection. Synthesizing theoretical perspectives on reflection, metacognition, and domains of knowledge, this group has developed a metacognitive model of reflection. The model includes six components--goals, knowledge, action, monitoring, decision making, and corridor of tolerance--and three spheres of reflection. In the practical sphere, teacher reflection focuses on improving actions in a particular course or class. In the strategic reflection, teachers attend to generalized knowledge or approaches to teaching that are applicable across contexts. Epistemic reflection represents a cognitive awareness of one's reflective processes, which influence reflection and enactment of plans.

With the model, McAlpine and Weston studied how reflection operates as a metacognitive process for six outstanding university professors to evaluate and improve teaching. Participants were followed for a semester in their day-to-day planning, instructing and evaluating of learners. Data were collected through teaching histories, interviews, and stimulated recalls.

The results validated the metacognitive model of reflection and highlighted the central role of goals and knowledge. In the process of reflection, goals not only provided bases for intentions and plans but also guided the attention to and evaluation of cues as well as the decision making process of adjusting teaching. The goals of the participating professors focused on students and learning. They found that knowledge played a central role in teacher reflection and provided the basic structure for teacher reflection. Professors became skillful in teaching because they had the necessary knowledge to

reflect on their teaching decisions. In terms of spheres of reflection, professors engaged mostly in practical reflection, less in strategic reflection, and far less in epistemic reflection. This indicates that professors' reflective thoughts are oriented more toward improving actions in a course or a class, less toward generating knowledge or approaches to teaching that are applicable across contexts, and far less toward cognitive awareness of their own reflective processes.

These two studies are distinctive in adopting a metacognitive perspective on teacher reflection. They emphasize teacher reflection as a dynamic and continuous process in which teachers perform a formative evaluation of their teaching. Both studies indicate that the goals and knowledge of the teacher are central in teacher reflection and that the reflections of the experienced teachers concentrate on students and student learning.

Studies conducted by this group (McAlpine & Weston, 1996; McAlpine et al., 1999) contribute significantly to the research on teacher reflection. As one of the first efforts to study teacher reflection in higher education systematically, the metacognitive model of teacher reflection provides "a language for describing reflection" (1999, p. 126) in higher education. Moreover, the focus on professors extends research on teacher reflection from the current emphasis on student teachers and teachers at the elementary and secondary levels. Finally, studying teacher reflection of university professors indicates that research on teacher reflection is moving from focusing on improving teacher preparation to improving the practice of teaching in a larger sense.

In summary, the three streams of research on teacher reflection within the cognitive tradition suggest that teacher knowledge is a central construct in teacher

reflection. The first stream sees teacher reflection as part of pedagogical reasoning and describes types of teacher knowledge and aspects of teachers' pedagogical reasoning processes (e. g., Shulman, 1986b; 1987). To understand the whole process of teachers' pedagogical reasoning, research needs to examine the characteristics of each aspect of teachers' pedagogical reasoning, the relationships between these aspects, and the knowledge associated with each of these aspects. The second stream has extended cognitive research on teacher knowledge development (e.g., Glaser, Lesgold, & Lajoie 1988; Leinhardt & Greeno, 1986) and found differences in reflection between expert and novice teachers (e.g., Borko & Livingston, 1989). This stream of research needs to be extended to higher education. The third stream views teacher reflection as metacognitive processes and examines the interrelations between overarching components (knowledge, beliefs, and goals) (Artzt & Armour-Thomas, 1998) and teacher thought process variables. It also explores the dynamics of teacher reflection process (e.g., McAlpine et al., 1999). However, McAlpine et al.'s (1999) study describes teacher reflection as monitoring and controlling mechanisms in instruction and focuses on the process of reflection-in-action (Schön, 1983). To understand the whole process of teacher reflection, the process of reflection-on-action needs to be explored.

Teacher Reflection as Critical Thinking

It is generally agreed that thoughtful teachers who reflect on practice are better than teachers who do not reflect. However, there is disagreement in the current literature about what teachers should reflect on, the criteria to be used in the process of reflection, and the degree to which teachers should incorporate a critique of the social context in teacher reflection (Grimmett, Mackinnon, Erickson, & Riecken, 1990; Richardson,

Anders, Tidwell, & Lloyd, 1990). This disagreement is largely due to differences in the epistemological traditions that underpin the different perspectives in research and practice of teacher reflection. Rooted in Habermas's (1971) critical theory and the social constructionist tradition (Kemmis, 1985), the critical approach views teacher reflection as ethical and moral reasoning (Zeichner & Liston, 1996). Research within the critical approach of teacher reflection examines the social conditions in which the instructional activities are situated and the social consequences of teaching.

For example, Gore and Zeichner (1991) examined effects of a teacher education program that was designed to promote critical reflection. Data were collected through journals and written reports of action research projects conducted by 18 student teachers during one academic year. Gore and Zeichner (1991) reported using three categories that corresponded to technical, practical, and critical reflection (Van Manen, 1977) as the framework in data analysis although they did not provide details of data analysis. The results showed that only a small group of students' projects revealed a clear concern for moral and political issues. The disappointing result was attributed to students' general unpoliticized view of schooling, the traditional emphasis on behavioral changes that accompanied student teaching, and the lack of role models of critical reflection among experienced teachers.

Similar results were found in other studies. Examining how the programmatic emphasis on critical reflection affected supervisors in a teacher education program, Zeichner and Tabachnick (1982) found that only two of the nine participants used moral criteria to evaluate classroom action. In their assessment of the degree of congruence between the expressed goals of a teacher education program and the quality of discourse

between university supervisors and student teachers, Zeichner and Liston (1985) found that about 20% of the total 260 minutes of discourse attended to reflective forms of communication. These results indicate that while social issues might be an important aspect in teacher reflection, student teachers' reflection focuses considerably more on cognitive aspects of their teaching than on social consequences of teaching. The following studies further confirm this characteristic of teacher reflection.

Drawing on Kitchener and King's (1981) seven-stage development model of judgement, Ross (1989) developed a coding scheme to evaluate theory-to-practice papers composed by 26 pre-service teachers. Five topics were used to stratify 134 papers collected from student teachers. Statements in the paper were coded along a continuum ranging from 1 (low: description with little analysis of context or multiple perspectives) to 3 (high: multiple perspective with recognition of pervasive impact of teachers' actions) was used to assess the effect of the course. The results show that only 22% of the pre-service teachers appeared to function above Level 2, suggesting that students reflected at a low or moderate level.

Another aspect of the critical reflection views reflection as an emancipatory process that aims at clarifying implicit personal assumptions and changing one's existing conceptions. For example, Boyd and Fales (1983) suggest that as a process that enables individuals to learn from experience, reflection clarifies meaning in terms of self and results in a changed conceptual perspective. Based on the interview and questionnaire responses from graduate students, adult educators, and practicing counselors, Boyd and Fales described reflection as composed of six stages: inner discomfort, identifying the

concern, open to new information, resolution, establishing continuity of self, and decision of action.

The study of Boyd and Fales (1983) brings together the cognitive and critical traditions of reflection. On the one hand, they view reflection as an internal process of problem solving, a notion reflecting Dewey's reflective thinking. On the other hand, they conceptualize reflection as a process of clarifying the relationships between self and the world, representing the conception of critical reflection as conceptual change (Mezirow, 1990).

In summary, the notion of reflection-as-critical-thinking is derived from the philosophical base of critical theory and focuses on examining the experiences, values, and goals of teachers in terms of their socio-political and cultural implications. This approach opens an alternative avenue to current thinking about teaching and emphasizes the importance for teachers to think about the social outcomes of education. This stream of research has contributed to the development of a few frameworks (e.g., Boyd & Fales, 1983; Ross, 1990; Sparks-Langer et al., 1990; Zeichner & Liston, 1985) that describe taxonomies of teacher reflection as well as techniques that facilitate reflective thoughts. However, this research has achieved limited results in promoting critical reflection among student teachers. Moreover, it has been hampered by insufficient methodologies to assess teacher reflection in terms of political, ethical and moral values.

Research on Methods that Promote Teacher Reflection

Research on teacher reflection has examined not only what to reflect on but also how to reflect. This section discusses a body of literature that examines the effects of using different methods to facilitate teacher reflection. The discussion includes (a)

teacher reflection through story telling and the type of teacher knowledge it has created, and (b) other methods that have been used to promote teacher reflection.

Teacher Reflection Through Story Telling

In the last two decades, remarkable progress has been made in research on methods that facilitate teacher reflection. One example of such progress is the development of teachers' narratives in studying teacher thinking (Berliner, 1992; Carter, 1993). This body of research indicates that teachers' narratives are powerful in revealing the meaning of teaching from teachers' perspective (Clandinin, 1992; Cochran-Smith & Lytle, 1990; Goodson, 1992), enhancing teachers' understanding of their own professional thinking (Carter, 1993; Grimmett & Mackinnon, 1992), and developing teachers' practical knowledge (Fenstermacher, 1994).

Specifically, teachers' narratives have been used in two different fashions in research on teacher reflection. One is using teachers' stories as the centerpiece of the research. This approach aims to elevate teachers' unacknowledged practical wisdom and bring to the surface teachers' voices through their own descriptions of the circumstances under which they make decisions. For example, Lampert (1985) tells a story of how she, as an elementary mathematics teacher, manages to teach. In search for solutions to a classroom management problem, Lambert finds that she is arguing with herself over the undesirable consequences of each alternative in terms of potential classroom confrontations. She describes her internal arguments as one element that prevails in her teaching. Lampert's story reveals that teachers deal with classroom problems from their perspectives rather than from the theoretical principles outlined in the literature. This type

of teacher reflective narratives has generated a new discourse in describing teacher reflection.

In addition to the first person self-study stories, the second fashion of teachers' narratives is used widely as pretext, data, or case study in research on teacher reflection. Recent literature provides numerous examples of these types teacher stories. Such examples include Shulman's (1987) contrasting portraits of an expert and a novice teacher in developing teacher knowledge, Schön's (1983) multiple case studies of how professionals reflect about their actions, Elbaz's (1991) narration of how a teacher makes sense of her instruction and develops practical knowledge, Tabachnick and Zeichner's (1986) account of two beginning teachers' experiences during their induction year, Day's (1987) retelling of the processes of staff development in a primary school, Goodson, (1980; 1992) and Woods' (1987) reports of teachers' life histories, Richert's (1991) justification of teacher cases for reflection and enhanced understanding, Brunner's (1994) stories of schooling, and Amundsen, Saroyan, and Frankman's (1996) longitudinal case study of the changes in methods and metaphors in the growth of a university professor. Although situated in different contexts, these studies represent the second fashion using teachers' own reflection to develop interpretative frameworks for understanding teaching.

The narrative approach of teacher reflection has opened a new way of thinking and has given greater credibility to teachers' practical knowledge. Other terms used to denote this narrative type of teacher knowledge include craft knowledge (Grimmett & Mackinnon, 1992), personal, practical knowledge (Clandinin, 1987; Elbaz, 1983), situated knowledge (Leinhardt, 1988), theory of action (Schön, 1983), practical knowledge (Sanders, 1986), culture of teaching (Feiman-Nemser & Floden, 1986); case

knowledge (Grimmett & Erickson, 1988; Shulman, 1992), conversation of practice (Yinger, 1990), wisdom of practice (Shulman, 1986a), story of experience (Connelly & Cladinin, 1990), and action research (Kemmis, 1985). As of yet, research in this aspect of teacher reflection remains as bodies of isolated descriptions. Developing a conceptual totality of teachers' narrative reflection is indeed a necessary next step.

Other Methods that Promote Teacher Reflection

In addition to teachers' reflective narratives, recent research has paid considerable attention to the effects of using different methods in promoting teacher reflection. Methods that have been studied include reflective journal writing (Pearce, 1995; Wodlinger, 1990), teaching portfolios (Huebner, 1997), structured dialogue (Pugach & Johnson, 1990), case discussion (Bolt, 1996), case writing (Whitcomb, 1997), teacher cases (Richert, 1991), peer-group clinical supervision (Long, 1997), coaching (Pasch, Arpin, Kragt, Garcia, Harberts, & Harberts, 1990), guided field experiences (Grinberg, 1990), classroom activities and discussions (Valli, 1997), and faculty members' modeling (Loughran, 1996). In general, these methods involve individual or group efforts in writing about, dialoguing with, and observing oneself or others in the process of teacher reflection. The following studies exemplify this aspect of research on teacher reflection.

Richert (1992) studied the influence of the social and artifactual conditions on the content of twelve student teachers' reflection. In a parallel case study design, two facilitating factors--a partner (social) and a portfolio (artifactual)--were combined to create four different conditions for reflection. Richert found that depending on the structural circumstances under which teacher reflection occurs, teachers' thinking differs

significantly in content, depth, clarity, and openness to explore. This understanding is fundamental in creating programs that offer opportunities for teachers to learn the knowledge and skills of reflective practice.

Journal writing, together with other forms of guided reflective writing, has been widely used to promote teacher reflection. Drawing on a philosophy that writing enables one to organize and think through new experiences and to reformulate or extend existing knowledge, Hoover (1994) examined how the writing assignment affected student teachers' reflection articulation. Data included weekly journals and assigned daily lesson analyses of two student teachers over a 15-week period of field experience. Recursive data analyses indicated that written reflection allows teachers to articulate thinking which might otherwise be implicit. However, it does not necessarily lead towards reflection beyond personal levels of concern and towards more analytical thought about the process of teaching and learning.

Similar results were found by Richard and Ho (1998) who studied the effect of journal writing in promoting reflective thinking of 32 Hong Kong student teachers. Analyses of the questions posed in the journals demonstrated that only about 20% of the questions were reflective and that there was little significant change of the teachers in developing a greater degree of reflectivity over time. They concluded that journal writing could provide an opportunity for teachers to write reflectively about their teaching, though in itself it does not necessarily promote critical reflection. Careful structure and monitoring of journal writing is required to achieve the goal of promoting reflection.

Cases are widely used in teaching and research. Richert (1991) examined the use of teacher cases to enhance teacher reflection and understanding. Data included

interview, questionnaire, and freewriting from 17 practicing teachers enrolled in a teacher education program. Analyses of the transcripts indicated that working with cases promotes teacher reflection and thus enhances teacher understanding.

Drawing on the notion that teacher reflection should also be a social activity, Pugach and Johnson (1990) examined how peer collaboration facilitated teachers' reflective practice. They found that after the intervention, teachers were more tolerant in accepting behaviors of the students with varied cognitive competence, more confident with their abilities to deal with classroom problems, and their descriptions of problems changed from focusing on student-centered problems to teacher-centered problems.

In summary, this aspect of research demonstrates that teachers' narratives are an effective way in studying as well as in facilitating teacher reflection. The approach sheds light on the complexity of teachers' lives, develops a new type of teacher knowledge, and provides a way of research on teaching. Research into other methods in promoting teacher reflection indicates that they can be equally effective in promoting teacher reflection. At the same time, it cautions us that these methods should be carefully used according to different goals and situations.

Applications of Research on Teacher Reflection

Research on teacher reflection has examined pre-service teachers enrolled in teacher education programs and in-service teachers already engaged in teaching. Teachers of both groups are encouraged to become reflective about teaching. However, these two groups differ in professional status, knowledge and experience and play different roles in the instructional process. Research in this area also points to different types of applications. While research on pre-service teachers' reflection aims at

ameliorating teacher education programs, research on in-service teachers' reflection leads to improving the practice of teaching.

Research on Pre-Service Teachers' Reflection

In the last two decades, research on teacher reflection has been conducted and applied largely in the context of pre-service teacher education. Various teacher education programs have been designed and evaluated in different ways (e.g., Ben-Peretz, Bromme, & Halkes, 1986; Clift, Houston, & Pugach, 1990; Grimmett & Erickson, 1988; Munby & Russell, 1992; Schön, 1991; Valli, 1990). In general, research on pre-service teachers' reflection falls into the cognitive tradition and/or the critical theory tradition. Research within the cognitive tradition focuses on effectiveness of teacher education program in making student teachers more thoughtful and the teaching more efficient.

Studies that evaluated Reflective Teaching (RT) (Cruickshank, 1991) exemplify this aspect of research. An on-campus teaching laboratory, designed for promoting thinking about the process of teaching, RT permits participants to teach one or more of 40 specially designed, 15-minute lessons to a group of four to six peers. This technique facilitates early feedback, evaluation, and modification of teaching. In an experimental study, Cruickshank, Kennedy, Williams, Holton, and Fay (1981) found that the students participating in the program produced more analytical statements about teaching and learning, made positive changes in attitudes towards student learning, but they were not more analytical during teaching than the control groups.

In another study, McKee (1986) compared Reflective Teaching with micro-teaching in developing and refining basic skills in lesson preparation, delivery, and evaluation. Results show that students favored Reflective Teaching over micro-teaching.

and that the RT program increased competency of pre-service teachers in decision making. Similarly, Troyer (1988) found that participants in the augmented RT groups were more reflective in their analysis of classroom teaching situations than those of the regular program and of the control group.

Evaluating a 13-course teacher education program, McCaleb, Borko, and Richard (1992) examined the importance of developing a knowledge base as substance for reflection and simultaneously promoting the practice of reflection. Eight participants were paired up with student teachers from a traditional teacher education program. Student teachers from both groups were observed teaching on two consecutive days and interviewed with open-ended questions following each observation. Analyses of the interview data showed that the treatment group was less likely to attribute classroom successes and failures to external factors and had a greater sense of control over classroom events than the control group.

These four studies focus on developing techniques and knowledge bases to facilitate teacher reflection and they reflect the cognitive tradition of research on teacher reflection. However, a considerable amount of studies on pre-service teachers' reflection falls into the critical traditions of teacher reflection. Instead of focusing on techniques that facilitate teacher reflection, the critical tradition highlights ethical and moral consideration in teacher preparation (Tom, 1985; Zeichner, 1993).

Using the critical incidence technique and the journal writing strategy, Sparks-Langer, Simmons, Colton and Starko (1990) examined levels of reflectivity of 24 student teachers with a 7-level Framework for Reflective Pedagogical Thinking. Results showed that student teachers were concerned more about using course principles (Level 5) to

describe teaching events, less about conditional and contextual factors (Level 6), and rarely about ethical and moral issues (Level 7), a finding similar to the results of other studies on developing critical reflection (e.g., Gore & Zeichner, 1991; Putnam & Grant, 1992).

Sparks-Langer et al. (1990) attributed student teachers' reduced attention to the ethical and moral aspects to their concern with technical aspects in order to survive the teaching week, the nature of the events that students selected for interview, interview questions not tapping moral aspects of student teaching, and lack of model of professors' critical social view of teaching methods. This argument mirrors a heated debate that centers around what to reflect in teacher reflection. The source of the argument is cognitive and critical tradition of teacher reflection (e.g., Kagan, 1992; Zeichner & Liston, 1996).

Current research on teacher reflection either reveals the difficulties in defining teacher reflection or directly probes the meaning of the construct. For example, Ross, Johnson and Smith (1992) reported their attempt to evaluate student teachers' reflective judgement. However, Ross et al. reported what faculty learned about reflective teaching from operating the program and observing student teachers rather than empirical findings of the study. They attributed this result to the evolving process of defining teacher reflection that faculty struggled along with the development of the program.

Clift, Houston, and McCarthy (1992) reported similar difficulties in evaluating a teacher education program six years after its existence. Rapid changes prevented a systematic study of the program. Instead, the authors examined factors that contributed to the change of the program. One factor was faculty members' perceptions of reflection in

teacher education. Interview data revealed that three faculty members involved in the program held four different perspectives on teacher reflection. Clift et al. (1992) concluded by emphasizing the necessity of involving professors into reflective conversations and in enacting practice of reflective teaching. This is in contrast to the current university structures that encourage research and publication.

The reports of Ross et al. (1992) and Clift et al. (1992) represent a considerable amount of literature that reveals the challenge of defining teacher reflection in developing teacher education programs (e.g., Ciriello, Valli, & Taylor, 1992; Oja, Diller, Corcoran, & Andrew, 1992; Putnam & Grant, 1992). Nevertheless, recent research has started addressing this challenge.

Clarke (1995) asked "What do student teachers reflect upon?, What precipitates reflection?, and What factors enhance or constrain reflection?" when studying student teachers' professional development. Drawing on Schön's notion that practitioners develop knowledge-in-action through recurring framing and reframing the problem, Clarke developed case studies of four science student teachers in a 13-week practicum. Student teachers reflected upon ownership of their practice, pupils' way of learning, and saw practice through the eye of the supervisor. Their reflection was precipitated by their own actions in practice and their supervisors' comments on their proposed actions. The four additional factors that enhanced or constrained student teachers reflection included (a) being able to set an agenda for discussing one's practice, (b) a shift from technical problem solving to problem setting, (c) intense observation followed by thoughtful and sustained dialogue, and (d) the school advisor shift from reporting on to inquiring into practice.

Along the same line, Wildman, Magliaro, Niles and McLaughlin (1990) investigated forces that stimulated reflection, types of reflective activities that teachers engaged in, barriers to teacher reflection in school setting, and impact of reflection. In that study, reflection was defined as a means for experienced teachers to activate and make explicit what they know and believe about teaching. Data included semi-structured interviews, monthly reports, and video-audio tapes of seventy pairs of beginners and experts.

Analyses of the data from three mentor-beginning teacher pairs indicated that teacher reflection was related to different contexts and that teachers' reflective activities and processes varied widely in form, focus, and intensity. Lack of time, the administrative climate, and personal risk were the three major constraints for reflection to happen. The opportunity to examine their professional experience, self-questioning, more learning along with the apprentice teachers, and changing views on the school system were the major impacts of reflective practice.

In summary, teacher education programs provide a most active context for research on teacher reflection. This body of research indicates varied effectiveness of teacher education programs in producing more reflective teachers, contributes a few frameworks for measuring reflective thinking, and provides some empirical evidence for clarifying the nature of teacher reflection. At the same time, it demonstrates that teacher reflection is an important yet complex construct and calls for more efforts to clarify the construct.

Research on In-Service Teachers' Reflection

Teachers are unlikely to make meaningful changes in their teaching without having the opportunity to learn and reflect upon their experience (Borko & Putnam, 1996). Understanding in-service teachers' reflection will help them become reflective practitioners (Calderhead, 1991; Mitchell & Marland, 1989). Recent research on teacher reflection has started addressing this aspect of teachers' reflection.

In the teacher thinking research, the pre-active, inter-active, and post-interactive phases of teaching have been established (Clark & Peterson, 1986; Shavelson & Stern, 1981). However, little attention has been paid to post-interactive thinking. To address this gap, Lowyck (1986) studied post-interactive reflection of 12 elementary school teachers and the impact of the reflection on their future teaching behavior. Post-class reflection was defined as the information processing activities of the teacher after a lesson or a broader unit of time. Data consisted of transcripts of retrospection, written responses to survey questions, and elaborated teaching plans. Cyclical data analyses generated six major categories of the content of teachers' post-interactive reflection: individual pupil, class group, teacher behavior, other people, organization, and lesson content. Participants' post-interactive thoughts fell mostly into teacher, pupils, and subject matter, a finding that supports Schwab's (1978) description of student, teacher, content, and context as four commonplaces of an instructional situation.

Lowyck found that teachers very often think in terms of problems or tasks and their thoughts are not connected nor ordered chronologically. Their planning and post-interactive reflection are tied together and there is no clear dissection between planning and thinking. Teachers seldom reflect systematically about past events, although they

store selective information. They rarely write down their post-interactive thoughts for a reflection in the long run and most of their thoughts are very volatile.

