

INFORMATION TO USERS

This manuscript has been reproduced from the microfilm master. UMI films the text directly from the original or copy submitted. Thus, some thesis and dissertation copies are in typewriter face, while others may be from any type of computer printer.

The quality of this reproduction is dependent upon the quality of the copy submitted. Broken or indistinct print, colored or poor quality illustrations and photographs, print bleedthrough, substandard margins, and improper alignment can adversely affect reproduction.

In the unlikely event that the author did not send UMI a complete manuscript and there are missing pages, these will be noted. Also, if unauthorized copyright material had to be removed, a note will indicate the deletion.

Oversize materials (e.g., maps, drawings, charts) are reproduced by sectioning the original, beginning at the upper left-hand corner and continuing from left to right in equal sections with small overlaps. Each original is also photographed in one exposure and is included in reduced form at the back of the book.

Photographs included in the original manuscript have been reproduced xerographically in this copy. Higher quality 6" x 9" black and white photographic prints are available for any photographs or illustrations appearing in this copy for an additional charge. Contact UMI directly to order.

UMI[®]

Bell & Howell Information and Learning
300 North Zeeb Road, Ann Arbor, MI 48106-1346 USA
800-521-0600

**Teacher knowledge in the university classroom:
Inexperienced, experienced, and award-winning professors'
critical incidents of teaching**

by

Timothy J. Rahilly

A dissertation submitted to the
Faculty of Graduate Studies and Research
in partial fulfillment of the requirements for the degree of
Doctor of Philosophy



Department of Educational and Counselling Psychology
McGill University
Montréal, Québec
June 1997

© Timothy J. Rahilly
1997



National Library
of Canada

Acquisitions and
Bibliographic Services

395 Wellington Street
Ottawa ON K1A 0N4
Canada

Bibliothèque nationale
du Canada

Acquisitions et
services bibliographiques

395, rue Wellington
Ottawa ON K1A 0N4
Canada

Your file Votre référence

Our file Notre référence

The author has granted a non-exclusive licence allowing the National Library of Canada to reproduce, loan, distribute or sell copies of this thesis in microform, paper or electronic formats.

The author retains ownership of the copyright in this thesis. Neither the thesis nor substantial extracts from it may be printed or otherwise reproduced without the author's permission.

L'auteur a accordé une licence non exclusive permettant à la Bibliothèque nationale du Canada de reproduire, prêter, distribuer ou vendre des copies de cette thèse sous la forme de microfiche/film, de reproduction sur papier ou sur format électronique.

L'auteur conserve la propriété du droit d'auteur qui protège cette thèse. Ni la thèse ni des extraits substantiels de celle-ci ne doivent être imprimés ou autrement reproduits sans son autorisation.

0-612-37015-1

Canada

Abstract

The bulk of research on teacher knowledge has taken place in elementary and secondary school settings. The goal of this study was to examine teacher knowledge in higher education by asking: 1) what types of knowledge are drawn upon in teaching in higher education?; and 2) Are there differences in the knowledge drawn upon by inexperienced ($M=5.77$, $SD=2.8$ years teaching), experienced ($M=18.79$, $SD=7.36$ years teaching), and professors who have won teaching awards ($M=19.50$, $SD=7.60$ years teaching)? Participants were selected at random from published lists of university faculty. Questionnaires were mailed to 500 potential respondents asking them to recall and describe two memorable teaching incidents and then rate their response, using a Likert-type scale, to a series of items based on descriptions of teacher knowledge found in the literature. They indicated the extent to which they considered each item, and the extent to which they felt they had been influenced by knowledge of the item at the time of the incident. Finally, respondents answered questions about their teaching background. A total of 102 completed questionnaires were returned. Principal components analysis (PCA) resulted in a four factor solution describing the knowledge drawn upon. Factors were 1) pedagogical content knowledge, 2) current knowledge of learners, 3) knowledge of content, and 4) knowledge of learners' background and appropriate pedagogy. Definitions of the four factors were generated using PCA results and descriptions of the incidents selected based on factor coefficient scores. Stepwise multiple regression was used to determine variables that best predict factor scores. Overall, no differences were found between the factor scores of inexperienced, experienced, and award-winning professors. Results indicated differences in the definitions of particular types of teacher knowledge in higher education that broaden the definitions found in the literature. Results also indicated a marked difference in the knowledge base for teaching in higher education than accounts based on other educational milieus. The major contribution of this study to knowledge is conceptual in nature and reflects a portion of the groundwork necessary in constructing a theory of teaching in higher education.

Resumé

En général, la recherche sur les connaissances des professeurs vise les enseignants en milieux scolaires primaire et secondaire. La présente étude porte toutefois sur les professeurs oeuvrant en milieu universitaire. Plus précisément, deux questions la gouvernent : l'enseignement en milieu universitaire privilégie quels types de connaissances?; ces derniers diffèrent-ils selon que l'on est un professeur inexpérimenté ($M=5.77$, $SD=2.8$ années d'enseignement), expérimenté ($M=18.79$, $SD=7.36$ années d'enseignement) ou un lauréat de prix en enseignement ($M=19.50$, $SD=7.60$ années d'enseignement)? La sélection des participants a été faite à partir d'annuaires de corps professoraux. Le nombre initial de participants correspond au nombre de questionnaires envoyés, notamment 500, toutefois les résultats de l'étude sont tirés des réponses contenues dans les 102 questionnaires dûment complétés qui ont été retournés. La démarche de l'étude se résume aux étapes suivantes : les professeurs sont invités à rappeler 2 événements marquants en enseignement et à en faire la description, laquelle constitue la matière à approfondir. Ils sont donc appelés à l'évaluer dans un premier temps selon une liste de questions définie par la recherche en matière d'exploitation de types de connaissances; vient ensuite la détermination par l'enseignant de la présence et de l'incidence de chacune de ces questions lors de l'événement marquant. Une échelle de type Likert a servi à cette fin. L'analyse factorielle a été empruntée pour définir le type de connaissances exploité par l'enseignant. A ce titre, une grille d'analyse comportant 4 facteurs, dont voici la liste, a permis la plus complète des interprétations des données: 1. la connaissance de la pédagogie propre à la matière; 2. les connaissances actuelles des étudiants; 3. la connaissance de la matière; 4. l'appréhension des connaissances des étudiants et de la pédagogie s'y rattachant. Pour chacun des événements décrits les résultats de l'analyse factorielle ont été calculés et ce, dans le but d'obtenir pour chaque type de connaissances la meilleure description. Quant aux définitions des facteurs, elles ont été élaborées depuis les questions constituant chaque facteur ainsi que les descriptions obtenues des événements marquants. Enfin, la régression a servi dans la sélection de variables susceptibles de prédire efficacement les résultats de l'analyse factorielle. En conclusion, les résultats de l'analyse factorielle des professeurs inexpérimentés, expérimentés et des lauréats ne démontrent aucune différence. Toutefois, les résultats de l'étude présentent certaines différences en ce qui a trait aux définitions des types de connaissances en enseignement supérieur lesquelles élargissent les définitions actuelles. De plus, les résultats démontrent l'existence d'une différence importante entre le bagage de connaissances exploité en milieu universitaire et celui dans les autres milieux scolaires. Enfin, l'originalité de la présente étude est d'ordre conceptuel, ses résultats jetant les bases pour l'élaboration d'une théorie de l'enseignement supérieur.

Acknowledgments

A few months ago, on a cold Saturday morning in Montréal I awoke to spend another day working on my dissertation. I was tired, run-down, and fast approaching "fed-up"; the situation was perfect to arrive at the "threshold of revelation". On this particular day, it occurred to me that completing a Ph.D. was much like running a triathlon. After all, only an academic could come up with the combination of a 10K swim, a 30K bike race and a 20K run through the Hawaiian lava fields wearing only the smallest of bathing apparel! For a few moments the analogy was so clear. Then I thought that the Ph.D. differs from the triathlon in that typically doctoral candidates do not have a crowd cheering them on, the course is not well mapped out, and you don't know exactly when you are supposed to swim, run, or cycle. Instead while in the Ph.D., there are a few friends along the way who will hand you a glass of water or kind faculty members on the side lines who will point you in the right direction and might give a piece of advice such as "leave your bike behind while you are swimming!" While on this endurance test, you may encounter fellow students; those who pass you by, or others you pass on your journey that appear completely exasperated as they search for the finish line before the somewhat liberal time limit runs out.

Well, the good news is that I was able to make myself get back to work that day, and my dissertation has finally been completed; the finish line is here! This section of the document is my only chance to acknowledge the process and those I have met and depended upon along the way. Overall, the Ph.D. has been a time of tremendous change for me as a person; I have grown, I have shrunk, and I think I have come to know a lot more about myself and the fields of study in which I have worked. However, this did not occur in complete isolation!!

At this time I would like to thank my committee members for all their knowledge and support; without them, this dissertation would not have been possible. **Alain Breuluex** helped me understand the nature of academic work and helped me to clarify my goals. **Susanne Lajoie** taught me a great deal about cognitive psychology and its relation to instruction. She has been a resource who helped shape this work from its initiation to its conclusion. **Jim Ramsay** has encouraged me to reach deep down and re-learn statistics; he has been patient and generous with his time and knowledge. **Cynthia Weston** is someone who has taught me "a lot" on an academic and personal level. I am extremely grateful for her feedback and ongoing encouragement. **Alenoush Saroyan** has been an unwavering supporter, who as my doctoral supervisor has stunned me with her knowledge, ability, and work ethic. Thank you Alenoush, you are one of my role models! I would also like to thank several other professors including **Cheryl**

Amundsen, Bob Bracewell and Carl Frederiksen who have contributed to this study along they way.

I would like to thank a few of my fellow students who have cheered me on, read drafts, helped find participants, and helped me clarify my thoughts. Thanks, "and more" go to **Jo-Anne Dillabough** who kept me sane and made me laugh. Merci to **Nancy Lavigne** for her generosity and many kindnesses. I have been fortunate to have been encouraged by my fellow students at the Laboratory for Applied Cognitive Sciences, and the Centre for University Teaching and Learning including role models **Lorna Cochrane** who reminds me that "wherever I go, there I am", **Sue Davies** for her many words of encouragement and support, and **Terry Gandell** for punctuating my graduate career with her voice or reason. Thanks also to my friend **Kieron Rogan** for his tireless ability to "discuss" and offer professional therapeutic services at Thomson House. I extend a special thanks and acknowledge the contribution of **Marguerite Roy** and **Steve Munsie** in supporting this work through our formal meetings and informal discussions. To all the doctoral students mentioned above my very best wishes for a quick and painless completion of your dissertations.