As for the content of post-interactive reflection, teachers reflect upon occurring events, behaviors, or situations, depending on their subjective perception. They tend to generalize the very concrete experiences into a higher level of abstraction and use these thoughts as a guide for future activities. In reference to the units of teacher planning (e.g., lesson moment, lesson, day, week, lesson unit, month, semester, year and career) (Eisner, 1979; Yinger, 1978), Lowyck found that majority of teachers' post-lesson reflection thoughts were clustered at the lesson level. Lowyck's study describes characteristics and contents of the post-active reflection of elementary teachers but does not address those of the teachers at other levels.

In the context of higher education, Irby (1992) conducted a qualitative study on how six distinguished professors made instructional decisions in clinical teaching. The clinical instructional reasoning and action model emerged from the data. The model includes (a) planning (before rounds), (b) diagnosing patients' conditions and learners' understanding, and interactive thinking and teaching (during rounds), and (c) afterwards, reflecting on the rounds.

Irby found that the physicians' reflection entails a rational and analytical process of problem solving, and that this process applies only to the planning and reflective aspect but not to the interactive dimensions. All six professors were engaged in some form of evaluation and reflection, and their reflective thoughts pertained to teaching, to themselves as teacher, and to learners and patients.

As one of the few efforts in studying professors' reflection on teaching, Irby's study provides empirical evidence that the experienced clinical instructors are reflective on teaching and describes the content of clinical professors' post-teaching reflection. This research has paved the way in studying reflection of professors who teach with other instructional methods in other subject areas.

In a narrative study, Pinnegar (1995) tells her first-person story of teacher reflection as she went back to re-experience student teaching in a primary school. Data consisted of a set of daily reflections that she wrote after and before each class. The written pieces were organized chronologically and coded for themes. Drawing themes from the data over time, Pinnegar identified three sub-categories within the after-teaching reflection: (a) immediate reflections, that occurred right after teaching; (b) delayed reflections which were not written until the next day or over a weekend; and (c) postponed reflections, made long after teaching events. Finding differences in the focus and content of the reflections written later, Pinnegar wondered whether there might be significant and instructive differences between the three sub-categories of after-teaching reflection.

These three studies, together with those conducted by McAlpine et al. (1999) and Rahilly and Saroyan (1995), have extended research on teacher reflection from pre-service teachers to different groups of in-service teachers, including professors. They have confirmed that the distinction between pre-active, inter-active, and post-active phases of teaching is applicable to in-service teachers. As well, they suggest that in-service teachers differ in characteristics and focus of post-active reflection from pre-service teachers and among different groups of in-service teachers.

Summary

The above discussion suggests that current research on teacher reflection falls into two different epistemological traditions, one viewing teacher reflection as cognitive processes and the other, as critical thinking. Besides studying what professors reflect on, the reviewed research has addressed ways in which teacher reflection can be promoted. As well, it has looked into ways of improving teacher education programs by increasing the understanding of in-service teachers' reflection. Methodologically, this research has moved away from the quantitative approach (Borko & Putnam, 1996) and used more qualitative case studies design (e.g., Schön, 1991; Shulman, 1986b). Obviously, research on teacher reflection has started to accumulate. Nevertheless, this research still suffers from an absence of a conceptual integration of comparable empirical findings. Primarily, because teacher reflection has been conceptualized in different ways and there is a lack of systematic assessment of teachers' reflective thinking (Shavelson & Stern, 1981; Taggart & Wilson, 1998). This indicates that teacher reflection is a difficult construct that entails complex processes involved by different people in different settings.

The situation calls for more research to clarify the construct. One way to accomplish this task is to study teacher reflection in various conditions. Compared to other education levels, research on teacher reflection in higher education has barely started. It is interesting to see the extent to which higher education can benefit from the research conducted at the primary and secondary education levels. However, studying teacher reflection in higher education in its own right can increase our understanding of teacher cognition, can promote professors' professional development, and more importantly, can improve teaching.

Research Questions

Based on the literature outlined previously, two major research questions were posed to examine professors' post-class reflection:

1. What are the characteristics of professors' post-class reflection?

    1.1. When does post-class reflection happen?

    1.2. Where does post-class reflection happen?

    1.3. Is professors' post-class reflection systematic?

    1.4. What purposes does professors' post-class reflection serve?

    1.5. What consequences does professors' post-class reflection lead to?

2. What do professors think about in post-class reflection?

    2.1. What do they reflect about regarding content of the class?

    2.2. What do they reflect about regarding the teacher aspect?

    2.3. What do they reflect about regarding students of the class?

    2.4. What do they reflect about regarding context of the class?

Chapter III

Method

Research Approach

To address the proposed research questions, the study followed the qualitative research tradition of cognitive psychology, a line of inquiry that pursues an in-depth study of mental structures and procedures used by individuals in different situations (Gall, Borg, & Gall, 1996). The purpose of the study was to describe characteristics and content of professors' post-class reflection that unfolded through variation of eight individual profiles at different levels of teaching experience, in different types of courses, and in different academic areas. This description ultimately contributed to the understanding of teacher thinking.

Research Design

To achieve this purpose, the study employed a collective case study design (Gall, Borg, & Gall 1996; Stake, 1995; 1996) to (a) focus on specific cases of professors' post-class reflection, (b) examine professors' post-class reflection in the classroom setting, and (c) investigate post-class reflection from professors' perspectives. Also, the design enabled the study to use the collection of eight individual professor profiles as instrument to describe characteristics and content of professors' post-class reflection rather than developing their experience into unique cases. Finally, the design allowed observation of multiple instances of professors' post-class reflection so as to provide a more comprehensive picture of the reflection from different individuals with different backgrounds.

The current literature provides various definitions of reflection based on different epistemological traditions. The rational and analytical tradition defines reflection as processes of (a) defining and solving problems (Dewey, 1933), (b) recapturing, analyzing, and evaluating experiences for new understanding or behavior change (Boud, et al., 1985), and (c) reviewing, reconstructing, analyzing teacher's own and the class's performance, and grounding explanations in evidence (Shulman, 1987, p. 15). The phenomenological tradition views reflection as thinking back and exploring the understanding obtained from handling a project (Schön, 1983, p. 61). The critical tradition sees reflection as examining one's beliefs and reassessing the efficacy of the strategies and procedures used in problem solving (Mezirow, 1990, p. xvi).

The study followed the notion that views teacher reflection as cognitive processes in which teachers look back at teaching events and learn from these experiences (Shulman, 1987, p. 19). Operationally, the study defined post-class reflection as thoughts about teaching and learning that professors generate immediately after a class. The unit of analysis consisted of a given professor's thoughts about the class they selected for the study.

Role of the Researcher

I played two salient roles in the study. First, I served as the primary "measuring instrument" in data collection. I observed the classes selected by the participants, interacted with them while they engaged in post-class reflection, and used empathy and other psychological processes to understand the post-class reflection as experienced by the participants.

Second, during class observations I acted as a "researcher participant" (Gans, 1982, p. 54, cited in Merriam, 1998, p. 101). While the participants, including professors and students in the class knew about my role, I saw participation in the group as definitely secondary to the role of information gatherer. This "peripheral membership role" allowed me to "observe and interact closely enough with members to establish an insider's identity without participating in those activities constituting the core of group membership" (Adler & Adler, 1994, p. 380). This "unbiased, objective scientific stance" (Mertens, 1998, p. 178) gave me access to a wide range of information so as to understand the context of professors' post-class reflection.

Pilot Study

A pilot study (Cao & Saroyan, 2000) was conducted to (a) generate a framework to understand professors' post-class reflection, (b) test the possible use of the semi-structured interview and classroom observation to explore professors' post-class reflection, and (c) develop the researcher's skills in conducting the study.

Six participants (five in social sciences and one in natural science) from two post-secondary education institutions in Canada participated in the pilot study. Among them, two participants had 9 to11 years of teaching experience in higher education, while four participants had more than 15 years.

Participants were contacted either in person or through electronic mail. They were informed about the study and were invited to participate. Once they agreed, participants were asked to select a class most representative of their teaching for the purpose of observation for the study. Five participants selected a lecture class and one selected a seminar class for the study. The selected classes were observed by the researcher and

field notes were taken. Immediately after each class, the participant was interviewed with the Post-Class Reflection Interview Protocol (Appendix D). The interview lasted 28 to 45 minutes. Transcripts of the interviews were processed using QSR NUD*IST 4. The observation field notes, copies of the lecture notes, and handouts were collected as secondary sources of data.

Thematic analyses of the transcripts indicated that professors reflected on the class deliberately and in a continuous way during and after the class. Reflecting on the class became an on-going process in their life and happened inside and outside the school. Professors reflected in order to improve teaching and they viewed this process as part of their job. However, they had difficulty in describing their way of reflecting on the class, indicating a lack of awareness of the process of their own reflection. Nevertheless, professors were consistent in their own way of thinking about the class. Across professors, this process was unstructured and situation-specific. Professors generally reflected on the overall effect of the class and were particularly interested in the new ideas and challenges that students brought up during the class. They tended to think about how the course went overall rather than how it unfolded in a specific class. Professors' reflective thoughts related more to how students behaved as a group than as individuals. They were concerned about students' understanding of the content and relied on student feedback for on going formative evaluation. The contextual factors seemed to have little influence on their post-class reflection.

With regard to the methodology, the pilot study indicated that the retrospective semi-structured interview can be a viable method in exploring professors' post-class reflection. All participants could readily respond to the interview questions. They seemed

quite comfortable pursuing the process of looking back at the class and articulating their reflective thoughts. Based on participants' comments and results of the pilot study, interview questions were reworded and the order of the questions was fine-tuned.

Findings from the pilot study were promising. The standardized open-ended interview granted an extensive exploration of professors' post-class reflection. I gained more experience in conducting qualitative research and developed interviewing skills that allowed participants to articulate their post-class thoughts.

Setting

Two departments in humanities and two in engineering in a Canadian university were selected as the settings for the study. These departments were chosen because they provided access to faculty members that met the sample selection criteria of the study as described in the following section.

Sample

This case study used the purposeful sampling strategy (Goetz & LeCompte, 1984; Patton, 1990). The sample was drawn from the population of full-time tenure-track professors with the title of assistant professor or professor who were teaching in the four departments during a fall semester.

Criteria for Participant Selection

The purpose of the sampling was to yield data that led to understanding of characteristics and content of professors' post-class reflection. Consequently, the potential for learning from each participant was considered more important than its representativeness (Miles & Huberman, 1994; Stake, 1996). The maximum variation strategy (Kuzel, 1992; Patton, 1990) was used to document diversity of

characteristics and content of professors' post-class reflection. Collectively, the selected participants offered the potential of understanding professors' post-class reflection in different contexts under which professors' post-class reflection unfolded.

Specifically, variations in professors' post-class reflection were observed through the following three participant selection criteria. The first criterion drew on the recent research on the relationships between disciplines and instructional behaviours. This research suggests that professors from different disciplines employ different behaviours in instruction (Biglan, 1973; Hativa & Marincovich, 1995; Murray, Rushton, & Paunonen, 1990). Since teachers' behaviours were largely determined by their thoughts (Clark & Peterson, 1986; Strahan, 1989), profiles of professors' post-class reflection from different disciplines were selected to understand the reflection from different disciplinary perspectives.

The second criterion drew on recent expert-novice research in education. This body of research suggests that expert teachers' knowledge is qualitatively different from that of novice teachers (Kagan, 1990; Leinhardt & Greeno, 1989); and that development of teachers' knowledge relates to teaching experiences (Kagan, 1992; Sternberg & Horvath, 1995). In higher education, recent research indicates that professors employ different ways of thinking in planning their courses after eight years of teaching experience (Gendron, 1994). Profiles of post-class reflection of experienced professors (with 23 or more years of teaching experience) and those of less experienced (with 6 or less years of teaching experience) were selected to understand professors' post-class reflection in terms of teaching experience.

The third criterion of participant selection drew on findings from research on teaching methods and class size in the last five decades. This research (McKeachie, 1990; 1999) demonstrates that class size significantly influences professors' choice of teaching methods and that teaching methods entail different instructional processes. Selecting professors teaching lecture type of courses and seminars, or equivalent, type of courses allowed the study to appreciate professors' post-class reflection in terms of instructional methods.

The above three criteria entailed an eight-cell ($2 \times 2 \times 2$) matrix (table 1). This sampling matrix guided in selection of the participants with teaching experience ranged from three and a half years to 36 years, who were teaching either a lecture class or a seminar class in humanities or engineering. This purposive sampling strategy allowed an observation of professors' reflection that varied in academic area, teaching experience, and course type. It entailed balance and variety in participant selection and offered an optimal opportunity to understand professors' post-class reflection.

Table 1.

Sampling Matrix

	H = Humanities		S = Engineering	
Lec = Lecture Class	ExHLec	InHLec	ExSLec	InSLec
Smi = Seminar Class	ExHSmi	InHSmi	ExSTut*	InSLab**

Note: Prefix: Ex = experienced professor; In = Inexperienced professor. * Tut = tutorial class; ** Lab = laboratory class.

Specifically, lists of the potential participants that satisfy the three criteria of sampling were obtained from the Course Timetables at the University Web-site. Potential participants were invited to participate in the study.

Data Source

The study drew on two sets of data. The primary data set consisted of participants' responses to a standardized open-ended interview (Appendix I). This data provided evidence of characteristics and content of professors' post-class reflection from a personal perspective. The secondary data set included classroom observations, field notes (Appendix K), participants' teaching portfolios, calendar description of the courses, course outlines and lecture notes, and classroom handouts. This secondary data set reported in Phase One data analysis in Chapter IV was complementary to the primary data in understanding participants' post-lesson reflection. They contributed to development of the eight profiles of individual participants and provided a context in which professors' post-class reflection unfolded.

Instruments

Pre-designed instruments (Miles & Huberman, 1994) were used in the study because the conceptual framework, the research questions, and the sampling plan had been established before the data collection. The pre-designed instruments helped in collecting the information that directly addressed the research questions. The interview protocol provided focus and consistency to the interview across all the participants. The pre-designed instruments enabled collection of "comparably measured" (Miles & Huberman, 1994) responses from different participants that facilitated cross participants

comparison. Finally, the pre-designed instruments allowed repeated measures of professors' post-class reflection and increased internal validity of the data.

Specifically, two pieces of pre-designed instruments--the Post-Class Reflection Interview Protocol (Appendix D) and the Classroom Observation Protocol (Appendix F)--were used for data collection. They were developed and refined through numerous discussions with the supervisor of the study, other senior researchers, and peer graduate students. They were reviewed in multiple panel meetings consisting of senior researchers specialized in research on teacher reflection in a research centre at the University. Finally, they were field tested in a two-round pilot study before they were used in the main study.

The Post-Class Reflection Interview Protocol

The Post-Class Interview Protocol (See Appendix D) was designed to facilitate standardized open-ended interviews and to collect professors' thoughts about the class that they had taught immediately before the interview. This protocol was designed so that the interview could be completed in approximately thirty minutes. This time frame was used to facilitate access to professors' busy schedules.

Also, the interview protocol provided standardized questions to help participants focus on the different aspects of post-class reflection (Schwab, 1978). The protocol contained three sets of questions. The first set of questions (Q1-Q9) aimed to collect content of participants' thoughts about the class they just finished teaching. The second set of questions (Q10-Q16) focused on characteristics of participants' thinking retrospectively about their class in general. The third set of questions (Q17-Q20) identified participants' teaching-related demographic information.

In addition, the Classroom Observation Protocol (Appendix F) guided the classroom observation, field note-taking, and recording of contextual information in terms of class size, physical settings of the classroom, flow of the instructional activities, and information about the students in the class (Appendix J & K).

Procedure

Data Collection Strategies

An advance letter (Appendix B) was first sent to potential participants. It informed them about and invited them to participate in the study, requested their consent for the participation, and ensured confidentiality of the information they would provide to the researcher. Interview sessions were arranged after participants consented to participate in the study. Before the interview started, participants were given information about the study and once again informed that they could withdraw from the study at any time without penalty or prejudice. They were and then asked to sign a written consent form (Appendix C).

The interview data were collected between the end of the fourth week and the start of the last two weeks of the semester. The starting point of data collection was chosen because recent research on teacher planning has demonstrated that "By the end of the fourth week of school, teachers had established a system of schedules, routines, and groupings for instruction. These structural and social features of the classroom then persisted throughout the school year" (Clark & Peterson, 1986, p. 260). The end point of data collection was selected to avoid running into make-up or end-of-term review classes. This period of data collection was arranged to ensure that the observed class was typical

of participant's teaching and that the post-class reflection was based on the same mode of instructional processes across the participants.

Each participant selected a class for observation. A class was selected because the participant regarded it as representative of their teaching in that the class followed their usual routine of teaching such as lecture and other instructional activities and had normal student attendance and participation. The participant was interviewed face-to-face for approximately thirty minutes immediately after the class. All interviews were tape-recorded. In addition to the interview, the researcher asked for permission to observe the class and collect the secondary data.

Data Analysis

Data analysis approach. Data analysis of the study focused on participants' classroom teaching activities and their individual perspectives and interpretation in post-class reflection. Analytically, this approach leaned toward the descriptive. The primary analytic task was to "uncover and explicate" (Van Maanen, 1979) characteristics and content of professors' post-class reflection in their daily classroom situation.

Data preparation. Tape-recorded interview data were first transcribed verbatim, following Baum's (1991) recommendations. A basic notation system was used to incorporate para-linguistic data, using (...) to indicate a brief pause, and (note:) to indicate missing data. Based on Seidman (1991) and the experience from both the pilot and main studies, transcribing each interview required six to eight hours.

Complete interview transcripts were sent back to the participants, who were asked to read over to ensure accuracy of the recording of their thoughts and to elaborate what

they had said in case they wanted to. Comments were incorporated in the final version of the transcripts, which were then analyzed.

Given the focus of the study on characteristics and content of participants' post-class reflection, an edited version of each transcript was prepared to facilitate reading and analysis. This entailed going through each transcript and removing all para-linguistic data, such as sound notations like mmh, ehr, etc. that were not meaningful in the transcript. The transcript was then organized into different sections corresponding to the order of the questions asked in the interview. Finally, to facilitate extracting themes of characteristics and content of professors' post-class reflection, the sections of transcript were segmented into mono-thematic blocks of sentences (Miles & Huberman, 1994) and each block formed a unit of coding applicable for assigning one or multiple codes to facilitate the analysis.

Data analysis software and coding scheme. The QSR NUD*IST 4 (Non-numerical, Unstructured Data Indexing, Searching, and Theorizing), qualitative analysis software package (Richards & Richards, 1997) was used for managing and analyzing the interview data. This software package was selected because of the need to organize and process large amounts of textual data and to look for patterns across data from different perspectives. The NUD*IST 4 supports an iterative process of data display and analysis (Miles & Huberman, 1994) that is partly top-down (derived from theoretical perspectives) and partly bottom-up (generated from the data).

Based on the existing research (e.g., Lowyck, 1986; Schwab, 1978; Shulman, 1986b), the research design and research questions of the study, preliminary categories of codes were created (Appendix G). These categories provided a starting point for data

coding and analysis. For instance, the pre-designed interview protocol provided a structure that allowed the NUD*IST 4 to automatically create a category for each question. Each target participant also was assigned a category to label all data or text searches.

On the other hand, the preliminary categories provided a general framework that was substantiated by subordinate categories derived inductively from data. Besides assisting in data analysis, the NUD*IST data file was used to check and retrieve evidence to identify and support themes and patterns from the data and to provide examples for the writing of the case study reports.

Data analysis and displays strategies. Analysis of the data proceeded in two different but related phases, each with a different focus. Phase One analysis focused on establishing the context of the study through developing profiles of individual participants. This analytical focus entailed the use of two strategies. The Personal Contextualizing Strategy (Miles & Huberman, 1994) provided narrative profiles of individual participants, which described teaching related demographics of the participants, such as their teaching experience and nature of the class selected for the study.

In addition, the Checklist Matrix strategy (Miles & Huberman, 1994) was used to summarize demographic characteristics of the participants as a group (Table 2). These two strategies paved the way for sorting the data according to the three participant selection criteria for the cross-participant analysis.

Phase Two analysis aimed at revealing characteristics and content of professors' post-class reflection. An iterative process of analysis (Hewson, Kerby, & Cook, 1995)

was used to extract themes and patterns in regard to characteristics and content of professors' post-class reflection. The responses to the interview questions (1 to 9) provided the data to identify the content of professors' reflection based on Schwab's (1978) four categories of an instructional situation. The responses to interview questions 10 to 16 were analyzed to document characteristics of reflection by using the straightforward interviewing questions of when, where, ways to reflect on the class, purposes, and consequences of the reflection about the class.

First, the interview transcripts were entered as NUD*IST files and put into the base data and case data categories. In the base data category, each transcript was linked to the demographic information of individual participants, while in the case data category transcripts were coded into sections that corresponded to each interview question. Second, the transcripts corresponding to each interview question were retrieved and coded under the major categories of content, teacher, student, and context, using the preliminary categories (Appendix G) and subordinate codes derived from the data. Third, the coded transcripts across participants were pooled together to produce a full listing of all segments corresponding to both the general categories as well as the specific interview questions. Then segments representing a relatively homogenous theme were sorted into a separate section. Each theme was summarized in the form of statements and displayed in a matrix together with the collected transcript segments. For example, a major theme emerged from the data about professors' way in reflecting on the class was that they had intuitive feelings about the class when they engaged in the reflection. Professor ExHLec's reflection provides such an example. (See Appendix I for a full sample matrix).

> As an example, well, the lecture on foreign policy, I think, went well. It's interesting that I used no overheads at that time. I only used the board. I just tried to think of an example that didn't go well. I haven't really had that feeling this year. But there have been times when I had that feeling that it was a failure. (ExHLec: 47)

Fourth, two different types of the selected frequency tables were exported from the coded transcripts to reveal patterns of characteristics and content of professors' post-class reflection in the context of participants' profiles.

In addition to the above analyses, data were used to describe trends about ways in which professors' post-class reflection was related to academic area, teaching experience, and class type. More specifically, themes reported in Phase Two analysis were sorted and reorganized so that professors' post-class reflection was reviewed in light of their academic area, teaching experience, and the type of class they taught. Although the study was not designed to identify any particular relationship between these factors, results may provide useful information for a future study.

Inter-Rater Reliability of Coding the Transcripts

Inter-rater reliability (Kirk & Miller, 1986) of coding the interview transcripts was established through comparison of coding the actual interview transcripts among three independent coders. The researcher first coded the eight complete interview transcripts using the preliminary coding category (Appendix G). The general categories were

substantiated with subordinate codes derived inductively from the interview transcripts. A codebook was then developed based on this coding.

Two graduate students were invited to assist the researcher and were trained on how to use the codebook. Each coder then used the codebook and independently coded one randomly selected interview transcript. The codes used or created by each coder were compared in a group meeting, resulting in a fifty eight per cent (58%) agreement. Then, the group resolved the disagreements and reached 100% agreement on coding the selected transcript through a sentence by sentence discussion. As a result of the discussion, definitions of codes were revised, ambiguous codes were clarified, similar codes were merged, and new codes were added to the codebook to better capture the meaning of the transcripts.

Then, the researcher used the revised codebook (Appendix H) and coded the selected interview transcripts once again to practice a more comprehensive approach to coding that was developed through the group discussion. This exercise produced 74% of consistency between the group coding and researcher's repeated coding.

With this consistency rate, the researcher proceeded to code all the eight interview transcripts for a second time. The other two coders used the revised codebook and independently coded another randomly selected set of transcripts to verify consistency of using the revised codebook. Comparison of the codes used or created in coding the selected transcript demonstrated a 79% consistency between the group coding and the researcher's coding.