Thanks to all the participants in this study and the pilot study for taking the time to share their experiences. Thanks also to the staff of the teaching centres in Canada and the USA who helped locate participants.

To my friends on the sidelines; their support was, and is, so very important! Thank you to long-time supporters **Carol Gordon, Carole Laviolette, Marc Lambert, Dan Stone, and Kieron Rogan** (again). Your belief in me made a world of difference.

I also want to thank my mother **Phyllis Rahilly**, my father **Vernon Rahilly**, and my brother **Mike Rahilly**, my aunt **Carol Rannie**, and my uncle **Thomas Rahilly, Jr.** for helping me to be the person I am becoming.

To **Charlie Chen**, my partner in life, I thank you for your love and support. You said I could choose, and I did. Onward and upward!

Lastly, I would like to thank all the sources of funding throughout the Ph.D. Major support came from *Fonds pour la Formation de Chercheurs et l'Aide à la Recherche*, the Social Sciences and Humanities Research Council of Canada, and the Royal Bank. I am extremely grateful for this support.

Table of Contents

Abstract.....	i
Resumé	ii
Acknowledgments.....	iii
Table of Contents	v
List of Tables.....	x
List of Figures.....	xi
Chapter One: Introduction and Review of the Literature	1
Introduction.....	1
Review of the Literature	5
Introduction.....	5
Teaching.....	5
Teaching in Higher Education.....	7
Teacher Thinking	11
Knowledge.....	16
Forms of Knowledge.....	17
Types of Teacher Knowledge.....	20
Methods Used to Examine Teachers Thinking and Knowledge.....	27
Teacher Growth.....	31
Emphasis in Teaching.....	31
Theories of Teaching.....	34
Expertise and Skilled Performance	35
Integration of the Frameworks.....	39
Summary	41
Theoretical Framework.....	42
Research Questions	43

Chapter Two: Methodology.....	44
Introduction.....	44
Selection of Methods.....	44
Overview of Methodology.....	45
Organization of this Chapter.....	46
Critical Incidents	46
History of the technique.....	46
New Uses for Studying Thinking	47
Critical Incidents and Cases	48
Strengths and Weaknesses of Critical Incidents	50
Innovative Uses of Critical Incidents.....	51
Pilot Study	52
Participants.....	55
Instruments.....	56
Critical Incident Questionnaire	56
Influences of Teaching Questionnaire.....	57
Tasks	58
Data Analysis	59
Phase One - Respondents, Grouping and Characteristics of the Incidents	59
Phase Two - Types of Knowledge Drawn Upon.....	60
Phase Three - Group Differences in Knowledge Drawn Upon	62
Summary.....	63

Chapter Three: Results	65
Introduction.....	65
Phase-One.....	65
Response.....	66
Feedback on Instruments.....	67
Participants.....	67
Grouping Participants.....	67
Teaching Incidents Reported.....	74
Phase Two - Types of Knowledge Drawn Upon.....	77
Exploratory Analysis of Factor Structure.....	79
Types of Knowledge not Included.....	84
Calculation of Factor Score Coefficients.....	85
Selecting Incidents that Typify the Factors.....	86
Pedagogical Content Knowledge	87
Current Knowledge of Learners	91
Content Knowledge.....	93
Learners' Background and Appropriate Pedagogy	95
Phase Three - Group Differences in Knowledge.....	97
Predictors of Knowledge scores.....	97

Chapter Four: Discussion and Conclusion.....	105
Introduction.....	105
Research Question One: Types of Teacher Knowledge ...	106
Types of Teacher Knowledge.....	107
Content Knowledge.....	107
Pedagogical Content Knowledge	108
Current Knowledge of Learners	110
Knowledge of Learners' Background and Appropriate Pedagogy.....	111
Types of Teacher Knowledge not Found.....	112
Knowledge of Teaching Routines.....	113
Knowledge of Curriculum.....	113
A Model of the Knowledge Base For Teaching in Higher Education.....	114
Methodological Issues.....	114
A Proposed Model	116
Theoretical Significance of Findings	119
Research Question Two: Group Differences in Knowledge Drawn Upon	121
Theoretical Significance of Findings	123
Strengths and Limitations of the Methods	124
Strengths.....	124
Limitations.....	125
Sample and Grouping.....	125
Representativeness of the Sample.....	127

Directions for Future Research.....	128
Contributions to Knowledge.....	129
Conclusions and Implications	130
Implications for Faculty Development.....	130
Conclusion	131
References.....	133
APPENDIX A: Certificate of Ethical Approval.....	151
APPENDIX B: Consent From.....	152
APPENDIX C: Questionnaire.....	153
APPENDIX D: Influences of Teaching Questions Based on Different Types of Knowledge Reported in the Literature	
APPENDIX E: Complete listing of Respondents Teaching Disciplines	175
APPENDIX F: Principal Components Analyses Factor Loadings.....	176
APPENDIX G: Complete listing of Critical Incident Summaries for each Factor.....	182

List of Tables

TABLE 1:	Number of Respondents in Each Group by Discipline	69
TABLE 2:	Number of Years of Teaching Experience and Current Teaching Load by Group	70
TABLE 3:	Respondents' Educational Background by Group	71
TABLE 4:	Number of Faculty Development Activities by Group (percentage)	73
TABLE 5:	Frequency of Poor and Exemplary Incidents by Time of Occurrence by Group.	75
TABLE 6:	Summary of High Loading ITQ Items from Principal Components Analysis for Knowledge Considered, and Knowledge Influencing Teaching	80
TABLE 7:	Number of Incidents Selected based on Factor Score Coefficients by Factor Type by Group.	88
TABLE 8:	Summary of Stepwise Multiple Regression of Variables Predicting Pedagogical Content Knowledge Factor Scores	98
TABLE 9:	Summary of Stepwise Multiple Regression of Variables Predicting Current Knowledge of Learners Factor Scores	99
TABLE 10:	Summary of Stepwise Multiple Regression of Variables Predicting Knowledge of Content Factor Scores	100
TABLE 11:	Summary of Stepwise Multiple Regression of Variables Predicting Knowledge of Learners' Background and Appropriate Pedagogy Factor Scores	101

List of Figures

Figure 1:	L. Shulman's (1987) model of pedagogical reasoning	15
Figure 2:	Graphic representation of teacher knowledge based on Leinhardt and Smith's (1985)	22
Figure 3:	Graphic representation of Shulman's 1986b model of teacher knowledge	24
Figure 4:	A model of the Inter-Relation of Different Types of Teacher Knowledge	117

CHAPTER ONE

Introduction

For those working in higher education or studying at the present time, it is clear that the idyllic days of the ivory tower have long passed and change is underway. In addition to dealing with diminishing budgets and escalating expectations in the areas of research, service, and teaching, schools and individual faculty must contend with higher levels of university enrollment (e.g., Statistics Canada, December. 4, 1996), changes in the mix of students (e.g., socio-economic background, educational background, cultural and linguistic background, age, national origin, etc.), the ever shifting role of technology in higher education, and ongoing and anticipated changes in faculty turnover and job responsibilities (Benson & Lewis, 1994; Millis, 1994).

Given these changes, it is not surprising that policy makers, students, faculty, industrial leaders, the press, and the general populous are questioning the mission, role, quality, and accountability of institutions of higher learning in our society at unprecedented levels (e.g., Altbach, 1995; Wright & O'Neil, 1994). While efforts such as the annual Maclean's Magazine rating of Canadian universities (see Lewis, 1996), which began in 1991, have resulted in a good deal of controversy within university circles, they seem to have been well received by a society of educational consumers who are eager for information about the best school to meet their needs as students (e.g., The students' guide to selecting a college or university, 1995).

In a similar vein, many policy makers and administrators have suggested that while research is vital to post-secondary education, the time has come to recognize that teaching is the primary task of

institutions of higher education; accordingly policies and resources must be reexamined to emphasize the importance of teaching (e.g., D. Kenny, 1990; Jacobson, 1992; Sheridan, 1991; Smith, 1991). A number of governmental and research initiatives such as the Commission of Inquiry on Canadian University Education (Smith, 1991), and the report of le Conseil Supérieur de l'Éducation (1991; 1994), as well as large scale surveys (e.g., Boyer, Altbach, & Whitelaw, 1994; Higher Education Research Institute, 1991) have consistently found that teaching in higher education is undervalued. Indeed, while there has always been high expectations with regard to the research done in universities, demand for accountability in teaching, at an institutional and individual level, is more recent (Jacobson, 1992; Ramsden, 1994).

Overall, these trends suggest that teaching is being seen as a vital component of post-secondary education (Collison, 1991; Millis, 1994). Institutions are beginning to see the importance of examining the quality of teaching in decisions relating to promotion and tenure (e.g., Seldin, 1991; Shore, Foster, Knapper, Nadeau, Neill, & Sim, 1986), and notions of good scholarship are shifting to include good teaching (Altbach, 1995; Boyer, 1990; Cunsolo, Elrick, Middleton, & Roy, 1996; Freedman, 1979). Moreover, there is evidence to suggest that individual faculty also recognize the importance of teaching. For example, the 1989 Carnegie Foundation survey of more than 5000 university faculty found that the majority agreed with the assertion that teaching effectiveness should be the primary criterion for promotion of faculty (Boyer, 1990).

However, the realization that teaching is vital to higher education does not guarantee its quality. The reality in higher

education is that faculty tend to be subject matter experts who leave graduate school with, often times, little or no teaching experience or training to teach. Clearly, the training of faculty in higher education is markedly different from that of teachers in primary and secondary settings. While a good deal is known about teaching and teacher training in pre-college or "lower education", unfortunately, these issues have not been extensively investigated in higher education. It is still unclear how professors learn to teach and what knowledge base they draw upon in the absence of formal pedagogical training. Indeed it would seem that many faculty are ill prepared for their teaching responsibilities.