Ethical Considerations

In accordance with the University's ethical guidelines for research with human subjects, a Certificate of Ethical Practice had been first obtained from the Faculty of Education (Appendix A) before the pilot and main studies. The ethical guidelines were observed through means such as informed consent (Appendix C) and the confidential treatment of the data.

Strengths and Limitations of the Methods

Strengths

The strengths of the methods for this study lie primarily in its research design. The collective case study design (Stake, 1995; 1996) enabled the study to use multiple profiles in observing professors' post-class reflection. Moreover, the cross sectional sampling strategy of the participant selection offered opportunities to observe professors' post-class reflection unfold in maximum variations (Miles & Huberman, 1994; Patton, 1990) in academic area, teaching experience, and class type. Together with the multiple profiles, this sampling strategy provided the possibility of bringing together different representations of professors' post-class reflection and understanding characteristics and content of the reflection in a more comprehensive way.

Also, the strengths of the methods consisted of eliminating or reducing threats to both external and internal validity and reliability of the study (Gall, Borg, & Gall, 1996; Kirk & Miller, 1986). For the external validity, the current study employed multiple profiles of the post-class reflection. This strategy produced a composite description of professors' reflection that could be generalized across the eight participants. The unobtrusive class observation strategy and use of a conversational tone in the interview

facilitated reduction of experiment effect. The use of standardized semi-structured interview and observation protocols (Appendixes D; E) increased consistency in the interview and classroom observation. The standardized instruments provided consistent prompts in soliciting responses from the participants, which offered an increased internal validity to the study. Moreover, the member checking strategy, through which the participants reviewed the transcribed interview transcripts and verified accuracy of the representation of their thoughts, ensured content validity of the data (Bogdan & Biklen, 1992). On the other hand, the multiple independent coding of the interview transcripts and development of the codebook (Appendix H) established 79% consistency among the three independent coders in observing characteristics and content of professors' post-class reflection from the transcripts. The secondary data sources established contexts of professors' post-class reflection and complemented the primary data source in identifying characteristics and content of professors' post-class reflection.

Limitations

With the acknowledgement that teachers' thought processes before, during, and after teaching are interrelated (Clark & Peterson, 1986; Lowyck, 1986), the study concentrated on the post-class reflection of participants because teachers' thinking is qualitatively different when they are with students in the classroom than when they are not with students (Clark & Peterson, 1986; Jackson, 1968; Calderhead, 1996). Therefore, participants' thoughts in pre-class planning and decision making during the class were excluded from the analysis, unless they contributed to the understanding of professors' post-class reflection. Also, the study intentionally avoided evaluating effectiveness of the class or assessing the teaching performance. When data pertaining to the evaluation of the

class and the assessment of teaching were generated, they were treated as content of participants' post-class thoughts.

The study concentrated on professors' post-class reflection immediately after teaching a class and did not include their thoughts on that class several days, months, or years after the class. The literature defines these aspects of reflection as delayed or postponed reflection and suggests these aspects of post-class reflection differ in focus and content (Pinnegar, 1995). Empirical verification of the differences among these aspects of post-class reflection was left to future research.

The case study design consisting of eight profiles of professors' post-class reflection and the cross sectional sampling strategy prevented the study from making multiple observations of each individual professor's post-class reflection within the limited period of time and resources available for the study. The current design and sampling strategy focused on identifying characteristics and content of the reflection through maximum variations of professors' post-class reflection rather than providing in-depth observations of characteristics and content of the post-class reflection of fewer or one professor. Therefore, the result of the study was a composite picture of post-class reflection of the eight participating professors as a group rather than a description of the reflection of one professor. The alternative research design and sampling strategy are further discussed in the section of recommendations for future study in Chapter V.

This case study focused on describing characteristics and content of post-class reflection of a group of eight purposively selected professors at one university rather than looking for assertions that could be generalized across the university and to other institutions. Moreover, the purposive sampling strategy of the study aimed at describing

professors' post-class reflection with variations limited to academic area, teaching experience, and course type, but not with other factors such as gender, course load, administrative status, time of the year the course being offered, personal factors unrelated to teaching, and student characteristics. These factors might influence on professors' post-class reflection, but they were not the focus of the current study. Furthermore, the purposive sampling strategy excluded part-time instructors such as adjunct or visiting professors, external professionals hired to teach a course, or teaching assistants. Discussion of the results, therefore, is strictly limited to post-class reflection of the selected full time tenure track or tenured professors.

The present study relied primarily on interview data in describing characteristics and content of professors' post-class reflection. Participants' responses to the interview questions were self-reports of their post-class reflection rather than direct observation of the reflection. Needless to say that the self report were limited by the degree of articulateness and the vocabulary the participants used in expressing themselves. Apart from considering individual differences as a factor in future research on this construct, it would be interesting to find more effective means to document tacit information processing of the participants and to seek ways that would take into account the power of expression of participants. Asking participants to provide their own account of some critical incidents seems to have the potential to address this methodological issue (Flanagan, 1954).

A related issue is the research effect on the participants. This study focused on documenting the participants' retrospective thoughts about the class taught as well as characteristics of their post-class reflection in their daily teaching routines. The invitation

to participate in the study and the involvement of the researcher in the process may have well had an impact on the way participants normally thought about their class. A longitudinal design along the line of anthropological studies and prolonged faculty development activities of reflective teaching practice before and during the study could perhaps reduce the research effect and is a factor to be taken into consideration in future studies.

Summary

This chapter outlined methodological issues of the study. It highlighted the study as a qualitative inquiry and justified a collective case study as appropriate research design in addressing the research questions. It provided justification for the Maximum Variation as an appropriate strategy in selecting the eight participants with different levels of teaching experience, in different types of classes, and in different academic areas. This chapter then described the procedure of data collection, data management, and data analysis, together with discussing issues related to ethical consideration, validity, and reliability in conducting this study. Results are presented in the next chapter.

Chapter IV

Results

Two phases of data analysis led to addressing the research questions. Phase One provided insight into characteristics of the purposively selected sample through a description of participants' profiles. This description provided the academic context in which participants' post-class reflection was observed. Based on this description, Phase Two data analysis revealed themes and patterns of characteristics and content of professors' post-class reflection. In addition, a secondary data analysis addressed relationships of professors' post-class reflection with academic area, teaching experience, and class type.

Phase One: Participants' Profiles

1. InHSmi

Professor InHSmi joined the University four and half years ago. This was his third time teaching this 400 level course in one Arts department. This six-credit course spanned the fall and winter semesters. Professor InHSmi selected the ninth week's class in late October for the study. This two-hour seminar class took place in a medium size rectangular classroom with a large table in the middle. The first half of the class consisted of a student presentation and group discussion about lower classes and the towns in 18th century Mother Country, a topic given in the previous class. The second half of the class comprised the professor's lecture on the socio-economic status of lower classes and their relationships with the urbanization of the country, based on the assigned readings, student's presentation, and the group discussion. Thirteen graduate and undergraduate students attended the class. They were active in asking questions and facilitating in the

discussion. On a few occasions, the class burst into laughter due to the professor's humorous comments. The class ended with the professor reintroducing the topic for next week's class.

2. ExSLec

Professor ExSLec had twenty-three years of teaching experience in higher education and had taught this 200 level course in an engineering department. The class that Professor ExSLec selected for the study was a one-hour lecture in the middle of the semester in early November. The Professor drew diagrams on the blackboard and continued his lecture on equations for calculation of forces, a topic that had started in the previous week. Forty-eight undergraduate students attended the class and appeared to be listening attentively. The professor responded to student questions during the lecture.

3. ExSTut

Professor ExSTut had twenty-nine years of teaching experience in higher education and taught this 200 level course twenty times in one engineering department. Two other 200 level courses were listed as co-requisites to this course. Professor ExSTut selected a one-hour tutorial class for the study in early November, which was one week before the mid-term examination. He used overhead slides to demonstrate specific steps of solving three problems on Rotation. Forty-nine undergraduate students attended the class and appeared to be listening quietly to the Professor, with some of them taking notes. About half of the students were female and they sat mostly in the front part of a large lecture hall, which had fixed furniture.

4. ExHSmi

Professor ExHSmi had twenty-five years of teaching experience in higher education and had been granted tenure before coming to teach at this University. However, he treated this existing 400 level course as if he was teaching for the first time because more than half of the course content was newly available research and was used in this course for the first time. The course was listed as a six-credit seminar that spanned the fall and winter semesters.

For the present study, Professor ExHSmi selected a two-hour seminar class in early November, ten weeks into the course. In a small seminar classroom, with a scenic view of the adjacent park, Professor ExHSmi introduced two piles of ten recent books about the class topic to eight students who attended the class, each of whom had a course pack in front of them. Students listened quietly most of the time and spoke occasionally during the class. Four students stayed after the class and talked with the professor about their thesis topics.

5. InSLec

This was the fourth time that Professor InSLec was teaching this 200 level course in one of the engineering departments since he joined the University three and half years ago. Apart from the three-hour lecture, this four-credit course had a two-hour laboratory period in alternate weeks as well as weekly tutorials. The calendar also stated that two more courses at the 200 level or equivalent were prerequisites or co-requisites for this course. For the study, Professor InSLec selected a one-hour lecture class in early November, right in the middle of the semester. The lecture was held in a medium size lecture hall crowded with sixty-three undergraduate students sitting at fixed desks and

chairs. The professor used the blackboard, an overhead projector, and a simulation model to lecture on the topic of compression. In general, students appeared to be listening to the lecture attentively and took notes; a few talked to each other occasionally.

6. InHLec

Professor InHLec had just gone through the tenure process in one of Arts departments. She had taught this 300 level course six times. The class that Professor InHLec selected for the study was a one-and-a-half-hour lecture in the middle of November, five weeks before the end of the semester. Professor InHLec lectured on the topic of Postmodernism to about fifty-five students who sat in a large auditorium classroom. Although the noise of construction from the other side of the wall was audible in the classroom, Professor InHLec managed to lecture with overhead slides and was able to project her voice clearly. She also raised questions and provided opportunities to involve students during the lecture. She seemed to know this group of students well and always called students by their names when they raised their hand. Most students appeared to be listening attentively and taking notes while a handful of them were active in asking questions and discussing issues with the professor.

7. ExHLec

Professor ExHLec had more than thirty-six years of teaching experience in higher education and had taught this three credit 200 level course for more than twenty times in one Arts department. The class that Professor ExHLec selected for the study was a one-hour lecture in late November, four weeks before the end of the semester. The professor used a laser pointer during his lecture on the topic to refer to slides projected on the screen. This class consisted of fifty students who sat at fixed seats in a medium size

lecture hall. He had to talk over the noise of the traffic coming from the open classroom windows. Students appeared attentive in listening to the lecture and more than half of them were taking notes during the class.

8. InSLab

Professor InSLab was going through the tenure process after teaching at the University for six years. However, this was his first time teaching this 200 level course in one of the engineering departments. This three-credit course combined two lectures with one laboratory and was offered in alternate years. For the study, Professor InSLab selected a three-hour laboratory class in late November, four weeks before the end of the semester. This laboratory class was to teach second year agricultural engineering students how to use the equipment in collecting data for constructing maps. The class started with a twenty-minute lecture in a medium size classroom where Professor InSLab introduced the equipment and distributed a handout entitled: Procedure for the Equipment. Then the class, consisting of Professor InSLab, a teaching assistant, and nine students, moved out into the field. Professor InSLab first guided a pair of students step by step in using the equipment. Then he stepped back and asked students to form pairs and to take turns to practice using the equipment. The class finished with students arranging their schedules for using the equipment for a group assignment after the class.

Summary

Table 2 shows that participants of the study represented diverse background in academic area, teaching experience, professorial status, and type of class they selected for the study. This demographic diversity was considered in observing the post-class reflection and describing teacher reflection in higher education. As Table 2 indicates, four

participants were teaching in two engineering departments and four participants were teaching in two humanities departments. While all four experienced participants were tenured professors and had an average of twenty eight years of teaching experience in higher education, the four inexperienced participants were not tenured and had an average of five years of teaching

Table 2.

Participants' Teaching Related Demographic Characteristics

Participant	Academic Area	Class Type	Years of Teaching Experience	Times Teaching the Course	Tenured	Teaching Award
ExHLec	Arts	Lecture	36	20	Yes	No
ExSTut	Engineering	Tutorial	29	20	Yes	No
ExHSmi	Arts	Seminar	25	1*	Yes	Yes
ExSLec	Engineering	Lecture	23	15	Yes	No
InHLec	Arts	Lecture	6	6	No	No
InSLab	Engineering	Labora-tory	6	1	No	No
InHSmi	Arts	Seminar	4.5	3	No	No
InSLec	Engineering	Lecture	3.5	4	No	No

* *ExHSmi had taught the course many times but he reported treating the course as if it were a first time course.*

experience. The four experienced participants had taught the course selected for the study for fifteen and more times, except one participant who believed substantial addition of the

new course content had turned the existing course into a new one. The four inexperienced participants had taught their selected course six times or less. Of the eight participants, only one experienced participant reported having ever won a teaching award.

As for class type, four lecture classes in engineering and humanities were selected by two experienced and two inexperienced participants, while two seminar classes, one tutorial class, and one laboratory class also in engineering and humanities were selected by the other two experienced and two inexperienced participants. All these classes were at the undergraduate level, except that two classes included graduate students.

Phase Two: Characteristics and Content of Professors' Post-Class Reflection

Phase Two data analysis drew on the primary interview data source and addressed the first two major research questions about characteristics and content of professors' post-class reflection. First, the coded transcripts across profiles were pooled together to produce a full listing of all segments corresponding to each specific research questions. The segments were then sorted into sections, each representing a relatively homogenous theme. Major themes were reported and supported with verbatim interview excerpts. Frequency tables were used to reveal patterns of characteristics and content of professors' post-class reflection. Finally, participants' profiles were cross-examined with the frequencies to highlight distinctive instances of characteristics and content of professors' post-class reflection.

Characteristics of Professors' Post-Class Reflection

Findings in this section addressed the first major research question with regard to characteristics of professors' post-class reflection as it pertained to the time, place, manner, purpose of and consequence of the reflection. These findings were the results of

analysis of participants' responses to the interview questions from 10-16 (Appendix D). Limited by the nature of interview, results reported here reflect professors' self report on characteristics of their post-class reflection rather than empirical documentation of these characteristics as they actually happened. In the analysis, distinctive characteristics of the reflection was of interest rather than the number of times that a characteristic was manifested in the transcripts. Therefore, frequencies reported here are only important in so far as they indicate whether a particular characteristic occurred rather than how many times that same characteristic appeared in the transcript.

When did the reflection happen? Thematic analysis of the transcripts provided two major findings to this question. First, professors reported reflecting on their classes at different points of time and in a continuous process. Their reflection occurred mostly right after finishing a class and entailed both looking back at the class, reflecting on what could be done differently, and thinking about what should be done in order to prepare for the next class. For example, Professor ExHSmi commented that:

> I think the moment you finish a session, you start thinking about the next one. Of the things that you think you could have covered differently. Usually I finish a seminar thinking that certain points could have been done in a much better way. (ExHSmi: 45)

Similarly, Professor ExHLec explained:

> The other point made is that sometimes after the class one doesn't reflect immediately. Maybe a day later, you think well I got to present the next lecture.

> What are the salient points of the last lecture. So you then reflect upon what you've said. It is the continuity. (ExHLec: 6)

Ambiguity about the time of reflection indicated that professors' reflection entailed an on-going process in which they regularly looked back (InSLab). In fact, Professor InHSmi clearly described this situation in the following statement:

> Well, there is a series of on-going processes throughout the semester. I tend to think that to a large extent, when you are in the middle of the class and it's all laid out what you are going to do and when, it's possibly too late for that particular class. Most of the lessons learned will be appropriate to the preparation for the next class. (InHSmi: 66)

Also, this on-going process of reflection occurred during the class when professors monitored whether the class unfolded as planned. For instance, Professor InSLab from an engineering department said that:

> I change the track in the middle of the lecture if it's not going well. It's easy enough to open it up to do that. No use to continue on if no one is paying attention or everyone is lost. Back up and find out what's gone wrong by asking a few questions and change track. Maybe not change topics if you are talking about something but you really need to talk about something else to understand where you've gone. (InSlab: 62)

Professors' reflection occurred also after examinations or the mid-term or end of term evaluations. On this aspect, one professor from an engineering department emphasized that:

> Certainly at the end of the course, I will look back. There's a mid-term course evaluation. I look back at that point. At the end of term evaluations, I certainly look back there. (InSlab: 47-48)

Since post-class reflection was on-going, professors felt that it occurred at anytime and therefore was hard to generalize when it happened. The time that professors' post-class reflection occurred depended on their work at hand and what had happened in the class. For example, Professor ExHLec referred to his own reflection in the following way:

> Sometimes, sometimes not, depends on what's on my desk. There are times when I think that I got something across. There are other times when I think that I was not success. You never quite know when that's going to happen. (ExHLec: 45-46)

Table 3.

Reported Occurrence of When the Participants Reflected on the Class

	ExHLec	ExHSmi	ExSLec	ExSTut	InHLec	InHSmi	InSlab	InSLec	*# of the Participants*
right after the class	1	1	1	0	1	0	0	1	*5*
on-going process	1	0	0	1	1	1	1	0	*5*
planning for the course next year	1	0	0	0	1	1	0	0	*3*

Note: 1 = reflection reported; 0 = reflection not reported.

The above examples show that professors' post-class reflection can become part of the daily routine. It can happen at any time, even on the way to and from work, when talking with family, and even when writing an article (ExHLec: 56).

As Table 3 shows, professors reflected on their classes deliberately and in a continuous way. Five out of the eight participants (63%) reported reflecting on their classes right after the class. Another set of five participants (63%) reported that their reflection was an on-going process. Three of them (38%) indicated their reflection occurred when they planned the course for another time.

Apart from the above themes, the participants reported that they reflected on the class some time later (ExHLec: 6; InSLab: 46; 57), any time (ExHLec: 45-46; ExSTut: 37), preparing the next class (ExHLec: 6, 76; InHSmi: 95), to and from work (ExHLec: 54), when writing article (ExHLec: 56), talking with family (ExHLec: 57), after examinations or evaluations (InSLab: 47-48), and during the class (InSLab: 62). The individual reports were themes that could not be generalized across the eight participants. They are presented here to document individual characteristics of professors' reflection.

Two distinctive profiles emerged among the participants on when the reflection occurred. Profile One, Professor ExHLec, had more than thirty six years of teaching experience; the longest among the eight experienced professor. He provided nine of the eleven themes. It is possible that his considerable experience in teaching this course has made the course an integrated part of his life. This was reflected by the diverse themes that he reported on when post-class reflection occurred to him. In comparison with other participants, his reflection happened almost anytime, such as when he was "talking to my wife, around the table with the family." (ExHLec: 57).

A second profile was Professor InSLab. He had six years of teaching experience but was teaching the course for the first time. His comments touched on four of the eleven themes (36%). He emphasized that "I guess on a weekly basis I am looking back" (InSLab: 55). Reflection became an on-going process that happened both during and after the class. "It's going to happen at the mid-term. It's going to happen at the end of the term." (InSLab: 51) These characteristics might be related to the hands-on type of class (lab) that he was teaching.

Where did the reflection happen? Just as the time of reflection is unpredictable, so is the reported place in which professors' reflection occurs. With this sample, reflection took place "right in the classroom" (InSLec: 5), when "walking back from the class" (ExSLec: 50), "in the office" (ExHLec: 52), and "in the library" (InHSmi: 73). The major finding concerning the question is that professors' post-class reflection happened "all over the place" (InHSmi: 70), even in unconventional settings. For example, Professor ExHSmi described:

> That's a very good question because I think about it in sort of quite unconventional settings. I saw a French film called East and West which deals with the Franco-Russian theme. I have been thinking of the Russian in it. I started to think how this particular film that is a very serious attempt to make the French public learn from the Soviet experience. ... It could be anywhere really for me to think about the class. (ExHSmi: 50-51)

Professor InHLec, who was teaching a lecture class in anthropology confirmed that reflection occurred to her when she was

at home, in the shower, at a movie. Pretty much everywhere. Sometimes I'll not think about it if I am doing something. I am always thinking about it. (InHLec: 59)

These statements show that these professors reflected in the formal school setting as well as in the informal settings such as home. Four of the eight participants (50%) highlighted that their reflection occurred anywhere. The rest of the group indicated their reflection happened at school settings as well as at home. One participant could not even pinpoint the specific place. He said that "It's hard to say, to generate when this happens" (ExStut: 37).

Professor InHSmi provided a clear insight with regard to where professors' reflection happened. This less experienced professor who was teaching a seminar course contributed the four of the seven (57%) themes pertaining to this question. His reflection took place at different locations at school as well as at home. Professor ExHLec also reported that his reflection "Can be anywhere" (ExHLec: 60), including at both formal and informal settings. These two instances suggest that academic area, teaching experience, and type of class are perhaps not determinant to where professors' reflection happened.

Ways in which the reflection happen. This question addressed an important aspect of the characteristics of professors' post-class reflection. That is, how do professors go about reflecting on their classes? Two major themes emerged from the data. First, professors reported reflecting on classes based on their impressions and intuitive feelings. For example, Professor ExSLec's comment was the following: "I think the class went all

right. There was no disturbance in the class. I could not hear it. I thought that everybody was attentive and following me. That is my impression." (ExSlec: 4)

Apart from going through a checklist in a rational fashion, professors were engaged in an emotional way when thinking about what had happened in the class. In fact, having feelings about their classes occurred to all the participants. Professors depended on whether they were having positive or negative feelings about the class to evaluate the effectiveness of the class and to make future plans. For example, Professor ExHLec described that "I didn't have the feeling, as sometimes I do, that I've lost them." (ExHLec: 11) Also, Professor InHLec reported "feeling relatively satisfied with yesterday's class" (InHLec: 5) while Professor ExHSmi commented "Well, sometimes I feel a bit dissatisfied. I think of how I can change that." (ExHSmi: 66)

Apart from relying on feelings to assess effectiveness of a particular class, professors also used their feelings in reflecting on the course. Professor ExHLec said that:

> As an example, well, the lecture on foreign policy, I think, went well. It's interesting that I used no overheads at that time. I only used the board. I just try to think of an example that didn't go well. I haven't really had that feeling this year. But there have been times when I had that feeling that it was a failure. (ExHLec: 47)

Similarly, Professor InHSmi said "Yes, this class confirmed my impression that this seminar is going reasonably well. I don't have too many worries about it, compared to some of the other classes I taught in the past." (InHSmi: 23)

Second, professors reflected in response to what happened in the class or to the course. They reflected in ways that were varied, spontaneous, and unstructured. For example, Professor ExHLec reported that:

> The way: that can vary. Sometimes I think of a remark one of the students made. Sometimes, I think a remark that I made or I lead to something, I think well, I really should change that. I mean there're things that happen. (ExHLec: 64)

Describing how reflection occurred to him, Professor InHSmi pointed out the following:

> It's just various ideas that come to me in no particular order. I don't sit down and think through any form of scheme, or even have a kind of mental checklist does this go well, does this not go well. It was more of an intuitive feeling about what was successful or what wasn't. (InHSmi: 77)

These examples show that professors' reflection happened in spontaneous and unstructured ways. There was no evidence that professors ever used a structure or a system to initiate or organize their reflective thoughts about their classes. Instead, their reflective thoughts came "when the thought comes." (ExSTut: 43)

As Table 4 shows, all eight participants (100%) reported having intuitive feelings about their classes and six of them (75%) were not systematic in thinking retrospectively. Interestingly enough, four participants (50%) emphasized that although they were not systematic on looking back at classes in the past, they were quite systematic in thinking about their classes to come and their planning for these classes was very logical (ExSLec) and systematic (InHSmi). For example, Professor ExHLec described that "I think the

class that is to come. There I am very systematic. What are the points that I am going to present. I may even take the material away on the weekend and do it very systematically." (ExHLec: 66)

Table 4.