In response to these needs, faculty development efforts are widely supported, despite on-going cut-backs. According to Erickson (1986) half of baccalaureate granting institutions in the United States had faculty development programs of some kind, to help professors meet the challenges associated with teaching improvement. In Canada, such programs have also received wide scale support; the Commission of inquiry on Canadian university education (Smith, 1991) recommended that "faculty development activities should receive a fixed, substantial portion of the university budget..."(p. 65). These programs can take on many forms and may range from one-time interventions (e.g., orientation of new faculty), consultation (e.g., specific skill development), workshops (e.g., dealing with stress, career planning, or specific classroom skills), or may include on going programmatic work with faculty (Centra, 1978; Harnish, 1994; Heppner & Johnston, 1994; Levinson-Rose, Menges, 1981; Sorcinelli, 1994; Watson & Grossman, 1994; Weimer & Lenze, 1991). These programs

are not static, they are ever evolving based on what is known about teaching and learning at the post-secondary level (Millis, 1994). In other words, research on faculty and their work is vital as it not only contributes to theory, but also informs the practice of faculty development (Cross & Angelo, 1988).

Accordingly, the focus of this study is on classroom teaching, which is one of the most common forms of instruction in higher education. Specifically, the study seeks to examine the knowledge base university professors draw on in real-life classroom teaching situations. It uses the critical incident technique to help stimulate detailed recall of one exemplary and one poor teaching situation and utilizes a questionnaire in order to explore teaching done by inexperienced, experienced, and award-winning professors.

The contribution of the study is twofold. At the theoretical level it contributes to the development of a theory of teaching in higher education. At the practical level it contributes to the knowledge base upon which faculty developers may draw upon in designing interventions to improve teaching.

Review of the Literature

Introduction

In this section the relevant literature on teaching is reviewed. Particular emphasis is placed on the role of teacher knowledge and thinking. It is important to note that the literature on teaching is very diverse; there are many viewpoints on both the theory and practice of teaching. The following review is limited in scope to the literature on teaching in formal settings, and draws mainly from the literature in education and psychology. In addition, while every effort has been made to include as much literature as possible on higher education, there are comparatively few studies of teaching at this level; a good deal of literature outlined is from elementary and secondary education. Accordingly, some of the differences between higher education and these contexts are addressed.

Teaching

There is no doubt that teaching was taking place long before anyone thought about what, where, and how it was being done. Although formal thought on teaching can be traced back a century or so (see McKeachie, 1990), philosophers such as Socrates and Aristotle began examining the nature of learning and thinking thousands of years ago. While no philosopher, psychologist, or educator has come up with the definitive definition of teaching, what has become evident is the vital link between conceptions of teaching and theories of learning.

In reviewing the literature, it is important to acknowledge the work of Aquinas, Locke, James, and Dewey, who among others, have not only shaped our views of education, teaching, and learning, but

also have had a profound influence on how we go about the process of inquiry on these topics. In reading the work of these individuals, it is evident that many of the contemporary issues in teaching are not new. It is humbling to realize that more than half a millennium ago, St. Thomas Aquinas (1225-1274) deliberated upon whether, among other things, teaching is theoretical contemplation or action (see A. Kenny, 1969, 1993); an important issue that will be addressed later in this review.

Despite this early body of literature, in reviewing the modern day literature, it is clear that a great deal more has been written about learning than teaching. For instance, while there are many theories of learning, there are no comprehensive theories of teaching. The one possible exception to this claim is the work of Bruner (1966) in which he articulates a few of the essential components of a theory of instruction. Thus, beginning with the modern day work of psychologists like Thorndike (1898) through more recent theories of cognition (e.g., Piaget, 1969) or situated cognition (e.g., Collins, Brown, & Newman, 1989; Brown, Collins, Duigud, 1989), the role of the teacher has been prescribed based on conceptions of how people learn. For example, following Thorndike's basic premise that learning is the formation of connections between stimuli and responses, one might drill students on multiplication tables. Similarly based on the Piagetian notion that knowledge growth arises from the construction of some kind of cognitive structure through the process of disequilibrium and equilibration, teaching might involve posing a question for which the learner has insufficient knowledge with which to respond. This requires the learner to engage in the processes of

seeking the answer through searching or based on a series of experiments. The work on situated cognition tells us that learners are apprentices who observe and require coaching and practice; learning is intertwined with the activities and environments in which it develops. Thus, in the past as well as in the present, good teaching has, for the most part, been viewed as series of behaviors, actions, or activities (e.g., Dillon, 1991; Glaser, 1990; Good, 1990; Schönwetter, 1993; R. C. Willson, 1987).

Indeed, the research on teaching has been dominated by studies investigating the effect of teaching behavior or performance on ubiquitous outcome variables such as that of "achievement" (Clark & Peterson, 1986). For example, research questions in this vein have looked at the effect of time-on-task, praise, or classroom management on students' understanding. In reviewing the research on teaching, Shulman (1986a) has labeled these studies as *process-product*. As he points out, such studies have been criticized as being grounded in a behaviorist tradition; while they have contributed a good deal towards the knowledge base of teaching and learning "in situ" they have done little to explicate the "**process**" of teaching. In other words these studies have not addressed "**how**" teachers use, for example, time-on-task, praise, or classroom management, to influence students' understanding. As Murray (1991) has asserted, "we need to understand the 'thought' behind teaching, including goals, planning, and decision making, and we need a theory of why it is that certain teaching behaviors affect students in certain ways" (p. 136).

Teaching in Higher Education

Although educators and psychologists have been interested in post-secondary teaching since the beginning of the 20th century (e.g., McKeachie, 1990), it is only in the last decade that the bulk of research in this context has been conducted. A recent search of the major electronic data base in education (i.e., ERIC) indicates that approximately half of the educational research indexed in the past decade has included some element of higher education. This stands in sharp contrast to the previous two decades when less than five percent of educational research addressed higher education. Despite this increased interest in higher education, few researchers have actually studied the process of teaching. Given this lacuna, it would seem that many of the generalizations made about teaching are based on older work done in primary and secondary settings.