Reported Occurrence of Ways Participants Reflected on the Class

	ExHLec	ExHSmi	ExSLec	ExSTut	InHLec	InHSmi	InSlab	InSLec	*# of the participants*
having impressions and intuitive feeling about the class	1	1	1	1	1	1	1	1	*8*
not systematic on thinking retrospectively about the class	1	1	0	1	1	1	0	1	*6*
systematic on planning for the class	1	1	1	0	0	1	0	0	*4*

Note: 1 = reflection reported; 0 = reflection not reported.

Similar to his responses as to when he engaged in reflection, Professor InSLab's profile stood out, once again, in addressing this question in that he contributed only one theme, the least among the eight participants. The fact that his class was the only laboratory class and most of the class time was spent in the field for students to practice using the equipment might have made it different from other classes.

Purposes of the reflection. In terms of why they engaged in post-class reflection, professors reported having twelve practical and general purposes. Four major purposes were reported in Table 5. First, their purpose was practical and focused on looking back at what had happened, particularly in the last class, in order to get ready for the next

class. Five participants (63%) reported having this purpose. For example, Professors InSLec explained that what happened in the last class caused him to think about the class. He said

> Sometimes I change because of timing. Change just so to suit you. But I want to make sure that the changes are smooth. Sometimes, they are not that smooth. Something seemed missing because I change, not exactly as I prepared. It is something after the class that I have to think right away. I reread the notes. What's finished? What's not yet [finished]? And get ready for the next class. (InSLec: 51)

Focusing on preparation of the next class through reflection indicated that professors' reflection was an on-going process, through which they linked their perception of what had happened in the last class, or to the course in general, with what they would like do next. Professor InHSmi clearly stated,

> Well, there is a series of on-going processes throughout the semester. I tend to think that to a large extent, when you are in the middle of the class and it's all laid out what you are going to do and when, it's possibly too late for that particular class. Most of the lessons will be appropriate to the preparation for the next class. (InHSmi: 66)

Similarly, Professor ExHLec described that he reflected in order to:

> Move on to the next one. I am always really thinking about what I am going to say rather than what I have said but I come back to the same issues. Sometimes I

Table 5.

Reported Occurrence of Participants' Purposes of the Reflection

	ExHLec	ExHSmi	ExSLec	ExSTut	InHLec	InHSmi	InSlab	InSLec	*# of the participants*
improve teaching	0	1	0	0	1	1	1	1	*5*
get ready for the next class	1	0	1	0	1	1	0	1	*5*
personal satisfaction	0	0	1	0	1	1	0	0	*3*
better student learning	0	0	1	0	0	1	1	0	*3*

Note: 1 = reflection reported; 0 = reflection not reported.

> am writing a new lecture and going back over the notes that I taught. Sometimes they were very terribly muddy. So I go over them and then I pick out. Yes, that's an important point. In another word, I have to get excited about the topic all over again. That's when I do the reflection. But before, as soon as I've given the lecture, well, I have to reflect on what I am going to say next. (ExHLec: 76)

These examples demonstrate that professors reflected more for practical purposes of what to do in the next class rather than for general and philosophical purposes of what to learn from their experience. Professor InSLec emphasized "The purpose is to make it better. Improve the next class, very short term. Short-term purpose, just for the next class." (InSLec: 72)

Second, professors described that they reflected in order to improve teaching in general. Another set of five participants (63%) reported that reflection caused them to "review in their mind "what we have covered in the last little while and what could be

changed." (InSlab: 54) Reflection became inspiration for improvement (ExHSmi), in that it helped find out "certain points that could have been done in a much better way" (ExHSmi: 45). Professor InHSmi pointed out that he reflected

> to improve my overall teaching performance. I do get a great deal of pleasure out of teaching. I also get a lot of pleasure out of research as well. It is difficult to balance the two. I certainly did not enter this profession so that I can spend more the time doing research and neglect my teaching. I regard them as equally important. (InHSmi: 85)

Apart from improving their overall teaching performance, professors reflected also to improve as a person. Professor InHLec described her purpose for reflection in the following way:

> To improve things. To make things better. To improve my teaching. If I improve my teaching, then I feel better as a person, which is sad. I can't divide the personal aspect of things and the teaching aspect of things. I can't. Some people are able to do that. I cannot. I am working on it but I can't. I am better than I was, a lot better than I was. It's still a lot of struggle. (InHLec: 67)

The examples show that the participants reflected not only for academic but also for personal purposes. In fact, personal satisfaction was a third major purpose (38%) that professors reported for their reflection, as Professor InHSmi said "Really, when the classes are improved and the results become obvious, it brings a great feeling of satisfaction." (InHSmi: 86)

Moreover, the participants reported individually that they reflected "to better student learning" (ExSLec; InHSmi; InSLab) (38%), "to get across information"

(ExHLec; InSLab) (25%), "to improve student learning experience" (ExSLec; InHSmi) (25%), to fulfil their duty (ExSLec; InSLec) (25%), "to make students think" (ExHLec) (13%), to have "control of the class" (ExSTut) (13%), to have "better student evaluation" (InSLab) (13%), "to revise the course pack" (ExHLec) (13%), and "to prepare the exam" (ExHLec) (13%).

In general, nine of the twelve purposes cited for reflection were related to what professors did as teachers and three were related to what they wanted their students to do.

Table 5 presents one distinct instance of purposes of professors' reflection. The first is Professor InHSmi who reported six of the twelve purposes (50%) of reflection, the highest number amongst the group. He had six years of teaching experience and was going through the tenure process at the time of the study. He reflected both for the practical purpose of preparing for the next class and for the purpose of improving teaching in general. Three of his six purposes involved students including better student understanding, improving student learning experience, and better student evaluation. This distinguished his profile from the rest of the group who stated purposes which were related mostly to themselves as teachers.

Consequences of the reflection. Three major themes emerged in terms of consequences of professors' post-class reflection. They indicate that professors' reflection, as reported, led to both cognitive and affective consequences. First, six of the eight participants (75%) reported that their reflection resulted in specific actions to improve course outlines or to revise course packs. For example, Professor ExHSmi commented:

> If you are discussing World War II for instance, I might say to myself well in the anthology there is actually no engaging treatment of the war. Perhaps a better way

> of doing this is, may be in my next anthology, I am going to change that. I am going to introduce some accounts by some of the Soviet writers, which I haven't done this time around. Because I feel there are so many problems that you deal with as historians you don't want to bring in this kind of material. Next time I might want to change that. (ExHSmi: 67)

Similarly, Professor InHSmi explained how his reflection on student feedback led to the revision of the current course pack. He said,

> Sometimes, when I repeat courses, like I give the same lecture, more or less, I get very different impression judging from students' reaction. So in other cases where I think that the lecture has gone not as well as it could, then I will rewrite it the next time I give it. I will make many various changes to the next time I think. (InHSmi: 60)

Professor InSLec's comment on what happened with his thoughts about the last class provided another example of professors' engagement of remedial actions as a result of reflection. He said that he reflected in order to:

> prepare for the next class. The consequences . . . , I think after I noticed something is wrong, I just try to correct them. If the examples are not good in this past class, I don't have the time to repeat to give another good one. I usually write it down for next year. I paste notes. I just put a sticker there that these examples should be changed. To remind me, next year, it's not good, not typical. Something for next year will also be considered. (InSLec: 76)

These examples indicate that professors' post-class reflection led them to go through classes in the past and have ideas about improving course materials, and helped them focus on their preparation of the next class, or the course when they would teach the next time.

Second, five participants (63%) reported that their reflection led to preparation for the next class. Professor InHLec explained:

> It goes on well in advance. I've already been thinking about the classes from now on. . . . I really think about the next class. Once that class ends. I think ok. what I am going to teach the next class. (InHLec: 55)

Professor InHLec's example shows that in their on-going efforts of improving teaching, professors engage in post-class reflection to assess effectiveness of the class and to help them make decisions regarding the selection of remedial strategies for the next class. Professor InSLec recalled:

> Today, it's noisy. I know that something is not that attractive. So next time, maybe I'll make it a little bit different. It's kind of corresponding to what happens in the class. This also happens within that 10 minutes rethinking. (InSLec: 73)

Third, as Professor InSLab pointed out that reflection also led to affective consequences. Feelings resulting from the reflection influenced how they dealt with the next class, or simply had an effect on their mood for the day. As a matter of fact, four participants (63%) reported post-class reflection had positive or negative affective impact. Professor ExSLec illustrated:

> At the end of the class if you had a good class, you feel that everything has gone the way you wanted. You feel good about it. You are aware that all was done in a

> nice fashion. You are in a good mood. You are enthusiastic. You are up. (ExSLec: 41)

He continued to describe the negative impact and said that

> But, if your class doesn't go well, you are kind of feeling down. It reflects in your not being quick. Your disposition is not as good. I think it has a great influence on the way you are acting during the day. (ExSLec: 42)

Similarly, Professor InHLec explained,

> Do I think about it? Yeah, yeah, it starts immediately. I will think about it for about 10 minutes. If I did not like something, it will nag me for at least the day. (InHLec: 57)

Professor ExSLec described that an affective consequence of reflection could surface immediately after the class in this way:

> After the class, you know immediately whether you had a good class or not a good class. That's it. That is determined immediately after the class. If the class has not gone as well as you wanted it to, you want to forget about it. You sort of get on to something else quite quickly. (ExSLec: 47)

Apart from the above three consequences, three professors reported making notes to themselves as a direct consequence of their reflection. For example, Professor InHLec, who shared the strategy with Professor InSLab, described what he did after reflecting on the class and said:

> Sometimes, I make a little note like--remember to go through this part far more quickly, or reduce reading or whatever, to remind myself the next time I plan the course. (InHLec: 64)

Professors' notes became a device to record their reflective thoughts and to indicate their action as a result of reflection. These notes were specific and dealt with adjusting the pace in covering the material, drawing lessons from the class taught (InHLec), correcting mistakes in the lecture (InSLec), or simply improving teaching (InSLab).

Table 6.

Reported Occurrence of Consequences of the Participants' Reflection

	ExHLec	ExHSmi	ExSLec	ExSTut	InHLec	InHSmi	InSlab	InSLec	*# of the participants*
improve the course (outline) or pack	1	1	1	0	0	1	1	1	*6*
preparing for the next class	1	0	0	0	1	1	1	1	*5*
impact on their own mood & feeling	1	0	1	0	1	0	1	0	*4*

Note: 1 = reflection reported; 0 = no reflection reported for this consequence.

Apart from the above common consequences, the participants reported individually that reflection led to intellectual stimulation (ExHLec) (13%), change of teaching strategy or content for the subsequent class (InSLab) (13%), gaining control as a teacher (ExSTut) (13%), improving teaching (ExHSmi) (13%), self encouragement

(ExSLec) (13%), correction of mistakes (InSLec) (13%), and asking questions during the next class (InSLab) (13%). Comparing to the purposes, consequences of post-class reflection were all related to their thinking, actions, or feelings as teacher.

As Table 6 shows, post-class reflection led to different consequences for different professors. However, Professor ExSTut provided a distinctive profile among the group. This experienced professor teaching a tutorial class in engineering specified that gaining control as teacher was both the purpose and the consequence of his reflection.

Summary. Patterns of reflection revealed characteristics of professors' report of post-class reflection in five aspects, that is, when, where, and in what way professors' post-class reflection happened, what was the purpose of reflection, and what consequences did reflection have. Verbatim interview transcripts and two types of frequency tables were used to display these characteristics. Participants' profiles were cross examined to elaborate on distinctive instances of professors' post-class reflection.

In general, post-class reflection was reported as routine: it happened at different points of time, mostly right after the class, and as a continuous process. Professors reported that their reflection occurred "all over the place," such as at school and at home. All eight participants described that their post-class reflection involved a mixture of having an impression, an intuitive feeling about the class as well as a process of thinking logically about how the class unfolded. Their post-class reflection was responsive to what happened in the class or to the course in general. It occurred in varied, spontaneous, and unstructured ways. The two major purposes for reflection were to get ready for the next class and to improve teaching in general.

Professors reported that their reflection led to both cognitive and affective consequences. In the cognitive aspect, professors drew lessons from their classroom experience to adjust instruction for the next class and to adopt remedial strategies to improve the course for the next time. In the affective aspect, professors reported that impression of and feelings about the class resulted in a strong impact on their mood or feelings. These intuitive feelings were related mostly to their thinking and actions as a teacher.

Content of Professors' Post-Class Reflection

Findings reported in this section addressed the second major research question concerning what professors thought about in their post-class reflection. These findings were results of analysis of participants' responses to the interview questions from 1 to 9 (Appendix D). Based on Schwab's (1978) work, the content of professors' post-class reflection was analyzed according to class content, teacher, student, and context.

This section is different from the last section which concentrated on distinctive characteristics of reflection in that it treats frequency of professors' reflective thoughts as important information. Frequency tables in this section report the number of times each theme actually appeared in the interview transcripts. It is assumed that the more a theme is repeated, the more prominent the theme is in the mind of the participant.

Class content. In the dimension of class content, professors reflected mostly about subject matter coverage. First, they reflected on whether they had finished their teaching as planned (InHLec: 10; InSLec: 16) or they simply reflected on specific topics delivered in the class.

> I focused on a book entitled Lethal Politics, which deals with the demographics to establish the losses to the society in the Soviet Union following the Revolution, the Civil War period, the period of Collectivization and Industrialization. (ExHSmi: 14)

Professors reflected on the progress of the course (InSLec: 5) in the semester. Professor InHLec reflected that, "The topic of post-modernism. I really like this stage of the semester, well, not only because it is almost over, but because I got to talk about the nitty-gritty of the theories of culture of the societies which is the theme of the course." (InHLec: 24)

> Second, they reflected on the link between classes. Professor ExHLec explained: I am thinking what I am talking about. I got this period to cover, and what are the possible topics that I should talk about. I am thinking about the future but I am also thinking about what I have done. (ExHLec: 53)

This reflection "will cause me to review in my mind what we have been covering in the last little while and what could be changed." (InSlab: 54)

Third, they reflected on the importance of the content, as Professor ExSLec emphasized: "Yes, this is a very important subject, because determining the internal forces in structural members is at the heart of the design problem. . . . So it is something which is very close to the engineering design . . . something basic and fundamental." (ExSLec: 10)

Professors also reflected on importance of a topic from students' perspective (InHSmi; 21). They explained that "I must make sure that they understand this stuff

because it is going to be of tremendous use to them (ExSLec: 11)" and that "It's fairly new. It's something that they would likely use in their future jobs." (InSlab: 12)

Teacher. As table 7 shows, professors reflected mostly about the aspect of teaching (35%), less about themselves as teachers (21%) and their knowledge (20%), lesser about effectiveness of the class or course (18%), and the least about objectives of teaching (6%). The following paragraphs highlight major findings about these five major themes.

Table 7.

Reported Frequency of the Teacher Aspects that Participants Reflected on

Aspects	ExHLec	ExHSmi	ExSLec	ExSTut	InHLec	InHSmi	InSlab	InSLec	*Total*
teaching	12	8	9	1	8	17	13	13	*81*
self as teacher	3	2	5	4	16	5	8	6	*49*
knowledge	8	18	2	3	4	5	6	1	*47*
effectiveness	4	2	3	1	10	8	4	10	*42*
purposes of teaching	1	5	1	0	3	0	4	1	*15*

Similarly, Professor InSLec reflected on experimenting with a new teaching strategy. He said that:

With regards to teaching strategies, professors thought mostly (85%) about using different strategies for different purposes, including instructional techniques as

devices to deliver information in the class as well as tools for reflection. For example, Professor ExHLec reflected that:

> Maybe a day later, you think well I got to present the next lecture. What are the salient points of the last lecture. So you then reflect upon what you've said. It is the continuity, as you [researcher] saw, at the beginning I put on the slide, which as the slide that I presented the last time. It was that continuity. (ExHLec: 6)

> I used the simple ruler to help show the example of buckling. It seems that it works. This is the first time that I used the model in the class. Usually, we don't use the model because they are university students. (InSLec: 18)

Professors also reflected on making use of lecture notes, a conventional instructional strategy, to remind them of the important points (InHSmi: 93) and to transmit accurate information (ExHLec: 18). They reflected on the constraints of instructional strategies, making effective use of instructional strategies (ExHLec: 19, 37) and using the lecture "to convey a certain amount of basic information" (InSlab: 59).

Furthermore, professors reflected on using different instructional strategies to facilitate student learning such as bringing "about a common base by making them read an anthology" (ExHSmi: 47), asking students "to write a memo, one or two page memo in relation to the question that I gave in the class" (InHSmi: 15), and "challenging them by saying things that they might find shocking or say things that you don't yourself believe in." (ExHSmi: 19) Lastly, professors reflected on utilizing different instructional strategies to promote active student participation such as "encouraging feedback from students before I made my comments at all. I nearly always give a question a week in

advance. Let the question focus their thinking while they are doing their reading." (InHSmi: 48).

Concerning themselves, professors reflected mostly on their role as teachers and about their beliefs of good teaching. They believed that transmitting knowledge was important and that presenting accurate information was crucial in teaching, as Professor ExHLec emphasized that:

> If you're lecturing about ideas, you want to express these ideas absolutely exactly. . . . The next class, I am almost certain to talk about Thomas Hobbs and his view of how the society is structured. He follows a very careful set of ideas. And I will be consulting notes then because if you lose or leave out one item, then the whole thing makes no sense. (ExHLec: 18)

Moreover, professors reflected on their beliefs of good teaching, including good preparation to gain control of the class (ExSTut: 55), not being "the total conveyer of the information" (InSLab: 18), active student participation (InSLab: 61), promoting high and low performance students (ExSLec: 63), and going beyond class performance and training students to think professionally (ExHSmi: 62).

Besides, professors reflected on their abilities to teach. Again, professors referred to their feelings in reflection (InHSmi: 85; InHLec: 39). They expressed their feelings concerning a specific class (InHSmi: 29) or their teaching in general (InHLec: 4). They also reflected on developing a learning environment, their experience as a teacher (InHLec: 7) and their student years (InHSmi: 31).

With regards to teacher knowledge, professors related their thoughts to different types of knowledge as classified by Shulman (1987). Their reflective thoughts were

related mostly (50%) to their knowledge about students but least (3%) about curricular knowledge. While twenty per cent (20%) of their reflection was about pedagogical knowledge, eighteen per cent (18%) was about content knowledge. Only eight per cent (8%) were about pedagogical content knowledge.

With regard to students, professors reflected on differences in student backgrounds (ExHSmi: 55), particularly on differences between groups of students. For example, Professor InHSmi described his class in this way:

> One of the interesting things about this particular class is that half of the students are graduate students. Although it was not terribly noticeable in conversations, there are various groups of students from different background. (InHSmi: 33)

Professor InHSmi's observation indicates that he was conscious in relating students' background with their performance in the class. This reflection communicates his implicit expectation that undergraduate and graduate students might have different levels of performance in the course due to their prior knowledge and experience in the subject.

Professors were found to apply their knowledge of students' background in making instructional decisions. For example, ExHLec reflected that "We get many students outside the [subject] string. I have noticed that in the papers that they don't know the technical side of writing an [academic] paper. Next year, I will devote an entire lecture to how to write an [academic] paper." (ExHLec: 42)

Also, professors reflected on students' intellectual abilities and learning styles and based on these, developed their expectations from the students. For example, Professor ExHLec reflected that:

> Their written work is not as good as I had expected. Given the intelligence they show, not only in the lectures where they're discussing things, but in the conferences, where they have to read something and come up with ideas. They are a very eager bunch. But their writing skills leave something to be desired. (ExHLec: 24)

Similar to awareness of their own feelings in reflection, professors were aware of students' affect. They thought about students' attitudes toward the course in general (InHLec: 30) and toward a particular class (InSLab: 9). Moreover, professors tried to understand the cause of students' attitude (ExSTut: 10) and know how students in the class got along with each other (InSLab: 6; ExSTut: 18).

With regard to teaching effectiveness, professors' reflective thoughts were related mostly to effectiveness of the class. In their reflection, professors resorted to both rational thinking and intuitive feeling in judging the effectiveness of the class. On the one hand, professors drew logical links between the class plan and how the class actually unfolded to assess effectiveness. For example, Professor InSLec explained: "Seems to me that today it's being a logical development. It went on smoothly. Sometimes, I could miss something, stuck somewhere. Today seems ok." (InSLec: 9)

On the other hand, professors relied on their impressions or feelings in assessing effectiveness of the class. The following quote illustrates the intuitive mode of reflection.

> As soon as I come away from the classroom, I get the general impression of whether the class went well or not. For all classes I teach. When I am walking away from a lecture for example, I kind of mentally run through my mind. Was

> that a good lecture? It's a kind of feeling you have. Whether it went successfully, whether you maintained namely attention of the students or lost? Whether you noticed people looking at the watches or pulling them in through the lecture? Whether I was giving them too much material or I was going too fast, things like that. (InHSmi: 59)

The above examples show that both rational and intuitive reflection occurred at the same time and that these two modes of reflection were not so distinguishable from each other.

Besides, professors reflected on the course (InHLec: 11) and how effective it was in achieving instructional objectives (InHSmi: 22, 23, 95; InHLec: 24). However, it seemed that teaching effectiveness was not always in professors' control and that it was elusive and sometimes even mysterious. For example, Professor ExHLec described that "There are times when I think that I got something across. There are other times when I think that I was not successful. You never quite know when that's going to happen." (ExHLec: 46)

With regard to the purpose of teaching, professors reflected mostly on developing different types of higher level thinking skills. For example, Professor ExHSmi said that "I think what you have to do, as a historian, is that you have to try and make students understand that the journalism does not represent what the historians try to achieve." (ExHSmi: 9) Similarly, Professor InHLec believed that teaching should enable students to go beyond simply receiving information and "make students think for themselves" (InHLec: 19). He highlighted that "The whole class is about trying to work beyond the

sorts of ideas. I don't feel that I am the authority on certain theories. I am going to give them my view on them, but I'd like to hear what they think." (InHLec: 13)

Besides, professors reflected on imparting knowledge as the main purpose of their teaching (InSLec: 21; ExHLec: 15; ExHSmi: 63). Finally, professors reflected on improving the learning environment. For example, Professor InHLec reflected in this way:

> So I would like the University to be a different kind of learning environment from what it is and that comes through in my teaching. Even though I am not really able to successfully accomplish this sort of alternative learning context, at this stage of my career, I tried a little bit to accomplish that. (InHLec: 16)

The previous section describes five major themes of professors' thoughts about teaching. Professors reflected mostly on teaching, which in turn, was related to use of instructional strategies. They reflected on themselves as teachers and focused their thoughts on good teaching. Thirdly, professors reflected on the students, particularly their background and prior knowledge, and general pedagogical knowledge. Fourthly, professors reflected on the effectiveness of the class and finally on the development of students' higher level thinking skills and imparting knowledge as the two major purposes of teaching.

Students. Related to professors' reflection on knowledge of students was their thoughts about student behavior and learning outcomes. Three themes emerged from professors' reflection on students. They reflected mostly (72%) on students' behavior, secondly (26%) on students' learning outcomes and (2%) on student satisfaction.

In the aspect of students' behavior, professors reflected more on the behavior of students as a group (88%) rather than their behavior as individuals (12%). For example, Professor InHSmi described active participation of his students in class like this:

> About this particular class, I suppose more people in that first half of the class asked questions to the presenter. More people than usual. Usually there were a few questions but I have to prompt a little bit. (InHSmi: 14)

Also, Professor InSLec reflected on students' participation, referring to their responses to his jokes in the class. Students' laughter became behavior cues for him to monitor and assess effectiveness of the class. He recalled that:

> Students are co-operative today although someone's still talking there. Well, I saw their response. Sometimes they laugh, which means I made some kind of joke and it is suitable, at least, to wake up the students. Not get bored by those mathematics. Seems to me that they are ok. Most of them are following me. (InSLec: 28)

Secondly, professors reflected on students' attendance as a group, as Professor ExSTut recalled: "More people showed up. Tutorial is often not well participated because sometimes they think well it is doing an assignment. Today, like I said, it's before the mid-term test. I think that almost everybody is there." (ExSTut: 7) In their reflection, professors not only noticed students' attendance in a particular class but also noticed the trend of students' attendance in the course at large. "Well, I suppose that this year I was struck by good attendance. It varies from year to year. So I am pleased." (ExHLec: 9)

Thirdly, professors reflected on whether or not they had captured students' attention in the class." (InSLab: 9) Describing his impression of the class, Professor

ExHLec recollected that "I think the class went all right. There was no disturbance in the class. I could not hear it. I thought that everybody was attentive and following me. That is my impression." (ExHLec: 4) On the other hand, Professor ExHLec was careful enough to notice losing students' attention at the end of his lecture. He remembered that "Of course, their attention is beginning to go. It doesn't really matter because it was the impression. They don't have to remember that quotation." (ExHLec: 5)

Finally, professors thought about the noise level when reflecting on group behavior. Using noise level as an indicator of students' response, Professor InSLec reasoned that "Another important thinking is the class response. Usually, I know today is pretty noisy because either the content is not that interesting, or I have made some mistake, or I talk too much without any interaction with the class." (ExSLec: 60)

Apart from student behaviors as a group, professors reflected on behavior of individual students. They thought about individual students' responses and participation. Professor InHSmi reported that:

> There's one student who said nothing at all. Unfortunately, that student very rarely says anything. ... She did give a very good presentation last week. When she has something ready to give, she can do it. But she is tremendously shy and reserved for the moment. Hope that will improve. There's another student in the class who usually says nothing. But she spoke up a couple of times yesterday. I was pleased to see that. (InHSmi: 5-6)

Similar to their thoughts about students' behavior, professors reflected considerably more (93%) on learning outcomes of students as a group than on those of students as individuals (7%). Professors reflected on students' understanding or

performance as a group. For example, Professor InSLab reflected that he felt the most important thing was whether students understood and that he always tried "to be very conscious to the pulse of the students whether they are with me or not. I don't mind getting on tangents as long as it topic related." (InSLab: 64) Looking back at the previous classes, Professor ExHLec felt satisfied and he said that:

> As I said, I think, they were understanding the main lines of debates really quite well. In combination with our discussions of the previous weeks, I think, we've reached a very good grounding in the nature of the developmental environment in the 19th century Britain. (ExHLec: 22)

On a negative note, Professor ExHLec assessed students' performance and commented that: "I think their overall level of interest is high. As I said the level of achievement hasn't yet met." (ExHLec: 41)

Just as professors' reflection on individual students was intrigued by their outstanding behavior, so was Professor ExHLec's reflection on outstanding performance of an individual student. He reflected that:

> I was reading an essay very recently. It was making a particular point. . . . The student put it extremely well. So here it was an external stimulus which jelled my memory about an idea, which I try to get across, I think, probably every year, but which has always struck me as the significant point. (ExHLec: 73)

In summary, results reported in this section indicate that professors thought mostly about students' participation and about learning outcomes and that the majority of

their reflective thoughts were about students as a group. They did reflect on individual students when they noticed unusual behavior or performance.

Context. The last major dimension of professors' post-class reflection was context, the physical and social environments in which their teaching took place. Professors reflected more on physical settings (51%) than on social factors (47%) that were related to their teaching.

In the aspect of physical settings, professors thought about the size of the classroom (ExSLec: 33; InSLec: 27), types of classroom they preferred to teach in (ExSLec: 26; InHSmi: 37), and the number of students in the class (ExHSmi: 33; InHLec; 27; 32). Professors' thoughts on the physical setting were focused on the following three themes. First, they reflected on having nice classrooms or environments, in which both teachers and students enjoyed meeting each other. Like Professor InSLec, who felt satisfied with the present classroom (InSLec: 35), Professor ExHSmi described that "We are very fortunate of having a very nice physical setting, ... we are luckily in a place where you can look outside and we are having this astounding view. I think that the students enjoy meeting each other here." (ExHSmi: 27)

At the same time, professors complained about the inadequacy of the classroom setting (ExHLec: 27) and malfunctioning classroom lights (InHSmi: 37). "Because of the physical inadequacy, I think this is unfortunate in some way. The classroom basically is in the 19th century setting while we teach the course where the students are in the 20th century." (ExSTut: 21)

Professors reflected on the physical setting because they realized that "setting makes a huge difference" (InHLec: 35) in teaching and learning. They were concerned

that inadequate physical settings would hinder student learning: "basically the classroom needs to be updated. . . . It's not really good for the student because when the visual is not good who's suffering? It is the students." (ExSTut: 22)

Concerning social factors related to teaching, professors reflected on a wide range of issues. There was no single issue shared by more than three participants. Although thirty eight per cent (38%) of the total group thought about topics related to collegial and institutional influence. These thoughts belonged to two less experienced professors and were hardly representative of the group.

In summary, in the dimension of context, professors reflected almost equally on physical settings and social factors related to teaching. Their sporadic thoughts related partly to the inadequacy of the physical settings that had an impact on their teaching and on student learning and partly to different social factors, such as lack of time and communication, and insensitive community attitude, that contributed to an unsatisfactory social teaching environment.

What else did professor reflect on? Similar to the findings of the pilot study, the majority of professors' reflective thoughts fell into the four dimensions--content, teacher, student, and context--of an instructional situation (Schwab, 1978). Nevertheless, some issues that participants thought about fell outside these four dimensions, including, shortage of teaching staff (ExHLec; 63; InHSmi; 34), need for more sound mechanism for teaching evaluation (ExHLec: 49), priority of research over teaching (ExSLec: 43), and the effect of researcher's presence on students' performance (InHSmi: 14).

Summary. The results reported previously represent the content of professors' reflection. They demonstrate that professors thought about four dimensions--content,

teacher, student, and context--in their post-class reflection about teaching. Verbatim interview transcripts and frequency tables were used to display findings in each of the four dimensions. Professors were found to have reflected mostly on teacher aspect (51%), less, but equally, on content (15%) and students (15%), lesser on context (11%), and some on other issues (8%).

Results reported in this section suggest that professors' post-class reflection involves rational as well as intuitive feelings. Of the eight participants, Professor ExSTut contributed five per cent (5%) to the group thoughts, while the other participants contributed eleven (11%) to seventeen per cent (17%) to the group thoughts of the content of post-class reflection. The fact that Professor ExSTut was teaching a tutorial class might explain his lower contribution. The following pages describe the relationship of professors' post-class reflection to academic area, teaching experience, and the type of class they selected for the present study.

Incidental findings on Relationships of Professors' Post-Class Reflection with Academic Area, Teaching Experience, and Class Type

This secondary data analysis describes trends observed in the relationships of professors' post-class reflection with academic area, teaching experience, and the type of class they taught. Limited by the proposed research questions and the research design of the study, the purpose of this analysis was to facilitate the understanding of post-class reflection of the eight participants rather than to develop assertions that could be generalized elsewhere. To achieve this purpose, themes and patterns reported in Phase Two data analysis were examined in light of academic area, teaching experience, and class type. As in Phase One, this analysis also looked at characteristics and dimensions.

The participating professors from different academic areas and those with different levels of teaching experience were not different with regard to when their reflection happened, although there was a difference among those who taught different types of classes. Similarly, the professors with different teaching experiences and those teaching different types of classes reported no difference as to where their reflection took place. The location of reflection differed among the two groups of professors from different academic areas. The ways in which reflection unfolded was consistent across different groups of professors from different academic areas, with different teaching experience, and different types of courses. Therefore, the purpose of reflection varied consistently among different groups of professors from different academic areas, with different levels of teaching experience, and different types of courses. Lastly, different groups of professors from different academic area, and those teaching different types of courses expressed the same thoughts about the consequences of reflection, while professors with different teaching experience differed on this point. These similarities and differences suggest that in the context of this study, characteristics of professors' post-class reflection could be partly related to the three grouping variables.

In the aspect of content of reflection, different groups of professors from different academic area, with different levels of teaching experience, and teaching different types of courses, varied in all four dimension of reflection. This suggests that professors' post-class reflection, as observed in this study, could be influenced by academic area, teaching experience, and type of course.

Chapter V

Discussion

This final chapter of the dissertation restates the research problem and reviews the methods used in the study and summarizes major findings. These findings are then interpreted in light of the existing theories and research studies reviewed in Chapters I and II followed by a discussion of theoretical and practical implications of the findings. An integrated model of professors' post-class reflection is then proposed based on these discussions. The Chapter ends with addressing contributions of the study to knowledge, followed by recommendations for future research and a discussion of the potential application of this study to faculty development practice.

Restatement of the Problem and Review of the Methodology

As explained in Chapter II, the study reported here was a collective case study consisting of eight profiles of professors' post-class reflection. As a case study, this research primarily used a qualitative perspective, attempting to discern characteristics and content of professors' post-class reflection with a view of contributing to the current understanding of teacher thinking.

The case study relied primarily on interviews. The researcher interviewed the eight purposively selected full-time tenure-track professors for 28 to 45 minutes. Participants in the study were either experienced (23 or more years) or less experienced (6 or less years). They were faculty members and were teaching an undergraduate lecture, seminar, tutorial, or laboratory class in humanities or engineering. Each participant was observed teaching a one-to-three-hour class that he or she selected for the study and field notes of the observation were taken. Besides, descriptions of the course provided in the

course catalogue, course outlines, lecture notes, classroom handouts, and teaching portfolio were also collected as secondary data. The QSR NUD*IST 4 software package was used to manage and conduct thematic analyses of the interview data.

Overview of the Significant Findings of the Study

Significant findings of the study have been organized in the following three sections, parallel to the two phases of data analysis reported in the preceding Chapter: characteristics of professors' post-class reflection; content of the reflection; and incidental findings pertaining to the relationship of professors' post-class reflection with academic area, teaching experience, and class type.

Major Findings on Characteristics of Professors' Post-Class Reflection

The results of the study reveal that professors' post-class reflection entails a continuous process and becomes a routine, that it happens at different points of time, mostly right after the class. Understandably, the reflection occurs "all over the place," such as at school and at home. Professors' post-class reflection draws on a mixture of impression and intuitive feelings about the class and involves rational and logical thinking about how the class unfolds. Their reflection was responsive to what happened in the class or in the course in general and, therefore, takes place in varied, spontaneous, and unstructured ways. Professors engage themselves mainly in this process for the purpose of getting ready for the next class and for improving teaching in general. Their reflective thoughts lead to both cognitive and affective consequences. In the cognitive aspect, professors draw lessons from their classroom experience to adjust instruction for the next class and they adopt remedial strategies to improve the course for the next time. In the affective aspect, the participants report that their impression of and feelings about

the class often result in a strong impact on their mood or feelings. Their reflection leads to consequences related to their thinking, actions, or feelings as a teacher, indicating that professors' post-class reflection is oriented more toward themselves, i.e., the teacher rather than toward students.

Major Findings on Content of Professors' Post-Class Reflection

The findings on the content of professors' reflection indicate that professors think primarily about four dimensions--content, teacher, student, and context--in their post-class reflection. Professors reflect mostly on the teacher aspect (51%), on the content (15%) and students (15%), on context (11%), and some on other issues (8%). Findings on content of professors' reflection confirm that professors' post-class reflection involves rational thinking as well as intuitive feelings about the class.

Incidental Findings on Relationships of Professors' Post-Class Reflection with Academic Area, Teaching Experience, and Class Type

The secondary analysis of sorting the themes derived from the Phase Two data analysis provides some trends regarding the relationship of professors' post-class reflection with their academic area, teaching experience, and class type. Of the five characteristics of reflection, the participants from different academic areas and those with different levels of teaching experience reported no difference on when their reflection happened, while the two groups of the participants teaching different types of class differed on time of reflection. Similarly, the participants with different teaching experience and those teaching different types of classes reported no difference on where their reflection took place. But locations of reflection differed among the two groups of the participants from different academic areas. The ways in which their reflection

unfolded were consistent across different groups of the participants from different academic areas, with different levels of teaching experience, and teaching different types of class. They all engaged in rational thinking and intuitive feelings during the reflection. Conversely, the purpose of reflection varied consistently among different groups of professors from different academic areas, with different levels of teaching experience, and teaching different types of class. Lastly, different groups of professors from different academic areas, and those teaching different types of classes reported similar consequences of reflection, while the two groups of professors with different levels of teaching experience differed on this point. These similarities and differences showed that in the context of this study, characteristics of professors' post-class reflection were partly related to their academic area, teaching experience, and class type.

In the aspect of content of reflection, different groups of professors from different academic areas, with different levels of teaching experience, and teaching different types of class varied in the four dimensions of reflection, which indicated what professors specifically thought about in post-class reflection, as observed in this study, were related to academic area, teaching experience, and type of class they taught.

Interpretation of the Findings in Light of the Existing Theories

This section discusses the results of the current study in light of three existing theories outlined in Chapter I, which characterize teacher reflection as rational and analytical inquiry, spontaneous knowledge and action, and critical thinking.

Teacher Reflection as Rational and Analytical Inquiry

The results of the study demonstrate that professors' post-class reflection, as revealed through the participants, entails a cognitive process which invokes rational and

analytical thinking about the instructional processes. This finding concurs with Dewey's (1933) notion that reflective thinking is an inquiry process in which individuals collect observable evidence and reason through a problematic situation to find a solution.

The reflective thinking process, outlined by Dewey (1933), is useful in describing professors' post-class reflection in general. For example, the findings of the study indicate that professors' reflection entails an ongoing process that is closely linked with their planning for the next class and the course. They reflect deliberately on the class taught and make use of reflection to adjust their plans for teaching the next class or the course for another time. The integrative process of planning, enacting the plan, and reflecting on the results is iterative and cyclical. Professors' reflection is, consciously or unconsciously, driven by instructional goals and their reflection helps them to assess the effectiveness of their teaching in order to achieve the goals. Cognitively, professors' reflective thinking involves the process of moving from an uncertain problematic situation--gaps between instructional goals and outcomes of the class--to a settled, harmonious situation--a new teaching plan drawn from the lessons learned by thinking through the problems.

At the same time, however, Dewey's notion of reflective thinking seems too large a construct in describing the cognitive process of professor's post-class reflection in this case study. Dewey (1933) describes reflective thinking as a five stage linear process of confronting and identifying a problem, making hypothesis, and testing the hypothesis to solve the problem, with an emphasis on the links between the five stages. The findings of the study suggest that professors' post-class reflection is only part of a larger process of teacher thinking and that post-class reflection alone does not always entail a linear process of going through all the five stages of reflective thinking. For example, the

findings of the study reveal that professors might not have explicit goals to compare with the actual class outcomes. Often, they have to wait until the following year when they teach the class again to test lessons or hypotheses drawn from the previous class. Under this circumstance, professors' post-class reflection ends quite often with generating hypotheses rather than reaching solutions to the problem.

Similarly to Dewey's description of reflective thinking as an inquiry process, Boud, Keogh, and Walker (1985) put forward a three-stage model of reflection in the context of learning from experience. They suggest that reflection entails: (a) returning to experience, (b) attending to one' feelings, and (c) re-examining experience and adapting the new knowledge.

Boud et al.'s model appears useful in interpreting the data from the study. In contrast to Dewey's (1933) neglect of the affective aspect in teacher reflection, Boud et al. highlight the importance of the affective dimension and its interactiveness and interrelatedness with cognition in the process of reflection. The findings of the study clearly demonstrate that all participants draw on impressions and intuitive feelings in the reflection process and that post-class reflection is a mixture of both cognitive and affective processes. For example, the participants consciously think about effectiveness of their teaching and are sensitive to whether their instructional goals were achieved by referring to purposes of the class or the teaching plan. They think about importance of the subject for the class and intend to achieve class goals or goals for the course. At the same time, the participants attend to feelings as reference points to recapture and elicit the relevant experience. Drawing on feelings facilitates the analytical process of reflection. The findings from the study strongly suggest that all participating professors refer to their

feelings when reflecting on the class taught as well as when they assess the progress of the course and evaluate the effectiveness of their teaching.

On the other hand, the findings of the study suggest that the order of the first two stages of Boud et al.'s model could be reversed. The results of the study indicate that the participants tend to start post-class reflection by first referring to feelings about a particular event rather than by "returning to experience" and then referring to feelings, as suggested by the model. The results demonstrate that the participants used impressions and feelings as a pointer to focus their attention to understanding what contributed to the impression and feelings and explaining why such a feeling occurred.

Also, the findings of the study demonstrate that reflection right after class might be too soon for the participating professors to deal with negative affective reactions to the class just taught. For example, one experienced professor reported that he wanted to simply forget a bad class rather than acknowledge and remove "obstructive feelings" as suggested by Boud et al. (1985, p. 27). Apart from the time issue, this finding suggests that teacher reflection is a learned ability and implies that learning from reflecting on experience includes making positive use of negative feelings to improve professionally rather than simply react to one's impressions and feelings. In practice, professors need to develop abilities and skills to deal with negative feelings generated from unfavorable teaching experiences or from aggressive student behaviors in order to benefit from reflection.

Similar to Dewey's hierarchy of reflective thinking, Shulman (1987) has put forth a model of pedagogical reasoning to describe cognitive processes occurring to teachers. Shulman suggests that reflection, one of the six dimensions of the pedagogical reasoning

process, includes "reviewing, reconstructing, reenacting and critically analyzing one's own and the class's performance, and grounding explanations in evidence" (Shulman, 1987, p. 15).

The findings from the study support Shulman's view that teacher reflection entails a retrospective cognitive process in which teachers recall, review, and learn from their experience (e.g., InSLec: 18; ExHLec: 42). The findings clearly indicate that participants engage in reflection after the class and at the time they are preparing for the next class. They rationally go through what has happened in the classroom and try to learn from that experience to improve teaching. This retrospective, cognitive process differs from teachers' on-site decision making, as suggested by Schön's conception of reflection-in-action.

On the other hand, Shulman's model implies that teacher reflection is a linear process in which teachers engage in sequences of rational thinking without taking account of affective factors. The data generated in this study do not support this framework. As discussed above, professors' post-class reflection as revealed in this study involves both rational and analytical thinking as well as impressions and intuitive feelings. Shulman described teacher reflection as looking "back at teaching events, the emotions, and accomplishment" (1987, p. 19). However, teachers' affect was treated implicitly and was regarded as an embedded part of the model. In contrast, findings of the present study indicate that affective factors play as important a role as rational and logical factors in the participating professors' post-class reflection. To have a better understanding of teacher reflection, teachers' affect needs to be attended to more carefully.

Frameworks put forth by Dewey (1933), Boud et al. (1985) and Shulman (1987) provide a useful approach to understanding teacher reflection as a rational and analytical inquiry process. This perspective is supported by the data from the present study which show that professors' post-class reflection entails a cognitive process in which the participants subject their own behavior to a critical analysis and take responsibility for their actions in comparison with their predetermined instructional goals. At the same time, the results show that a broader view of teacher reflection is needed, one that goes beyond the assumption that teachers always use logical, rational, step-by-step analyses of their own teaching and the contexts in which that teaching takes place. The following section offers interpretation of findings that views:

Teacher Reflection as Spontaneous Knowledge and Action

Based on the epistemology of practice, Schön (1983) developed the notion of reflection-on-action, which includes recalling past enactment, gaining insight from experience, and bearing implication to future action. Similar to the stages of reflection outlined in the rational and analytical perspective, reflection-on-action aims to explore and verify new knowledge developed during the process of reflection-in-action, rather than to find solutions to a problem.

Schön's (1983; 1987) notion of reflection-on-action and its underlying epistemology are useful in interpreting results of this study. First, the concept of practical knowledge appears to shed light on the process of the participants' acquisition of professional knowledge from teaching experience. Unlike teachers in lower education, professors in higher education usually receive little formal pedagogical training (Kagan, 1992; Ramsden, 1992) and they have to draw on their knowledge of teaching from

practice (Kugel, 1993; Shulman, 1987). The findings from this study support this approach of professional knowledge construction among the participants. For instance, the study found that the participants tended to rely on their own experience rather than drawing on instructional theories and educational research in improving teaching. There was little collegial conversation about teaching and learning even among professors teaching different sections of the same course in the same department. On the other hand, the participants deliberately and consciously drew lessons from their own teaching experience. For example, they made notes to themselves for improvement of teaching, indicating that they tried to glean practical knowledge of teaching from a grounded approach and that they make efforts towards eliciting tacit knowledge into explicit format (Sternberg & Horvath, 1999).

Second, the results of the study support the notion of reflection-on-action and its function as a metacognitive process in helping the participants explicate the action, assumptions, models of world, or problem-settings that are implicit in reflection-in-action (Schön, 1983). For example, Professor InSLec reported his delight of finding a ruler to be a useful model in explaining a complex engineering concept, which he had never used before when teaching to university students. He reflected on this experience after the class and reported it as one insight that he had gained from teaching the class. Encouraged by the seemingly positive effects of this strategy, he was thinking of using it again in the future. This example supports Schön's (1983) description of reflection-on-action and demonstrates that the participants reflected on teaching to sharpen their knowledge in order to understand the complex phenomenon of teaching rather than to find solutions to the problem.

Third, the collective case study data support Schön's notion of tacit knowledge and show that the participants reflect on the complex practice of teaching, which was "full of uncertainty, uniqueness, instability, and value conflict" (Schön, 1983, p. 42). Understandably, their reflection entails not only processes of logical and analytical analyses of their teaching behaviors and explicit thoughts that could be readily represented in language, but also processes that are implicit and existing in their hard-to-explain impressions and feelings. For example, when asked about their way of reflecting on the class, three participants (ExHLec, ExSLec, & InSLab) were unable to describe their way of reflection in a straightforward fashion. The other five participants clearly stated that their reflection involved non-rational factors such as emotions and impressions of the class, which is consistent with the finding of the pilot study (Cao & Saroyan, 2000). Since professors are usually well-trained in scientific thinking and they consciously engage themselves in reflecting on classes, this result indicates that strictly logical thinking is not always the way that they think about classes (Sternberg & Caruso, 1985).

Finally, Schön's notion of reflection as spontaneous knowledge and action appears useful in describing professors' post-class reflection in this study. For example, professors were found to rely heavily on their impressions and intuitive feelings in reflection. The non-rational processes seemed important for the participants to locate meaningful and relevant points to initiate reflection. In fact, the participants rarely allocated a period of time to sit down and reflect on classes. They tended to assess effectiveness of a class through their impression and feelings about it. They were not always able to clearly articulate what they learned from a particular class and to provide a specific rationale for

decisions to change their teaching approach. During teaching, the process of sensory perception, interpretation of the information, and action or reaction to a specific teaching event played an important role in the participants' everyday teaching and their knowledge acquisition process. Their non-rational tacit knowledge of teaching became a major source to draw on in order to improve teaching.

Teacher Reflection as Critical Thinking

Based on Dewey's (1933) epistemology of inquiry and Habermas's (1971) critical philosophy, Mezirow (1990) describes teacher reflection as critical thinking. He suggests that critical reflection entail a transformative learning process in which individuals critically examine presuppositions that constrain their understanding of the world, reformulate their perspectives, and make decisions upon the new understanding.