The application of these research findings to higher education seems dubious as there are major differences between the context of higher and lower education (Buchanan, 1993; Fong, 1987; Sirotnik & Goodlad, 1988). For example, there is little doubt that: a) university students have different needs, abilities, and backgrounds than other students (e.g., Merriam, 1987); b) there are many more domains, subjects, or disciplines represented in higher education; c) there is a greater variation in the scope and depth of courses taught in higher education; d) post-secondary faculty have a greater variety of responsibilities apart from classroom teaching (Centra, 1993); and e) post-secondary teachers have more years of formal education than primary or secondary teachers. Most notably, however, unlike teachers in kindergarten through high school, few university professors have

been formally taught how to teach (Ramsden, 1992; Zuber-Skerritt, 1992). Instead, they draw their knowledge of teaching from their own experiences as students and what they learn once "on the job" (Fenstermacher, 1994; Kagan, 1992).

Given the differences in these contexts, one would expect disparity in the teaching and professional development of school teachers and university professors. The literature suggests that teachers are influenced by the context in which they teach; lower education teachers are concerned with issues such as classroom discipline and management (e.g., Dinham & Blake, 1991; Veenman, 1984; Westerman, 1991) while university professors are concerned about content (e.g., Marshall, 1995; Wilson, 1987). Lucas (1990) states that teachers in higher education focus most of their attention on development within their area of specialization (reading, conferences, research, etc.) and not on teaching as such. While the development of an extensive and up-to-date knowledge of one's domain will positively influence teaching, it does not guarantee teaching ability or quality (e.g., Magnusson, Andrews, & Garrison, 1993). In the case of a study of alternative teacher certification in secondary education where a comparison group of formally trained teachers was readily available, Clarridge (1990) found that expertise in subject matter alone resulted in poor teaching performance; subject matter experts were less able to keep students on task, give feedback, assess performance, and deliver content than those with some pedagogical training.

In addition to differences between educational setting, there are also differences in how teaching has been studied at the various levels. Overall, teaching ability or doing a good or effective job of teaching in

higher education has typically been associated with students' course evaluations (e.g., Cashin, 1988; Centra, 1993; Cranton 1992; Feldman, 1988; Sherman, Fowler, Armistead, Barksdale, & Reif, 1987). Findings from these studies indicate that enthusiasm, clarity of presentation, ability to stimulate students' interest, preparation, organization, and knowledge of content are the attributes associated with good teaching (Andrews, Garrison, Magnusson, 1996; Centra, 1979; Sherman et al, 1987). Good teaching has also been studied based on student achievement (e.g., Dickinson, 1990; Tanner & Celso, 1982); thus good teaching results in increased learner performance on outcome measures. For example, many studies have compared teaching strategies in multiple sections of a class addressing the same content knowledge. Based on the results of these studies, good teaching is said to be whichever methods are found to be associated with the highest test scores (e.g., Pressley, Tanenbaum, McDaniel, & Wood, 1990). Similarly, good or effective teaching has also been associated with creating situations that allow students more time on the learning task in the classroom (Fisher, 1981; Placek, 1982).

As noted above, process-product research in both higher and lower education has been criticized. While much is understood regarding teaching skills in higher education that has contributed to educational practice (e.g., McKeachie, 1990), a good deal less is understood about the thinking behind the observable teaching. In their review chapter on research in higher education in the *Handbook of Research on Teaching*, Dunkin and Barnes (1986) appealed for more process oriented research in higher education that allows for the exploration of teachers' thinking. Indeed, we already see this trend in

research conducted in the context of primary and secondary education but it is still relatively rare in higher education. Such research is of vital importance in order to inform improved practice.

Teacher Thinking

As changes in the dominant paradigm in educational psychology from behaviorism to cognitivism took place (i.e., Shulman, 1986a), educational researchers began investigating the unexplored "black box of teacher thinking" (e.g., Brown & McIntyre, 1993) or as Elbaz (1991) labels it, "teaching from the inside". The literature investigating this perspective has been broadly labeled teacher thinking (e.g., Calderhead, 1987; Clark & Peterson, 1986; Elbaz, 1991) and beginning in the mid-1970's, many researchers turned their attention towards the influence of teachers' thoughts in the classroom. For example, Shavelson (1973) called decision making the basic skill of teaching; this was quite different from other skill-based views of teaching at that time (e.g., use of behavioral objectives, effective classroom management behaviors, etc.). The underlying assumption of research on teacher thinking is that mental activities (e.g., thoughts, plans, judgments, decisions, etc.) influence teaching actions. As Shavelson and Stern (1981) point out, interest in teacher thinking arose out of interest in looking at the intentions associated with behaviours with the hope that findings from such studies would be used in implementing educational change.

Today, one need only examine the programs or proceedings from learned conferences in the area (e.g., American Educational Research Association, Canadian Society for Studies in Higher Education, etc.) to see studies of teacher thinking far outnumber process-product studies. Viewed from a thinking perspective, teaching

is recognized as more than a prescribed set of behaviors. Indeed, teaching is seen as a complex and multidimensional endeavor requiring the individual to face a number of demands, to draw on a diverse knowledge base, and to deal with a number of constraints such as the immediacy, unpredictability, and public nature of the task (Anderson, Blumenfeld, Pintrich, Clark, Marx, & Peterson, 1995; Calderhead, 1991; Doyle, 1986; Leinhardt & Greeno, 1986; Shavelson & Stern, 1981).