Mezirow's (1990) critical perspective on reflection appears useful in interpreting the study results. Professor InSLec's reflection on his use of a ruler as a model in explaining a complex engineering concept to university students seemed to be such an example. Reflecting on this experience, Professor InSLec realized his presupposition--that university students were intellectually sophisticated enough and that he needs not to use simple ways to explain engineering concepts at the university level--needed to be adjusted to improve his teaching. Triggered by this specific teaching incident, Professor InSLec obviously engaged himself in a process that involved critical examination of his belief that had been guiding his teaching practice for 3.5 years of experience. This critical examination made him realize that it was his unreflected assumption about university students and university teaching that had constrained his understanding of the teaching and learning process and prevented him from using alternative strategies in teaching.

The positive effect of the new teaching strategy and his critical reflection helped modify his perspective on university teaching and learning and encouraged him to test the newly formulated assumptions in future teaching. As a result, critical reflection led Professor InSLec to pose a new problem of testing his adjusted assumption in future teaching practice rather than simply finding a solution to an existing problem.

In summary, this section discussed the study results in light of Dewey's (1933) and Schön's (1983) theories that focus on cognitive processes of teacher reflection and Mezirow's (1990) critical theory that highlights transformation of one's belief systems through the process of teacher reflection. These theories appear useful in interpreting results of the study in general. However, they provide different perspectives on teacher reflection and each theory sheds a different light on teacher reflection that is evidenced in the study. Taken together, this discussion indicates that teacher reflection, as a complex phenomenon, demands multiple theories to explain. This integrated perspective offers the potential for a more holistic understanding of teacher reflection and is further explained through the following discussion of the study results in light of the existing research studies on teacher reflection.

Interpretation of the Findings in Light of the Existing Research Studies

This section discusses results of the current study in light of the existing research studies, using three organizational categories outlined in Chapter II.

Epistemological Traditions In Research On Teacher Reflection

Conceptualizing teacher reflection as a cognitive process, or as a critical thinking process, represents two epistemological traditions that have guided current research on teacher reflection. The cognitive tradition highlights the central role of teacher knowledge

in teacher reflection while the critical tradition emphasizes social and contextual factors in examining teaching. Recent studies carried out within the cognitive tradition have viewed teacher reflection as pedagogical reasoning, in the context of expert-novice differences, and as metacognition. In the following section, the results as they pertain to each category are discussed.

Teacher reflection as pedagogical reasoning. Based on the view that teaching is a complex cognitive process, research on teacher reflection as pedagogical reasoning has focused on the role of teacher knowledge in developing teachers' pedagogical reasoning skills (Grossman, 1990; Shulman, 1987; Wilson, Shulman, & Richert, 1987). The results of the present study reveal characteristics of professors' post-class reflection that support Shulman and his colleagues' description of reflection as part of the teacher's pedagogical reasoning process and the way in which teachers develop knowledge of teaching through reflection. For example, the results show that when the participants engage in post-class reflection, they reflect on the content of the class, on instructional strategies they used in teaching, academic and social context of their teaching, and particularly on student learning outcomes. This reflective process enables the participants to draw on their thinking in organizing content and selecting instructional strategies, on recalling and reviewing the instructional process, on evaluating the effectiveness of the class, and on deriving new knowledge or hypotheses about teaching. These characteristics of reflection support the hierarchical but interlocking relationship between six aspects of Shulman's (1987) model of pedagogical reasoning and action.

Second, the results support Shulman et al.'s (Grossman, 1990; Shulman, 1987; Wilson, Shulman, & Richert, 1987) characterization of teacher knowledge. In fact, a

preliminary coding scheme (Appendix G) based on Shulman's categorization of teacher knowledge was very useful in coding the interview data, presenting the analysis results, and understanding professors' post-class reflection. In the order of importance, the participants were found to have drawn on knowledge of students, pedagogical knowledge, content knowledge, pedagogical content knowledge, and curricular knowledge in their post-class reflection. This finding indicates that the types of teacher knowledge outlined by research on teachers' pedagogical reasoning, carried primarily out in primary and secondary contexts, are useful in understanding professors' reflection in particular and thus applicable to the context of higher education in general. Further studies on how professors develop different types of teacher knowledge would be a next step in promoting professors' reflection.

Expert-novice differences in teacher reflection. Because of the ill-defined nature of teaching, current research still faces the challenge of defining expertise in teaching. In the research literature on teaching, pedagogical expertise has quite often been defined directly in terms of years of teaching experience (e.g., Borko & Livingston, 1989; Borko, et al., 1992; Carter, et al., 1987; Westerman, 1991). It is believed here that expertise in teaching should not be confused with experience. Paradoxically, expert-novice research, that has been plagued with its own difficulties in defining expertise, demonstrates that mere experience will not make teachers reflective practitioners. There are too many experienced teachers who have not become expert at their craft, who do not carefully think about their work, or try to constantly improve (Berliner, 1988; Kagan, 1992; Sternberg & Horvath, 1995). It is assumed here that apart from a lack of motivation for pursuing professional excellency in teaching, awareness of the importance of teacher

reflection and mastery of techniques that facilitate the reflection contribute to this experience and expertise dilemma. Nevertheless, the selected studies, reviewed in the section of expert-novice differences in Chapter II, are relevant for discussion of the results of the current study. These studies share with the present study in using teaching experience as a criterion in selecting participants.

Although the purpose of the study was not to compare experienced and less experienced professors, the results of this study provide some evidence that suggest there might be differences in the reflection patterns of the two groups of professors. On the one hand, the results of the current study support the expert-novice difference research. First, the current study shows that the experienced professors generate more reflective thoughts on different types of teacher knowledge than the less experienced professors (See Table 7). This result is consistent with the finding that expert teachers differ from novices in having extensive, well-developed, and readily accessible knowledge (Borko & Livingston, 1989; Borko, et al., 1992).

Second, the results of the study are consistent with the finding that experienced teachers are more coherent in their thinking about planning, teaching, evaluation and reflection, (Westerman, 1991). The experienced professors engaged in reflection primarily for improving teaching in general, while less experienced professors reflected when preparing for the next class (See Table 6). It seems that the experienced professors engage themselves in reflection with larger or more general goals in mind while the less experienced professors tended to reflect in order to deal with teaching on a day-to-day basis.

Third, the experienced professors were found to have different purposes for reflection and their reflection led to different consequences from those of the less experienced professors. The experienced professors were concerned more with student learning whereas the less experienced professors were concerned more with themselves as teacher, the purpose of the class, and physical and social contexts of teaching.

Fourth, the experienced professors of the study were found to generate more reflective thoughts in the dimensions of content and student, while the less experienced professors were found to have generated more reflective thoughts in the dimension of teacher and context. This finding is consistent with those of the expert-novice research that knowledge is a determinant for teacher reflection (Borko & Livingston, 1989; Carter, et al., 1987; Winitzky, 1992) and that experienced teachers engage in more reflection and metacognition (Kagan, 1990; Rahilly & Saroyan, 1995). The possible explanation for this finding is that experienced professors might have developed modularized routines in teaching (Leinhardt and Greeno, 1986; Sternberg & Horvath, 1995) that reduced the amount of information processing in their reflection. This automated thinking (Leinhardt, 1986) enabled them to concentrate on a few selected areas such as achieving their goals of teaching. A closer look at the content of reflection shows that the less experienced professors were concerned more with effectiveness of one particular class, themselves as teachers, and use of teaching strategies, while the experienced professors thought more about student learning and class content.

On the one hand, the study results do not support the finding that expert teachers are more flexible in teaching, which was found in other expert-novice research (e.g., Borko & Livingston, 1989; Borko, 1992; Leinhardt, 1992; Shulman, 1987; Westerman,

1991). In fact, data dealing with flexibility of teaching were generated by three less experienced professors in the present study and presented a mixed picture on flexibility of their teaching. One less experienced professor teaching history and one teaching an engineering course appeared to have little flexibility in their teaching. They reflected that once they started teaching they had to carry out the prescribed teaching plan and use examples that they had prepared before the class. They thought that the new ideas were too late for the class that already started, though they were open to alternative methods of teaching the class and were willing to try new ideas in the future classes.

In contrast, another less experienced professor also teaching in engineering reported greater flexibility in teaching. He reflected on changing the teaching plan by constantly checking on student learning during the class and adopting new teaching strategies accordingly. This is more in line with expert practice reported in the literature (e.g., Leinhardt, 1992; Shulman, 1987). The fact that this professor had six years of teaching experience could have brought him closer to the experienced end of the continuum.

These conflicting results may also be explained by the controversy over the characteristics of expertise. In the expert-novice research, pedagogical expertise is primarily based on data collected from teachers in primary and secondary education. Inflexibility of teaching was attributed to teachers' lack of subject content knowledge (Shulman, 1987). However, unlike their counterparts in lower education, professors are typically experts and usually do not lack content knowledge they teach. They need to develop pedagogical knowledge, a comprehensive view of the classroom, and the knowledge to connect components of the lesson to students' prior knowledge in order to

improve teaching. Although research has started exploring teacher knowledge and expertise in higher education (e.g., Gendron, 1995; Rahilly, 1997), more efforts are needed to establish clear criteria for the expert pedagogue and for the promotion of pedagogical expertise in higher education.

In summary, the previous discussion suggests that the results of the study support the relationship between teacher reflection and knowledge outlined in the existing research literature. The experienced professors tend to think more generally about improving teaching and concentrate on content and student learning, while the less experienced professors tended to reflect more specifically on a particular class and concentrate on management of teaching.

Teacher reflection as metacognition. Viewing teacher reflection as part of the regulative processes of instruction, two groups of researchers (Artzt & Armour-Thomas, 1998; McAlpine et al., 1999) conceptualized teacher reflection as metacognition and produced research results that are consistent with findings of the current study. For example, the present study found that the participants engaged in reflection intentionally and in a continuous way, that they reflected not only after class but also during the class, and that they made no clear distinction between reflection on the class taught and their planning for the next class. This continuous regulative process of planning, monitoring, and assessing the instructional process appears to be a nice fit to the metacognitive process that Artzt and Armour-Thomas (1998) described. It highlights the interrelationships of knowledge, beliefs, and goals with teachers' preactive (planning), interactive (monitoring and regulating), and postactive (assessing and revising) thought processes.

On the other hand, the present study shows that in the postactive thinking process, the participants not only assessed effectiveness of the class or the course and used the results to revise their future teaching plans, but they also derived practical knowledge of teaching from the thinking process. For example, Professor InSLec reflected on his experience of using a ruler to simulate a concrete beam in order to explain an engineering concept. He drew practical knowledge from the reflection that it is useful to use a tangible model in lecturing and that university students need help to understand complex concepts.

Second, this finding suggests that Artzt and Armour-Thomas's model (1998) could describe the metacognitive process of teacher thinking more accurately if learning from reflection or knowledge derivation were included as an additional aspect in the postactive process. The description of the new comprehension aspect in teacher pedagogical reasoning process (Shulman, 1987; Wilson, Shulman, & Richert, 1987) lends support to this modification.

Third, the results of the current study support teacher reflection as a formative evaluation process. In their study of the reflection of six outstanding mathematics professors, McAlpine et al. (1999) report that teachers monitor instructional action and make decisions about teaching in accordance with their goals and under regulation of their knowledge. In the present study, the participants were found to consciously assess effectiveness of the class and draw lessons from the teaching experience to prepare for the next class or to improve the course. Professors' reflection after a class seemed to serve as summative evaluation to the class taught, and at the same time it definitely functioned as formative evaluation for the course.

Fourth, the results of the present study are consistent with McAlpine et al.'s (1999) findings that the participants engaged mostly in the practical sphere of teacher reflection. They focused on improving actions in a particular class or course, engaged themselves less in the strategic reflection to generalized knowledge or approaches to teaching that were applicable across contexts. The consistency of the findings could be further explained with the data from the present study. The participants reflected on the class mostly for preparation for the next class or for the next time they would teach the same class and that they draw new knowledge from both rational thinking and intuitive feelings.

Similar to McAlpine et al.'s study, the results of the current study do not support the sphere of epistemic reflection--a cognitive awareness of one's reflective processes, which influence reflection and enactment of plans--described in McAlpine et al.'s (1999) metacognitive model of reflection. Similarly, the present study has found that the participants were either not aware of, or were unable to characterize their way of reflecting on the class. This finding indicates that professors are occupied with or even overwhelmed by their day-to-day business of teaching without developing abilities that enable them to consciously regulate their thinking process about the classes. Finding ways to develop professors' metacognitive abilities, particularly the second order ability to regulate their reflection, seems to be the logical next step in research on teacher metacognition.

In summary, with minor adjustment to the two models of metacognitive reflection, the current study results support findings of studies by Artzt & Armour-Thomas (1998) and McAlpine et al. (1999) of teacher reflection as metacognition. The

results also support their description of reflection as a dynamic cognitive process in which teachers perform formative evaluation to regulate their teaching and draw practical knowledge from this metacognitive process.

Teacher Reflection as Critical Thinking

Research on teacher reflection as critical thinking is different from research on teacher reflection as cognition. It focuses on the examination of the experiences, values, and goals of teachers in terms of their social-political implications. One branch of research on teacher reflection focuses on the external effect of teacher reflection, which looks at the social conditions in which the instructional activities are situated and the social consequences of teaching (e.g., Gore & Zeichner, 1991; Ross, 1989; Zeichner & Tabachnick, 1982). Since the current study was based on the cognitive tradition of research on teacher thinking, it did not produce data that specifically address the aspect of teacher reflection in terms of the social conditions or consequences of teaching.

Nevertheless, the results of the current study yield support to the second branch of research of teacher reflection as critical thinking, which looks into the internal process of clarifying implicit personal assumptions and changing one's existing conceptions. For example, the current study collected considerable amount of reflective thoughts from the participants of their roles as a teacher, their conceptions of teaching and learning, and the meaning of good teaching. These are the issues that Boyd and Fales (1983) studied about ways individuals learned from reflecting on experience.

The current study results are consistent with Boyd and Fales's finding that reflection serves as a process that helps individuals clarify meaning in terms of self and lead to possible conceptual change. These results demonstrate that the participants'

teaching practice is guided by their explicit and implicit principles of teaching (e.g., ExSLec) and that reflection could serve as a mechanism in changing their presuppositions or unexamined assumptions about learning and teaching (e.g., InSLec; InHLec). In general, the results of this study indicate that teacher reflection could entail a cognitive as well as an emancipatory process that helps one examine and change his or her own unexamined assumptions. This finding bears significant conceptual and methodological implications for researchers who attempt to promote teachers' conceptual change.

Research on Pre-Service Teachers' Reflection

Recent research on teacher reflection has been conducted and applied largely in the context of pre-service teacher education. In comparison with university professors, however, student teachers play the role of apprentice teachers, who take responsibility of teaching for a relatively short period of time under supervision of an in-service teacher. These individuals typically have less teaching experience and less sophisticated subject content knowledge. Their reflection appears somewhat different from the professors' reflection in this study. For example, a previous study that investigated four science student teachers' professional development in a 13 week practicum concluded that students teachers reflected upon ownership of their practice, pupil's way of learning, and saw practice through the eye of the supervisor (Clarke, 1992). The present study yields a very different portrait of professors' reflection that focuses mostly on the teacher dimension, particularly on the use of teaching strategies, on content and students, and on the physical and social contexts of instruction. Unlike student teachers' reflection that was concerned mostly with relationships with their supervising teachers, professors usually

have no partners in teaching and their reflection focuses primarily on the instructional processes designed by themselves.

Notwithstanding these arguments, the results of this study share similarities with the findings that teacher reflection is related to different contexts and that teacher reflection varies in forms, focus, and intensity. Moreover, lack of time, the administrative climate, and personal risk are three major constraints for reflection as outlined by a study of teacher reflection in three mentor-beginning teacher pairs (Wildman et al.,1990). The results of the study clearly demonstrate that professors lacked time for reflecting on their class, because of their busy schedules and multiple responsibilities. The department and the university are not particularly fostering an environment for collegial discussion about teaching, and that professors are prone to use traditional instructional methods such as lecture in order to have better control of the instructional process rather than to adopt innovative strategies in teaching. Research needs to address these important issues in order to promote reflective teaching and improve the quality of teaching and learning in higher education.

In summary, the discussion indicates that although teacher reflection entails different formats and meaning in different contexts, research on different populations and aspects of teacher reflection can inform, and be informed by, each other. This body of literature casts light on different aspects of teacher reflection and demonstrates that teacher reflection is a complex phenomenon that requires a considerable amount of inquiry.

Research on In-Service Teachers' Reflection

Research on in-service teachers' reflection focuses on improving the teaching practice. This is different from research on pre-service teachers' reflection that aims at reforming teacher education programs. Understanding the cognitive process of in-service teachers' reflection provides the potential of helping in-service teachers become reflective practitioners (Calderhead, 1991; Mitchell & Marland, 1989; Zeichner & Liston, 1996) and learn better from their teaching experience (Borko & Putnam, 1996).

Previous studies of in-service teachers' reflection studied reflection of teachers at both lower and higher education levels. This body of literature confirms the complexity of teacher reflection as revealed in research of pre-service teachers' reflection (Clift, et al., 1990; Munby & Russell, 1992; Valli, 1992; 1997). It is also partly supported by the results of the present study. For example, the results of the current study are consistent with Lowyck's (1978) characterization that teachers' reflective thoughts are not connected or organized chronologically but are situation specific. Their planning and post class reflection are closely tied together and there is no clear distinction between planning and reflection: that teachers seldom reflect on past classes systematically, write down their post-class reflective thoughts, or express them explicitly.

While characteristics of elementary teachers' post-lesson reflection outlined in Lowyck's (1987) study appear to be a perfect fit with the results of the present study, content of reflection in Lowyck's study somewhat differs from that of the present study. For example, Lowyck's study shows that the content of elementary teachers' post-interactive reflection included individual pupil, class group, teacher behavior, other people, organization, and lesson content. However, the present study suggests that the

participants reflect primarily on behavior and learning outcomes of students as a group, and that unlike teacher reflection in lower education, their reflection rarely involves other people such as parents. The above two examples show that while teacher reflection presents some generic characteristics across different groups of teachers, each group also bears its own characteristics and focus in reflection.

This point is underscored by the fact that results of this study both confirm and contradict Irby's (1992) findings. He conducted a qualitative study on instructional decision making process of six distinguished physician-professors. On the one hand, the results of the study are consistent with Irby's (1992) findings that the participants deliberately engage themselves in a continuous process of previewing lesson plans, monitoring instructional process, and evaluating the class in order to plan for the next class. Their reflective thoughts pertain to teaching, themselves as teacher, the learner, and class content.

On the other hand, there seems to be a difference in the description of nature of reflection between this study and Irby's finding (1992). Irby (1992) found that physician-professors' reflection entailed a rational and analytical process of problem solving, and that this process applied only to the planning and reflective aspects, but not to the interactive dimension of reflection. In contrast, the present study demonstrates that the participants' reflection involved rational thinking as well as intuitive feelings, that their post-class reflection is not always rational and analytical, and that affect plays a significant role in post-class reflection. The above discussion indicates that teacher reflection is a complex construct and it entails different characteristics and foci in different phases of reflection among different groups of in-service teachers.

In summary, this discussion demonstrates once again that no one approach provides a comprehensive view of teacher reflection and that an integrated view of teacher reflection is needed for better understanding of teacher reflection. In the following section, an integrated view of teacher reflection is offered and discussed.

Theoretical Implications of the Study

The results of the study suggest that professors' post-class reflection is a complex phenomenon, which involves different types of information processing routines. For example, in their post-class reflection, the participants reported consciously assessing the effectiveness of their class in light of their instructional goals. This finding indicates that professors' post-class reflection involves rational and analytical information processing. It confirms Yinger's (1990) notion of "conversation of practice" that "involves the careful alignment of goals and means in the design, action conforming to the design, and thoughtful analysis and evaluation of the outcomes" (Yinger, 1990, p. 84).

Also, the results of the study show that professors' post-class reflection involves non-rational processes in interpreting data and making decisions about teaching. The participants were found to unanimously rely on impressions and intuitive feelings in post-class reflection. Sometime, the intuitive feelings were so strong that they circumvented rational thinking. For example, Professor ExSLec reported that sometimes he just wanted to simply forget about the bad class and go on teaching the next class without rationally analyzing what caused the class to be so bad. This finding indicates that non-rational processes play an important role in professors' post-class reflection. It also confirms the observation that much of everyday classroom teaching relies on teachers' non-rational behavior (Clandinin & Connelly, 1987; Elbaz, 1983; Schön, 1983).

Obviously, it is important to give serious attention to this alternative way of teacher thinking. This is simply because professional knowledge consists of more than that which can be told or written on paper (Sternberg & Horvath, 1999) and that professional learning is something more than a process of using "rules" to make decisions about how to behave in a classroom situation (Russell et al., 1988). Teachers' non-rational information processing might explain expert teachers' masterful execution of "teacher routines" (e.g., Clark & Yinger, 1979; Leinhardt, 1986; 1987). The expert teachers might intuitively react to different cues and make decisions on whether or not to activate "programmed" strategies, making it possible for them to deal with a great many different stimuli at the same time (Day, 1984).

Taken together, the results of the study suggest a broader view that integrates both rational and non-rational perspectives on teacher reflection. This integrated view of teacher reflection rejects the dichotomous thinking that is pervasive in the current discussion of teacher reflection. Originated from Dewey's (1933) notion of reflective thinking, most conceptualization of teacher reflection and reflective teaching are based on the logical and analytical approach of information processing in teaching (Korthagen, 1993). The rational perspective of teacher reflection is important and has proven to be useful in understanding teacher reflection, promoting reflective teaching, and facilitating teachers' professional development.

However, rational thinking is not the only way in which teachers process information and direct decision-making in teaching practice and good teaching should not be determined only by rationality. The results of the study show that during actual teaching, the participants do not have enough time to reflect on all their decisions, often

not even after the class is over. Over emphasis on a one-sided view of rational and analytical thinking may leave professors with a feeling of inadequacy and a sense of nonprofessionalism in teaching which is disadvantageous for teacher development.

On the other hand, the results of the study suggest that non-rational information processing plays an important role in everyday teaching though it is neither the only nor a better way to promote teacher reflection. The current study was not designed to compare teacher reflection based on rational thinking (Dewey, 1933) with that based on "epistemology of practice" that has been forwarded by Schön (1983) as a more relevant and a better way of thinking. The results suggest an interrelated relationship between rational and non-rational information processing in teacher reflection. This finding suggests that becoming aware of the non-rational aspects of teacher reflection may complement rather than opposing the rational approach.

In summary, the results of the study suggest that a better understanding of the "continuous interplay" (Shulman, 1988) between cognitive and affective factors in the process of professors' reflection would increase our understanding of teacher reflection and promote reflective practice in higher education.

Conceptual Framework: Two Modes of Professors' Post-Class Reflection

A conceptual framework of Two Modes of Professors' Post-Class Reflection is proposed here to depict teacher reflection as interrelated rational and non-rational information processing. Although the aim of the study was neither to test nor generate a model for professors' post-class reflection, the findings can be summarized parsimoniously in this format.