Definitions of teaching from this perspective generally emphasize the process of transforming content knowledge into instruction (e.g., Gudmundsdottir, 1991; Shulman, 1986b). This transformation includes the adaptation, alteration, and enrichment of content based on teachers' thoughts about classroom life (Wilson, 1988). It is a process whereby the "known and valued information is newly built, jointly rebuilt, and passed from one source to another" (Leinhardt, 1993, p. 1). Indeed according to Byrne (1983), good teaching consists of "employing appropriate representations which in some way relate to, or build upon, the representations of knowledge which pupils already possess (p. 18). However, as with earlier conceptions of teaching, there is no one approach to the task; a good deal depends on who the teacher is, who the learners are, where the teaching is taking place, what materials are to be used, and the nature of the content being taught (Leinhardt, 1993; Shulman 1986b).

In order to better understand the process of teaching, researchers have tried to de-construct the task. In doing so, Jackson (1968) suggested that there are pre-active and interactive phases of teaching. In other words, what teachers do whilst interacting directly with

learners is a markedly different type of task, requiring different kinds of thinking and action than that which takes place outside the classroom (e.g., preparing for class, grading, etc.). More recently, others (e.g., Kagan, 1990; Reynolds, 1992; Westerman, 1991) have suggested that the task can be broken down further to include the three main components of action and their associated thinking. The pre-active phase of teaching includes the selection and comprehension of content and materials, adaptation of content and materials, and the preparation of plans. The interactive phase of teaching takes place while "interfacing" (e.g., in a classroom, tutorial, on-line, etc.) with learners and includes the implementation and adjustment of plans as well as the monitoring of students, time, and ("in class") evaluation of students. Lastly, the post-active phase includes such activities as reflection on classroom activities and actions, as well as ongoing professional development and interaction with colleagues. While deconstructing the task helps recognize the many elements involved in teaching, given the iterative nature of teaching, the distinction between the phases of teaching is not straight forward. For example, how is the reflective thought after today's class, different from, or incorporated into the planning for tomorrow's class?

Another way to look at teaching is to contrast the types of thinking involved in the task. Clark and Peterson (1986) suggest a cognitive skills approach to teaching in which teacher thinking can be divided into three main parts, each of which involves a variety of tasks; planning (pre- and post- active thoughts), interactive thoughts and decisions, and teachers' theories and beliefs. Although the authors distinguish among these types of thinking, they state that it is the last

category, theories and beliefs, which is of greatest importance as it includes a rich knowledge base that is brought to bear on pre, inter, and post active thoughts. The literature in cognitive science supports the inclusion of an individual's theories and beliefs as part of the knowledge base that must be examined in investigating any kind of skilled performance (e.g., Bereiter & Scardamalia, 1986; Glaser, Lesgold, & Lajoie, 1988; Lajoie & Lesgold, 1992; Leinhardt & Smith, 1985; Royer, Cisero, & Carlo 1993).

Despite this recognition that knowledge has a pervasive effect on teaching, relatively few researchers have looked at the influence of knowledge in relation to teachers' thinking. Among the few who have addressed this question is L. Shulman (1987) who proposed a model of teachers' reasoning (see Figure 1) that is focused on several different types of knowledge involved in teaching and how knowledge growth takes place. This iterative model begins with the process of *comprehension* of the content, *transformation* (which includes determining how to represent content to the learners, adapting it based on characteristics of the learners, and selecting of an appropriate instructional strategy), *instruction* (observable teaching), *evaluation* (on-line or in class as well as formal testing), *reflection* (analyzing one's own and the class' performance and trying to ground the explanation on evidence based on the processes of reviewing, reconstructing, reenacting and critically analyzing one's own, and the class' performance), leading to *new comprehension* (of content, teaching, students, etc.). According to this model of pedagogical reasoning, the process or thinking of all teachers will be similar, however, the level or

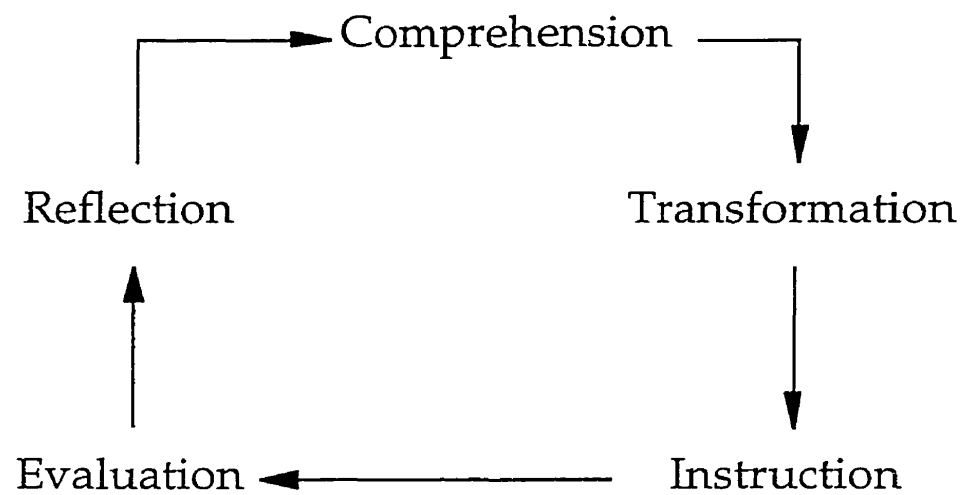


Figure 1. L. S. Shulman (1987) -- Model of pedagogical reasoning

degree of comprehension, and thus actions, will vary from one teacher to another.