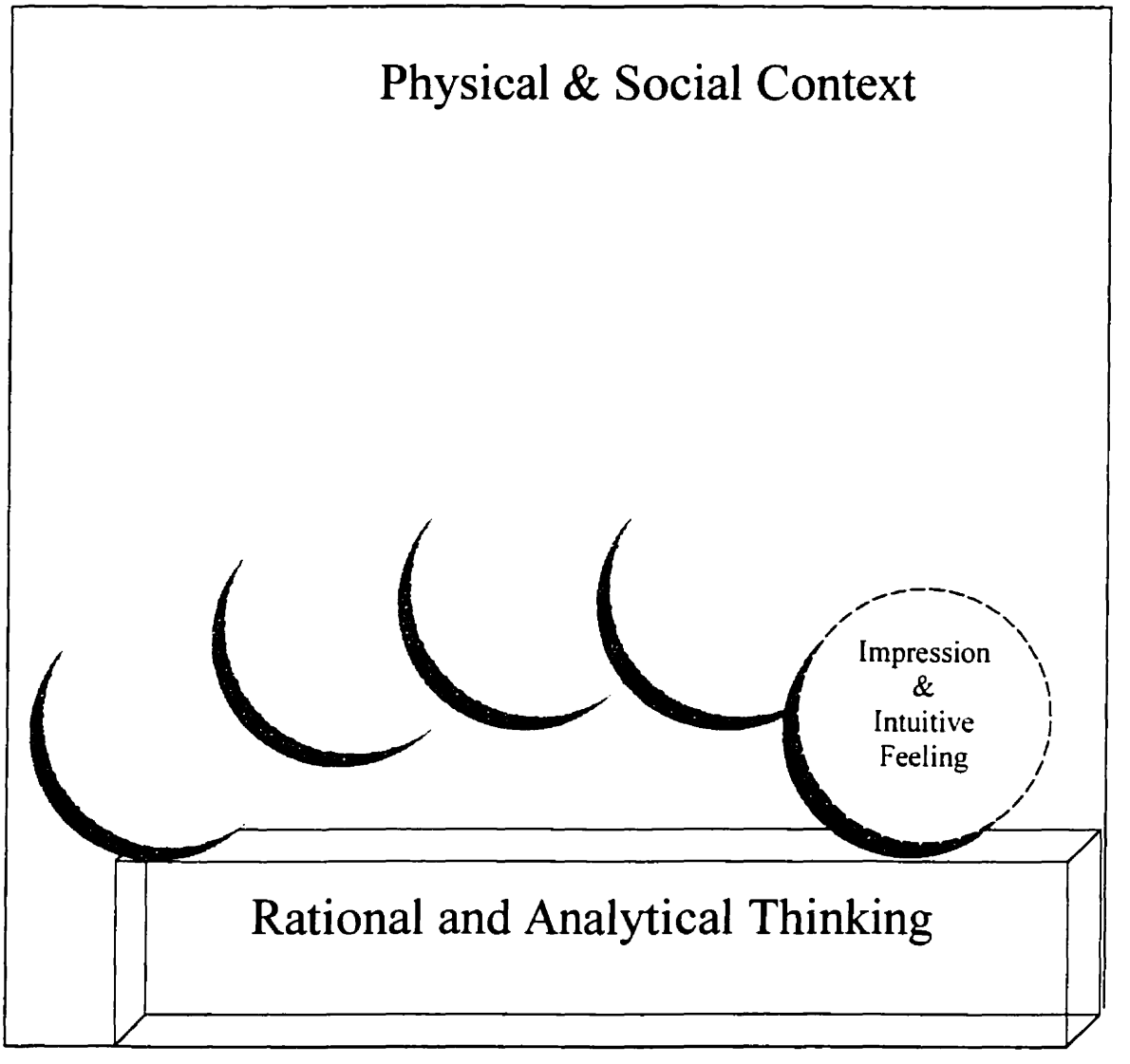

Figure 1. Professors' Post-Class Reflection as Interrelated with Rational and Non-Rational Information Processing.

Figure 1 depicts the relationship of the components of professors' post-class reflection. The solid box at the bottom depicts the rational mode of professors' post-class reflection. It suggests that professors' post-class reflection entail a linear and logical cognitive process in which they rationally and analytically reflect on planning, implementation, and evaluation of their instruction.

The moving circles superimposed or above the solid box depict the non-rational mode of professors' post-class reflection. They suggest that professors' post-class reflection also involves non-rational elements such as impressions and intuitive feelings that may accompany the rational mode of reflection. The dotted line of the circles indicates that relative to the rational and analytical mode of reflection, the non-rational mode of professors' post-class reflection is flexible and vague in shape. Different positions of the moving circles suggest that the non-rational mode of reflection may take place in such a way that it can supersede the rational mode of reflection. This is when professors use impressions and feelings as a reference point to logically analyze the class, or when the emotions and feelings are so strong that they circumvent the rational mode of thinking.

Together, the two modes of reflection represent a dynamic process of professors' post-class reflection that takes place in a context, depicted as the larger box that holds the rectangle and the circles. The results of the study indicate that this context consists of physical and social factors that relate to the class. The integrated model of professors' post-class reflection emphasizes a broader view in understanding professors' post-class reflection, which is different from the existing theories and models of reflection.

Contributions to Knowledge

The contribution of this study is primarily theoretical. The results of the study indicate that professors' post-class reflection is a complex phenomenon. By examining characteristics and content of professors' post-class reflection, the study reveals that the participants engage in rational and non-rational modes of thinking when they reflect on classes. The Conceptual Framework of Two Modes of Professors' Post-Class Reflection extends our understanding of teacher reflection beyond the dichotomous thinking about teacher reflection in current literature (Shulman, 1988). In particular, it provides insights into the complexity and dynamic nature of teacher reflection. It also highlights the fact that teacher reflection is an important and worthwhile construct that requires further rigorous inquiry. The findings of the study can be used to help educational researchers and practitioners develop a better understanding of teacher reflection and promote reflective teaching.

Recommendations for Future Research

Although there have been a few studies of teacher reflection in the context of higher education (e.g., Irby, 1992; Gendron, 1995; McAlpine et al., 1996; 1999; Rahilly & Saroyan, 1995), research on this topic remains largely an uncharted area. The results of the study confirm the need for a better understanding of teacher reflection. One way of addressing this need is use the model presented above in order to elaborate a methodology to map the relationship between the rational and non-rational modes of reflection. For instance, exploring differences between novice and expert teachers in terms of when they engage in each mode of reflection or what precipitates and constrains

each mode of reflection could provide useful information for faculty development activities.

Another way to verify the model and to overcome the limitations of the present design and sampling strategy is to make in-depth multiple observations of post-class reflection of one participant for a longer period of time. The depth of the longitudinal design would complement the comprehensiveness of the present study in identifying characteristics and content of post-class reflection among professors.

Although the purpose of the study was not to ascertain the relationships of professors' post-class reflection with academic area, teaching experience, and the type of class they teach, future studies could look into this area on the basis of the incidental findings reported in this study. For example, quantification of the qualitative data (Boyatzis, 1998; Kuckartz, 1995; Yin, 1993; 1994) of a larger sample and the Log-Linear Model (Stevens, 1996) could serve as alternative means to statistically identify these relationships of different groups of the participants.

Implications for Faculty Development

Although the primary goal of this study was to contribute to theoretical knowledge in the area of teacher reflection in the context of higher education, findings could be useful to practitioners in understanding the information processing of teacher reflection. As the results of the study show, the complexity of professors' post-class reflection is in direct contrast to the notion that teaching is a set of behavioral skills. This understanding suggests that faculty development intervention programs need to transcend mere training in the use of specific behavior competencies and should address content and procedural characteristics of teacher reflection.

Methodologically, faculty development interventions can benefit from using techniques that capture both rational and non-rational modes of teacher reflection and evoke professors' internal motivation for continuous professional development. For example, faculty developers could make the intervention programs more appropriate and effective by avoiding imposing criteria of good teaching suggested by the literature and drilling professors to conform to this checklist. Instead, they could use techniques such as the critical incident techniques (Flanagan, 1954) to encourage professors to reflect on their personal experiences, explicate their thinking and express their feelings, and find solutions by themselves to resolve problems they encounter in teaching.

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Appendix B: Advance Letter to Participant

Your Thoughts on Teaching:

A Research Project

Dear Prof. :

Research Project. It is widely accepted that human beings learn from reflecting on their experience. However, little is known about what and how professors reflect on their teaching experience and how they use newly gained insights to improve teaching. This research investigates characteristics and contents of professors' thoughts after teaching a class. One of the implications of the study is to design faculty development interventions to promote reflective practice in higher education.

Researcher. My name is Li Cao. I am conducting this project as my doctoral dissertation research. My supervisor is Dr. Alenoush Saroyan, professor at Centre for University Teaching and Learning and the Department of Educational & Counselling Psychology at McGill University.

How is Your Name Selected. Your name has been purposefully selected from the Course Timetables on the Web. Only a small proportion of the faculty members in your academic area have been selected to participate, so your experiences and thoughts are very important. You will be representing many professors who are similar to yourself in many ways.

30 Minutes Time is All that is Required of You. All you need to do is to allow me to come to observe one of your classes in this semester and answer a few questions after the class. The interview will take approximately 30 minutes. In addition, I would like to have a copy of the handout for the class, if you have any. Naturally, all the data will be confidential, and you can terminate your participation at any time in this study.

Contact. I realize that you are very busy but as this is very important to my research, I will follow up with a phone call in about a week's time. I thank you in advance for your consideration in this matter. If you have any questions or concerns, please feel free to call Li Cao at (514) 398-6648 or E-mail: lcao@po-box.mcgill.ca

Sincerely,

Li Cao Ph.D. Candidate
Department of Educational Psychology
McGill University

cc. Prof. Alenoush Saroyan, Ph.D.

Appendix C: Consent Form

I agree to participate in a doctoral dissertation research conducted by Li Cao under the supervision of Dr. Alenoush Saroyan of the Department of Educational and Counselling Psychology at McGill University.

I understand that the purpose of the study is to describe characteristics and identify contents of professors' post-class reflection for a better understanding of the complex processes of teacher thinking and teacher development, and that my performance or ability is not being judged.

I understand that my participation and the data generated in the study will be treated with confidentiality.

I understand that I will select one class that will be observed unobtrusively by the researcher.

I understand that I will conduct an interview with the researcher after the observed class and that the interview will be audio-taped.

I understand that I will provide the researcher with related materials (e.g., planning notes, lesson plan, assignments).

I understand that the data from this study may be published.

I understand that I will not be paid financially for my participation but that I can have a report of the study results after its completion.

I understand that I am free to withdraw my consent and to discontinue my participation at any time during the study.

I understand that if at any time I have further questions, I will contact Dr. Alenoush Saroyan at 514-398-6648 or Li Cao at 514-398-8063.

I HAVE CAREFULLY STUDIED AND UNDERSTAND THIS AGREEMENT AND THEREFORE I FREELY CONSENT TO AGREE TO PARTICIPATE IN THE STUDY.

NAME: _____

SIGNATURE: _____

DATE: _____

Appendix D: The Post-Class Reflection Interview Protocol

My name is Li Cao. I am conducting doctoral study investigating professors' thoughts about their classes. Thank you for agreeing to participate in the study. Please sign the consent form to insure confidentiality of your participation.
Please be reminded that the purpose of the interview is **not** to assess the effectiveness of your teaching. It is to collect your thoughts about the class that you just taught. This is to help me understand what comprises thinking about teaching.

1. Could you tell me EVERYTHING about today's class?
2. Now that the class is finished, what stands out in your mind about this class?
3. Is there anything about the content of today's class that is particularly vivid?
4. Is there anything about your teaching in today's class that stands out in your mind?
5. Is there anything about the students in today's class that has stayed in your mind?
6. Is there anything about the classroom setting that has stayed in your mind?
7. Did today's class prompt you to think about other factors, for instance, the department, the university, and/or other colleagues?
8. Was today's class representative of your teaching? Why would you say that?
9. Is there anything else about today's class that you think I should know?

(Now I will ask questions about ways in which you think about your class.)

10. Do you typically think about your classes after teaching them? (If not, why?) If so, what do you think about, specifically?
11. When does this thinking process start?
12. Where does this thinking happen? that is, in which place does it happen?
13. How would you characterize the way you think about your class after you teach it? (For example, is it structured or unstructured? step-by-step or free-thinking?) Can you elaborate on your way of thinking about your class?
14. Do you consistently follow this way when you think about your classes? Can you explain?
15. For what purposes do you engage in this thinking process?
16. What are the consequences of this thinking?
17. How many times have you taught this course?
18. Approximately how many years have you been teaching in higher education?
    1st year 2-3 4-5 6-9 10-15 16 or more years
19. Are you a tenured professor?
20. Have you ever received any teaching awards? If yes, was it a departmental award, an institutional award or a national award?

Thank you very much for taking the time to answer these questions

Appendix E: Types of Interview Probes

- Show interest. An expression of interest and understanding, such as "uh-huh", "I see," and "yes" conveys the message that the response has been heard and more is expected.

- Pause. Silence can tell a respondent that you are waiting to hear more.

- Repeat the question. This can help a respondent who has not understood, has misinterpreted, or strayed from the question to get back to track.

- Repeat the reply. This can stimulate the respondent to say more, or recognize an inaccuracy.

- Ask a neutral question:
  - For clarification: What do you mean exactly?
    Could you please explain that?
  - For specificity: Could you be more specific about that?
    Tell me about that. What, who, how, why?
  - For relevance: I see. Well, let me ask you again – repeat the question
    Would you tell me how you mean that?
  - For completeness: What else?
    Can you think of an example?

Appendix F: Classroom Observation and Field Notes Protocol

Date _____ Classroom location _____

Professor _____ Course title _____

Topic _____ Duration _____

- Contextual factors
  - class size
  - physical settings of the classroom
- Student characteristics
- Instructional methods
- Researcher's impressions of
  - the class observed
  - the interview conducted.

Appendix G: Preliminary Code Category

Based on Lowyck (1986), Schwab (1978), and Shulman's (1986) work, the following code categories of four levels and 22 variables were selected to delineate the meaning and scope of professors' post-class reflection in data collection, categorization, analysis and report.

Level 1	Level 2	Level 3	Level 4
content	course	subject matter content	amount of content importance of content
teacher	teaching	management	timing/pacing control
		effectiveness	
		purpose	objectives
	self	beliefs	role of teacher role of students
		behavior	
		cognitive	ideas
		affective	feelings
	knowledge	subject matter knowledge	content knowledge ped. cont. konwledge curriculumknowledge
		pedagogical knowledge	teaching strategies
		knowledge of students	
student	learning		learning outcomes
	behavior		individual behavior group behavior
context	physical	classroom setting	
	social	colleagues	
		departmental	
		institutional	
		societal	
other			

Appendix H: Code Book

(7 1*) Coding/Characteristics: idiosyncratic ways of thinking about the class**

(7 1 1) Coding/Characteristics /When prof reflect: A reference to the time when post-class reflection happens.
(7 1 1 1) /Right after the class

Example:
After the class you know immediately whether you had a good class or not a good class. That's it. That is determined immediately after the class. If the class has not gone as well as you wanted it to, you want to forget about it. You sort of get on to something else quite quickly. (ExSLec: 47)

(7 1 1 2) /preparing the next class
(7 1 1 3) /To and From work
(7 1 1 6) /writing article
(7 1 1 7) /talking with family
(7 1 1 8) /random hard to generalize when
(7 1 1 9) /on-going process
(7 1 1 10) /after examinations or evaluations
(7 1 1 12) /During the class
(7 1 1 13) /planning for the course next year
(7 1 1 14) /sometime later

(7 1 2) Coding/Characteristics /Where prof reflect: A reference to the place where the post-class reflection happens.
(7 1 2 1) /Anywhere

Example:
It happens in the office. It happens when I am walking. It happens on my way to and from the work. It happens at my home. It happens at any place when the thoughts occur to me depending on the environment, the stimulus, and what I am doing. It could happen while I am reading, or working, or writing the next lecture. (InAHLec: 48)

(7 1 2 2) /Walk back from the class
(7 1 2 3) /do not know
(7 1 2 4) /at home
(7 1 2 5) /in the classroom
(7 1 2 6) /in the office
(7 1 2 7) /in the library

* Numbers in the bracket indicate node addresses of the codes in the QSR NUD*IST 4 research project created for the study.
** Phrases after the colon are definitions of the codes.

(7 1 3) Coding/Characteristics /Ways professors reflect: Description of their characteristic way of thinking about the class taught.

(7 1 3 1) /have intuitive feeling about the class

Example:
Thinking about the class, this is not systematic at all. This is basically intuition. (ExHSmi: 59)

(7 1 3 2) /continuing process
(7 1 3 3) /varied ways
(7 1 3 4) /systematic on planning for the class
(7 1 3 5) /not systematic on thinking retrospectively on class
(7 1 3 6) /systematic

(7 1 4) Coding/Characteristics /consistent?: Verification whether they follow the same way in thinking about the class all the time.

Example:
Yes. Systematic in thinking about the future lecture but not so systematic in thinking retrospectively about the past classes. (ExHLec: 69)

(7 1 4 1) Coding/Characteristics /consistent?/hard to say

(7 1 5) Coding/Characteristics /What purposes?: Specification of why(objectives) they think about the class.

(7 1 5 1) /get across the information
Example:
Because unprepared lecture, the lecture that you haven' thought about, tends to be unorganized and difficult to follow. To get across the information and the ideas to the students, to make them think about these issues. (ExHLec: 72)

(7 1 5 2) /make students think
(7 1 5 3) /my duty
(7 1 5 4) /control of the class
(7 1 5 5) /better student evaluation
(7 1 5 6) /improve teaching
(7 1 5 7) /become a better teacher
(7 1 5 8) /personal satisfaction
(7 1 5 9) /better student learning
(7 1 5 10) /improve students experience effective or social
(7 1 5 11) /revise the course pack
(7 1 5 12) /get ready for the next class
(7 1 5 13) /prepare the exam

(7 1 6) Coding/Characteristics /What consequences?: Description of what happened / they did with their thoughts about the class.

(7 1 6 1) /want to forget the bad class

Example:

After the class you know immediately whether you had a good class or not a good class. That's it. That is determined immediately after the class. If the class has not gone as well as you wanted it to, you want to forget about it. You sort of get on to something else quite quickly (ExSLec: 47)

(7 1 6 2) /impact on the mood & feeling
(7 1 6 3) /preparing for the next class
(7 1 6 4) /review what's covered and plan for change
(7 1 6 5) /write a note to self
(7 1 6 6) /intellectual stimulation
(7 1 6 7) /gain control as teacher
(7 1 6 8) /improve the course(outline) or pack
(7 1 6 9) /improve teaching
(7 1 6 10) /change teaching strategy or content
(7 1 6 11) /improving learning
(7 1 6 12) /self encouragement
(7 1 6 13) /correct mistakes
(7 1 6 14) /co-ordination of courses

(7 1 7) Coding/Characteristics /How long PC ref last: Specification of the duration (how long) of their post-class reflection.

Example:

Right after the class. 15 minutes later I am not thinking of the course any more. Get something else. (InSLec: 54)

(7 1 8) Coding/Characteristics /Trigger for ref: Description of what stimulated them to think about the class.

(7 1 8 1) /student performance on exam

Example:

Other thing that might key it in is that students did poorly on the exam or did exceptionally well on the exam. So I will try to analyze why. (InSlab: 52)

(7 1 8 2) /mid and end term exam
(7 1 8 3) /questions by students
(7 1 8 4) /students evaluations
(7 1 8 5) /planning for the next class
(7 1 8 6) /correcting student assignments
(7 1 8 7) /Looking at the blackboard after class
(7 1 8 8) /mistake or confusion found after the class
(7 1 8 9) /new information in the field
(7 1 8 10) /perception to students' experience
(7 1 8 11) /intuition

(7 1 8 12) /remembering of past class
(7 1 8 13) /reading articles
(7 1 8 14) /nature of the course

(7 1 9) Coding/Characteristics /Do you reflect after teaching class: Verification of whether or not do they think about the class after teaching it.
Example:
Yes, definitely. Sometimes, you missed quite a few things; sometimes, you could not cover the material that you wanted to cover because you sort of overestimated the time you have or underestimated the material. Always, things like this happen. So, then you make sure that in the next class you will make up for it. You have this class dynamic which is always playing a role. (ExSLec: 38)

(7 2) Coding/What do professors reflect on?: content of their post-class reflection

(7 2 1) Coding/What do prof reflect on?/content: Reference to the subject materials covered in the class.
(7 2 1 1) / subject matter coverage
Example:
Well, I suppose that I am aware of what I didn't say because I had an hour and I had to cover essentially 20 years' of very complicated events. I just managed to squeeze the last quotation in. (ExHLec: 4)

(7 2 1 2) /mistake made in the lecture
(7 2 1 3) /importance of the topic
(7 2 1 4) /level of difficulty

(7 2 2) Coding/What do professors reflect on?/teacher: Reference to any aspect related to the instructor, such as teaching, self as teacher, teachers' knowledge

(7 2 2 1) Coding/What do prof reflect on?/teacher/self: Reference to instructor's beliefs of teaching, behaviors, ideas, and feelings related to teaching the class.
(7 2 2 1 1) /teacher/self/beliefs
(7 2 2 1 1 1) /beliefs/role of teacher
Example:
Nowadays, I know that if you are well prepared you will not lose control. You lose control because you didn't prepare well. (ExSTut: 55)

(7 2 2 1 1 2) /role of student
(7 2 2 1 1 3) /critical thinking
(7 2 2 1 1 4) /principles of teaching

(7 2 2 1 2) /behavior
(7 2 2 1 3) /affective or feelings
Example:

Another important thinking is the class response. Usually, I know today is pretty noisy. Either it's the content is not that interesting, or some mistake I could make. Or I talk too much without any interaction with the class. (InSLec: 60)

(7 2 2 1 4) /stage as a teacher
(7 2 2 1 5) /ability to teach
(7 2 2 1 6) /burn out
(7 2 2 1 7) /rapport with students
(7 2 2 1 8) /teaching experience
(7 2 2 1 9) /experience as student

(7 2 2 2) Coding/What do prof reflect on?/teacher/teaching: Reference to the instructional process of the class, such as management, teaching strategies, planning for the teaching, presentation, etc.

(7 2 2 2 1) /teacher/teaching/management
(7 2 2 2 1 1) /timing or pacing
Example:
No, because I didn't throw out questions to the students, which I haven't done for the last two weeks because I am so behind them. It's terribly time consuming. But at the same time, it likely to get a debate going on. I have done that in the past. But otherwise that would be fairly representative. (ExHLec: 37)

(7 2 2 2 1 2) /control
(7 2 2 2 1 3) /TA work
(7 2 2 2 1 4) /smooth change to the plan

(7 2 2 2 2) /teacher/teaching/teaching strategy: Reference to any teaching strategies in the class
(7 2 2 2 2 1) /make learning fun & positive experience
Example:
Well, I tied obviously to make students think for themselves. I think sometimes, what you have to try and do is to challenge them by saying things that they might find shocking or say things that you don't yourself believing. Of course, all the dark facts which we brought up today, as a result of the latest research in Russia and scholars in the west also, such as this book called Lethal Politics. (ExHSmi: 19)

(7 2 2 2 2 2) /Layout on the board
(7 2 2 2 2 3) /interactive strategy
(7 2 2 2 2 4) /organization of lecture or plan
(7 2 2 2 2 5) /use of teaching strategy
(7 2 2 2 2 6) /giving feedback to students
(7 2 2 2 2 7) /dealing with shy students

(7 2 2 2 3) /teacher/teaching/planning
(7 2 2 2 3 1) /planning of this class

Example:
Nothing in particular. We generally have this type of class. It depends on your preparation and than you are able to command the attention of the class. If you are not well prepared, then, your attention wanes. And their attention also wanes. I think it is the function of how well you are prepared to do your work. (ExSLec: 7)

(7 2 2 2 3 2) /planning for the next class
(7 2 2 2 3 3) /ways to plan for the next class
(7 2 2 2 3 4) /Planning for the course

(7 2 2 2 4) /teacher/teaching/presentation of the lecture
(7 2 2 2 5) /better evaluation mechanism
(7 2 2 2 6) /teaching style
(7 2 2 2 7) /teaching environment
Example:
I like that sometimes. I like having a dynamic in the classroom, but I personally prefer teaching a small group of students. (InHLec: 31)

(7 2 2 3) /teacher/effectiveness: Reference to how well they did with the class.
(7 2 2 3 1) /effectiveness of the course in general
Example:
but I am very much on schedule for this semester. So I was feeling very much relaxed. I enjoyed it. (InHLec: 11)

(7 2 2 3 2) /effectiveness of this class
(7 2 2 3 3) /progress of the course

(7 2 2 4) /teacher/purposes or objectives: Reference to the intended outcomes of the class
(7 2 2 4 1) /imparting knowledge
Example:
How do you get across set of ideas for which people were prepared to die, which today people loved. That's the challenge. (ExHLec: 15)

(7 2 2 4 2) /train students to think professionally
(7 2 2 4 3) /make students understand
(7 2 2 4 4) /creating learning environment
(7 2 2 4 5) /develop competency

(7 2 2 5) /teacher/knowledge: Reference to different types of teacher knowledge

(7 2 2 5 1) /content knowledge: Reference to teachers' subject matter knowledge
Example:
I think that at the seminar level the main purpose is imparting new knowledge in the field. Fortunately in the Soviet and pre-Soviet Context, you can do this because there has been all these incredible changes preceding the past. I think in another field, I might reply

this question quite differently. I might want to convey a sense of tradition, or go back to the past that has been lost. Not here though. (ExHSmi: 63)

(7 2 2 5 2) /teacher/knowledge/pedagogical content knowledge: Reference to knowledge of how a particular subject matter should be taught
Example:
I think the way things are done in books are sometimes complicated. So we want to simplify them. You want to say to the students: Look, this is a better means of doing it. Sometimes, the students are having hard time accepting it because they often think everything written in the book is better than what the teacher would say. They don't realize in fact that the author who wrote the book is also a teacher. (laugh) (ExSLec: 60)

(7 2 2 5 3) /teacher/knowledge/pedagogical knowledge: Reference to knowledge of hot to teach in general
Example:
We didn't have discussions of that kind today. But I think it's something that will animate the seminar in the future. (ExHSmi: 24)

(7 2 2 5 4) /teacher/knowledge/knowledge of students: Reference to knowledge of the students in the class
(7 2 2 5 4 1) /students background
Example:
Now the other thing to bear in mind actually is it does bring into an area of new curriculum. We get many students outside the history string. I have noticed that in the papers that they don't know the technical side of writing a history paper. Next year, I will devote an entire lecture to how to write a history paper. I never found the need to do so before. But I do really find it now. (ExHLec: 42)

(7 2 2 5 4 2) /student prior knowledge
(7 2 2 5 4 3) /group rapport
(7 2 2 5 4 4) /intellectual level or ability or Learning style
(7 2 2 5 4 5) /students attitude or beliefs or perspectives

(7 2 2 5 5) /teacher/knowledge/curricular knowledge: Reference to relations among different courses or whether this course stands in the program.
Example:
So look back on these things. I make notes for the next time I teach the course. You only need to teach the course every second year, or it's only given every second year. So I need to make notes or I don't know or remember in two years from now what I try to improve on. That's about it. (InSlab: 43)

(7 2 3) /student: Reference to students' behaviors and learning outcomes

(7 2 3 1) /student/learning outcomes: Reference to how well the students learned.
(7 2 3 1 1) /individual student understanding learning
Example:

In terms of reflecting on the past. I think it's simply intellectual stimulation. You think about all sorts of things. which happens to be one's area of interest. I'll give you an example. I was reading an essay very recently. It was making a particular point. I don't think it really matters what the point it was. I was thinking how interesting that the student in this essay was making a point that I used to think was original with me in the lectures. I can't remember whether I spoke about this at that point or not. But I was struck by the fact that there was a tie between this comment in the paper and the idea that I was trying to get across many years ago and also today. The student put it extremely well. So here it was an external stimulus which jelled my memory about an idea, which I try to get across, I think, probably every year, but which has always struck me as the significant point. It was actually comparison of Scotland's and England's relations with France. (ExHLec: 73)

(7 2 3 1 2) /group understanding or performance

(7 2 3 2) /student/behavior: Reference to students' involvement in the class
(7 2 3 2 1) /individual behavior
Example:
There's one student who said nothing at all. Unfortunately, that student very rarely says anything. I haven't managed quite reach through the wall of shyness yet. She did give a very good presentation last week. When she has something ready to give, she can do it. But she is tremendously shy and reserved for the moment. Hope that will improve. (InHSmi: 5)There's another student in the class who usually says nothing. But she spoke up a couple of times yesterday. I was pleased to see that. (InHSmi: 6)

(7 2 3 2 1 1) /response or participation

(7 2 3 2 2) /student/behavior group behavior
(7 2 3 2 2 1) /students response & participation
Example:
About this particular class. I suppose more people in that first half of the class asked questions to the presenter. More people than usual. Usually there were a few questions but I have to prompt a little bit. Yesterday was somewhat forth coming. Wonder whether it is because they saw you in the corner perhaps. It's possible. (InHSmi: 14)

(7 2 3 2 2 2) /noise level
(7 2 3 2 2 3) /attendance
(7 2 3 2 2 4) /students attention
(7 2 3 2 2 5) /position in classroom

(7 2 4) /context: Reference to environmental (physical & social) factors

(7 2 4 1) /context/setting: Reference to the physical structure of the classroom
(7 2 4 1 1) /ill equipment
Example:

On the classroom itself, it's not a good classroom. It's pretty dingy and I prefer a room with windows. I prefer a room that's where the lights function properly. You may have noticed the other half of the light wasn't functioning. (InHSmi: 37)

(7 2 4 1 2) /nice room or environment
(7 2 4 1 3) /room size
(7 2 4 1 4) /impact on teaching & learning
(7 2 4 1 5) /room type
(7 2 4 1 6) /class size

(7 2 4 2) /context/social factors: Reference to colleagues, dept, and university that related to the class
(7 2 4 2 1) /courses offered by colleagues
Example:
Obviously it does. Some of the students are also taking classes from my colleagues. But there is no member of my department I would image who knows anything about what I am saying any more than I do. Of course, I don't know what other people have to say. We just don't have the time. (ExHLec: 32)

(7 2 4 2 2) /hear from or talk with colleagues about teaching
(7 2 4 2 3) /not concerned with today's class
(7 2 4 2 4) /smaller class size
(7 2 4 2 5) /more funding
(7 2 4 2 6) /colleaguial and institutional influence
(7 2 4 2 7) /cross stimulation
(7 2 4 2 8) /support or influence from outside department
(7 2 4 2 9) /rapport within the dept
(7 2 4 2 10) /help from TA
(7 2 4 2 11) /co-ordination with other person
(7 2 4 2 12) /co teacher's good job on teaching
(7 2 4 2 13) /colleagues' teaching style
(7 2 4 2 14) /rapport with colleague

(7 2 4 3) /context/resources & environment to teach: Reference to the resources and environment related to the class or course in general.
Example:
We are very fortunate of having a very nice physical setting, which is not always the case when I had some seminar previously in Leacock, where the design inside the building has no windows. At that time, I thought this has a lot to do with the intellectual concentration. But we are luckily in a place where you can look outside and we are having this astounding view. I think that the students enjoy meeting each other there. (ExHSmi: 27)

(7 2 5) /other: Reference to aspects not included above, such as their research, course load, future plans, etc.
(7 2 5 1) /research
Example:

To improve my overall teaching performance. I do get a great deal of pleasure out of teaching. I also get a lot of pleasure out of research as well. It is difficult to balance the two. I certainly did not enter this profession so that I can spend more the time doing research and neglect my teaching. I regard them as equally important. (InHSmi: 85)

(7 2 5 2) /effort required for teaching
(7 2 5 3) /ways to plan for new course
(7 2 5 4) /develop teaching dossier
(7 2 5 5) /Work or course load
(7 2 5 6) /course format
(7 2 5 7) /future plan
(7 2 5 8) /colleagues' interest
(7 2 5 9) /curriculum or program
(7 2 5 10) /resources for teaching
(7 2 5 11) /better evaluation mechanism
(7 2 5 12) /researcher effect

Appendix I: Sample Table of Collected Transcript Segments and Summary Statement:

Ways in Which Professors Reflected on the Class?

Summary Statement

Professors' reflect on the class through:

1. having intuitive feeling about the class
2. not systematic on thinking retrospectively about the class
3. systematic on planning for the class
4. continuing process

1. Sorted Transcript Statements: Professors reflect through intuitive feeling about the class.

> I didn't have the feeling, as sometimes I do, that I've lost them. (ExHLec: 11)
>
> I try not to rely too heavily on notes. If I read, which occasionally I do, I sense that I begin to lose students. They don't listen to me. I am not talking to them. And so I'd like to talk to them directly. Well, that means you have to have in your mind, without help. You have the screen to help you but you have to have a general idea of what you are going to say. But what you actually say is not prepared at all. The way in which you express it. You just have to talk about what you want to say. (Knock on the door. The interview paused for a minute.) I think it is better if you're speaking to the students. I know some of my colleagues who've won the teaching prize, actually read the lectures. I don't say it's wrong. I realize that I begin to lose students if I rely too heavily on the notes. (ExHLec: 19)
>
> As an example, well, the lecture on foreign policy, I think, went well. It's interesting that I used no overheads at that time. I only used the board. I just try to think of an example that didn't go well. I haven't really had that feeling this year. But there have been times when I had that feeling that it was a failure. (ExHLec: 47)
>
> No, it's not really structured. It's more an emotional way of thinking about something that I am confused or could have done better, which might inspire improvement next time around. (ExHSmi: 54)
>
> Thinking about the class, this is not systematic at all. This is basically intuition. (ExHSmi: 59)
>
> ExHSmi: Well, sometimes I feel bit dissatisfied. I think of how I can change that. (ExHSmi: 66)

I think the class went all right. There was no disturbance in the class. I could not hear it. I thought that everybody was attentive and following me. That is my impression. (ExSlec: 4)

At the end of the class if you had a good class, you feel that everything has gone in the way you wanted. You feel good about it. You are aware that all was done in a nice fashion. You are in a good mood. You are enthusiastic. You are up. (ExSlec: 41)

But, if your class doesn't go well, you are kind of feeling down. It reflects in your not being quick. Your disposition is not as good. I think it has a great influence on the way you are acting during the day. You are not a machine. You have this effect. I think this effect varies from people to people. Some people are more sensitive. So they feel the effect more. Some people are able to turn off. All depends. (ExSlec: 42)

After the class you know immediately whether you had a good class or not a good class. That's it. That is determined immediately after the class. If the class has not gone as well as you wanted it to, you want to forget about it. You sort of get on to something else quite quickly. (ExSlec: 47)

The consequence is that if you feel that you've lost the control of the class, I think, over the year, you gradually improve. You have absolute control of the class. It's a learned behavior. You won't let anybody bother you. (ExSTut: 54)

I feel relatively satisfied with yesterday's class. (InHLec: 5)

but I am very much on schedule for this semester. So I was feeling very much relaxed. I enjoyed it. (InHLec: 11)

I was by and large proved relatively satisfied. (InHLec: 15)

So inevitably ... very occasionally, do I come out of the class and think: Yes, I nailed that class; that was really good. Very rarely I feel that. I always have a slight or great sense of disappointment. (InHLec: 19)

By and large, I felt relieved, hew, one more class out of the way. I felt like I was exposed. Every time I am lecturing, I feel exposed. (InHLec: 22)

The topic of post-modernism. I really like this stage of the semester, well, not only because it is almost over, but because I got to talk not about the nitty-gritty of the theories of culture of the societies which is the theme of the course. I like talking about post-modernism. It's not like I am preaching about it and trying to convert people to a different way of thinking. It gives me a feeling of being more relaxed. I feel more at home to talk about the kinds of

things that we are speaking about now. (InHLec: 24)

As I said earlier, my deficiencies. But I think it's ok. It's ok. I can always tell. I look at students' faces and every time I can sense little things. I am a little sensitive. I am over-sensitive, I'll say. Sometimes, when the students make little faces, I'll think of it as being because they are thinking badly about me or because they've been talking to each other. I'll think they are making comments about me. (InHLec: 26)

Yeah, this group, I quite like them. I get a good feeling from them. I get the sense that they are relatively satisfied with the class. (InHLec: 29)

Yeah, pretty much. No, I don't feel like that ok, I'll re-evaluate my teaching. No, there's so much pressure and judgement that goes on in this place anyway. I realize that I don't need to add anymore myself. To just keep myself up to standard. But I naturally do that anyway. That's my nature. I sort of criticize myself. (InHLec: 63)

Yes, this class confirmed my impression that this seminar is going reasonably well. I don't have too many worries about it, compared to some of the other classes I taught in the past. (InHSmi: 23)

As soon as I come away from the classroom, I got the general impression of whether the class went well or not. For all classes I teach. When I am walking away from a lecture for example, I kind of mentally run through my mind. Was that a good lecture? It's a kind of feeling you have. Whether it went successfully, whether you maintained namely attention of the students or lost? Whether you noticed people looking at the watches or pulling them in through the lecture? Whether I was giving them too much material or I was going too fast, things like that. (InHSmi: 59)

It's just various ideas that come to me in no particular order. I don't sit down and think through any form of scheme, or even have a kind of mental checklist does this go well, does this not go well. It was more of an intuitive feeling about what was successful or what wasn't. (InHSmi: 77)

But after the class and thinking about how it gone, whether I get responses from the students or not? I will carry my feeling of one lecture to the next time I meet with those students. That makes me ask questions at the beginning of the next lecture. If I feel that they were lost at the first few reviewing points, or more so, I may direct me to change what I may cover in the next lecture. (InSlab: 69)

A new chapter, new concept. Maybe that's a little easier to demo and also easier to attract the students. That's my feeling. (InSLec: 6)

2. Sorted Transcript Statements: Retrospectively, professors do not reflect systematic on the class.

The way, that can vary. Sometimes I think of a remark one of the students made. Sometimes, I think a remark that I made or I lead to something, I think well, I really should change that. I mean there're things that happen. For instance, sometimes, I talked about King Arthur, I didn't pursue it. There is a question whether he ever existed. I always say he didn't. There is no evidence that he existed. Very recently they discovered a stone with his name. More recently still, somebody has cast a doubt on the validity of the stone. So something new information comes, I think about what I said. It's again a continuing process. I read review and I think that could be an interesting idea to get across in this particular lecture. (ExHLec: 64)

No, I don't. (The telephone rang. Interview paused for a minute). I think the class that is to come. There I am very systematic. What are the points that I am going to present. I may even take the material away on the weekend and do it very systematically. But here, you are asking me how I thing retrospectively. Frankly, no, it's been given. I am going to reflect upon it if I decide I want to be with that topic the next year. It's done. Now, it's does come up when I set the examination, which is issue I emphasized this year. But only in a very general way. (ExHLec: 66)

Yes. Systematic in thinking about the future lecture but not so systematic in thinking retrospectively about the past classes. (ExHLec: 69)

No, it's not really structured. It's more an emotional way of thinking about something that I am confused or could have done better, which might inspire improvement next time around. (ExHSmi: 54)

You can't, I think, really structure this because students in every seminar are quite different. Quite quite different background. They also have quite different ways of thinking. So you have to take into account. In the first weeks in the seminar, I've taken up and try to understand what the students have really done. They'll tell you while in the first class why they are taking the class. This is usually a bit humiliating. (ExHSmi: 55)

No, obviously not systematic. When the thought comes, it just comes. (ExSTut: 43)

I am very critical. I criticize myself. I am more inclined to think of ways that I feel that I could improve or things that I did wrong. No, I don't have a structured way to think about the class. (InHLec: 61)

Sometimes, I make a little note like -- remember to go through this part far more quickly, or reduce reading or whatever, to remind myself the next time I

plan the course. So not in a systematic way, but in a sort of casual manner I will evaluate what went on. (InHLec: 64)

It's just various ideas that come to me in no particular order. I don't sit down and think through any form of scheme, or even have a kind of mental checklist does this go well, does this not go well. It was more of an intuitive feeling about what was successful or what wasn't. (InHSmi: 77)

So nothing systematic is my answer. (InHSmi: 79)

Yes, I am consistently non-systematic. (InHSmi: 82)

I don't record. I register them mentally. I don't write anything down after this. I could see how it could be beneficial perhaps to do so. Then we come back to if I am particularly systematic in my thoughts. It will just be a jumbo of thoughts. I am not sure that will be terribly helpful particularly to that class. (InHSmi: 94)

I don't have a special, as I told you, right after the class maybe 10-15 minutes, even less than that I quickly go through the notes to see if I finish or not finish. It's mostly like this. If not finish, I have to start that for the next class. I don't think about any of the special technique. Very routine, I don't think there is anything special there. (InSLec: 64)

3. Sorted Transcript Statements: Professors are systematic on planning for the class.

No, I don't. (The telephone rang. Interview paused for a minute). I think the class that is to come. There I am very systematic. What are the points that I am going to present. I may even take the material away on the weekend and do it very systematically. But here, you are asking me how I thing retrospectively. Frankly, no, it's been given. I am going to reflect upon it if I decide I want to be with that topic the next year. It's done. Now, it's does come up when I set the examination, which is issue I emphasized this year. But only in a very general way. (ExHLec: 66)

Yes. Systematic in thinking about the future lecture but not so systematic in thinking retrospectively about the past classes. (ExHLec: 69)

There is a systematic way in the sense that there is an anthology, which is compiled for the seminar. I expect to cover that.
This is systematic. (ExHSmi: 58)

I don't think you want to make it unorganized. I think you want it to be the simplest possible, clearest possible, and with the widest applications. So, that is the challenge you have. (ExSLec: 56)

> Now I like to be logical. I like to be simple. That means hard work, hard hard work. If you want to simplify something, you have to work very hard to do that. The more you are understood by others, the more you will be appreciated. That's the thing. You have to think a lot of things. If you want to do things, which are in essence complicated, you want to present them in the simplest possible steps. Then everybody understands it and everybody appreciates it. Then your research is classified as something good, useful, and meaningful and so on. If you don't communicate this, in another word, if you don't organize it and your ideas are scattered, then it's very difficult for a large number of people to appreciate them. Only a special group of scholars understand what you are trying to find, the new things that you are trying to say. (ExSLec: 59)

> I don't record. I register them mentally. I don't write anything down after this. I could see how it could be beneficial perhaps to do so. Then we come back to if I am particularly systematic in my thoughts. It will just be a jumbo of thoughts. I am not sure that will be terribly helpful particularly to that class. (InHSmi: 94)

4. Sorted Transcript Statements: Professors' reflection is a continuing process.

> At home, in shower, at a movie. Pretty much everywhere. Sometimes, I'll not think about it if I am doing something. I am always thinking about it. (InHLec: 59)

Appendix J: Sample Record of Classroom Observation

Date: Oct. 27, 1999 (Week 9) Classroom location: Building L Room X

Participant: InHSmi Course Title: XXXX

Topic: YYYY Duration: 13:30-15:30 p. m.

- Contextual factors
  - class size: Thirteen students attended the class
  - physical settings of the classroom: Medium size rectagular classroom with a large table in the middle

- Student characteristics: Students were mostly undergradurate students and a few of them were graduate students. They appeared to have read the assigned reading material about 15-20 pieces before the class and ready to discuss them in the class.

- Instructional methods:
  - •Student presentation in the first half of the class
  - •Guided discussion on an assigned topic in the second half of the class

- Researcher's impressions of
  - the class observed: This is a well-organized class. There was a smooth flow of the activities. Students participated actively in the class and were ready to discuss the topic.
  - the interview conducted: It was a great interview. The professor was very nice and interested in the topic of teacher reflection. He was talktive during the interview.

Appendix K: Sample Field Notes from Classroom Visit

Record of Classroom Site Visit

Course:	Humanity
Date:	Fall, 1999
Scheduled Time:	13:30 -- 15:30
Location:	L Building of the University
Participants:	Professor, 13 undergraduate and graduate students, and the researcher

Time	Observations
13: 30	Four students came into the classroom chatting over a magazine.
13: 32	Five more students arrived at the classroom, chatting. One of them typing on a laptop computer over a journal.
13: 36	Professor came into the classroom. I introduced myself to him. This was the first time we saw each other in person.
	One more student came in the classroom.
13; 37	Professor distributed marked assignments back to the students.
13: 40	Professor said "Good afternoon" to start the class. He talked about the next paper and gave students option for submission of the paper. Students selected January.
13: 42	Professor introduced the subject for the next week and suggested four reference books for reading.
	Two more students came into the classroom.
13: 45	Professor introduced the topic for a student presentation and exchanged his middle seat with the student presenter.
13: 46	A student started her presentation by reading her paper to the class. Professor, with a cup of coffee in hand, listened to the presentation with other students. A few students appeared taking some notes.
13: 50	The student presenter started introducing six different books one by one and described themes of these work in relation to the assigned discussion topic.
14: 04	The student presenter compared the six writers about the topic.
14: 14	The student presenter tried to address the question posed last week.
14: 15	Professor asked if there was any question to the presenter.
	A student asked a question.
	The presenter responded to the question, relying on her vague memory of the books.

14: 17	Professor asked if there were any other questions.
	Another student raised a question
	The presenter answered the question and asked the person "What do you think?"
	The student responded to the counter-question.
14: 19	Two more students spoke out about the topic.
14: 20	When the presenter highlighted one issue in the discussion, the Professor stimulated another question out of the discussion.
14: 21	Two more students raised their hands to join the discussion.
	Professor pointed to one of them, who talked about the issue that the presenter highlighted.
14: 22	Another student spoke out.
	Professor joked about the input and the class laughed.
14: 24	The presenter responded to the question.
14: 25	Professor allowed another student to ask question.
14: 26	Professor clarified one concept during the discussion.
	The presenter grabbed a folder and answered the question.
14: 27	Professor asked: "Any other question?"
	A student spoke out.
	The presenter tried to answer the question by drawing on what the author said in the book.
14: 28	Two more students raised their hands. One student tried to introduce her way of seeing the issue.
14: 30	The student with the laptop computer elaborated on the topic.
14: 37	The presenter discussed the definition of one term.
14: 39	Another student asked a question.
14: 40	Professor suggested a 3-4 minutes class break.
14: 48	Professor went back to the middle seat and talked to a student.
14: 49	Professor closed the door and started the class after the break by asking students to explain a concept.
	A student responded.
	Professor probed the answer by asking, "What do we mean by that?"
	Another student responded, referring to one book discussed previously.
14: 52	Professor allowed another student to explain one concept.

14: 53	Professor elaborated on the concept and introduced another concept together with a reference book.
14: 58	Professor referred to the readings discussed in the presentation and compared three authors' ideas about the discussion topic.
15: 06	Professor asked a general question to encourage synthesis of the ideas.
	A student responded to the question.
	Professor pushed for the answer and smiled.
15: 09	Another student spoke out after professor nodded to her request.
15: 10	Professor said sorry to allow still other student join the talk.
	The two students argued back and forth.
15: 12	Professor asked a student if he had question.
	The student spoke out.
	Professor elaborated on the topic and allowed one student spoke out.
15: 14	Professor commented on students' point.
	A student spoke out.
	Another student responded, commenting the other student.
15: 19	Professor smiled and allowed another student to speak.
15: 20	Professor answered a question raised by a student.
15: 21	Professor allowed two students to speak after one another.
15: 23	Professor introduced a reference for summarizing the literature and elaborated on the discussion topic.
15: 29	Class laughed about Professor's humor.
	Professor reintroduced the topic for the next week.
15: 30	Class is over and students were moving out.