Many of the seemingly different accounts of the process of teaching are not incompatible. For example, Clark and Peterson's (1986) and Shulman's (1987) work emphasize the inter relatedness of all of the tasks involved in teaching; they acknowledge the iterative process of thinking and instructing, and they emphasize the importance of knowledge in teaching. In addition, these accounts of teaching are compatible with general theories of cognition (e.g., knowledge acquisition, decision making, problem solving, skilled performance, & expert/novice differences) in other fields as outlined in the literature in cognitive science (e.g., Berliner, 1986; Borko & Putnam, in press; Ericsson & Smith, 1991; Ericsson & Lehmann, 1996; Sternberg & Horvath, 1995).

In summary, the literature addressing instructional situations strongly emphasizes learning rather than teaching (e.g., Dillon, 1991). Recent work acknowledges the link between teaching and learning (e.g., Calderhead, 1991). While teaching has often been seen in terms of actions, there seems little doubt that teachers' mental processes (e.g., Clark & Peterson, 1986) have a profound influence on what they do in the classroom. While research on teacher thinking is relatively recent, it has addressed many areas such as the planning of instruction (e.g., Housner & Griffery, 1985), teachers' beliefs (e.g., Carpenter, & Fennema, 1997; Peterson, Fennema, Carpenter, & Loef, 1989; Prawat, 1992), teaching behaviors (e.g., Leinhardt & Greeno, 1991), and teachers' decision making (e.g., Copeland, Birmingham, DeMeulle, D'Emidio-Caston, Natal, D., 1994; Westerman, 1991), to name just a few. A key

aspect of the research on teacher thinking is based on the premise that teacher thinking, like the thinking of other skilled professionals, is largely knowledge driven (e.g., Calderhead, 1991; Carter & Doyle, 1987, Leinhardt, 1991).

Knowledge

Based on the literature in cognitive psychology, there is little doubt that knowledge is a key construct in mental activity and that the essence of this knowledge is some kind of structure (Anderson, 1984). In this section, the nature of knowledge, its forms and types, is addressed and the knowledge base for teaching is explored.

Researchers agree that knowledge is central in teachers' interpretation of the task, perception and representation of classroom situations (e.g., Calderhead, 1983; Calderhead & Robson, 1991; Delandshere & Petrosky, 1994; Wood, 1991), in processing or thinking about teaching events (e.g., Copeland et al., 1994; Hashweh, 1987; Putnam, Lambert, & Peterson, 1990), and action in the classroom (e.g., Borko & Livingston, 1989; Shavelson & Stern, 1981). Although there seems to be a consensus that knowledge is a vital component of teaching, or skilled performance in general, there is still a good deal of debate in the literature as to the nature of teachers' knowledge, as well as the nature of the knowledge upon which teachers *should* draw in order to teach well (e.g., Reynolds, 1992). Unfortunately, in addressing this knowledge, few researchers have taken into account variables such as the context or milieu of teaching settings (e.g., high school, university, industrial training, etc.), teachers' backgrounds (e.g., formally trained, subject matter experts, etc.), difference in cultural and

geographic communities, different student or learner populations, and so on.

Further complicating discourse in this area is a general problem of terminology not only throughout the teaching literature, but also in the literature in cognitive science. For example, Alexander, Schallert, and Hare (1991) identified more than 25 labels applied to knowledge that has been addressed by various researchers. According to these authors, the terminology is often confusing, as similar types of knowledge are often given different labels that either imply differences where there are none, or fail to distinguish between differences among differing *types* of knowledge. The literature on teaching is full of such labels which may be arbitrary in nature. However, despite this confusion, the literature is clear on the importance of different *forms* of knowledge that are involved in carrying out complex activities such as teaching. These forms of knowledge are often cited in the cognitive science literature and are also evident in the literature on teaching and teacher education. As individuals gain experience in a domain (e.g., teaching, engineering, medicine, etc.) growth occurs in terms of the several forms and types of knowledge outlined below.

Forms of knowledge

In the next section various types of knowledge involved in teaching will be discussed (e.g., content knowledge, pedagogical knowledge, etc.). Within each of the types of teacher knowledge the following forms may be present.

Declarative knowledge. Declarative knowledge has been classically defined as "**knowing what**" or "knowing that" (Anderson, 1983). While such a definition appears very straight forward, it is

important to recall that a person may have declarative knowledge of almost anything and yet not be able to use that knowledge in carrying out a task (e.g., an action or a mental process). For example, a teacher may articulate the procedure on how to run a class discussion but be unable to use that knowledge in actually leading a discussion (e.g., Fayol, 1994; Gudmundsdottir, 1987).

Procedural knowledge. Procedural knowledge has been defined as "knowing how" (Anderson, 1983). Tasks like changing a light bulb involve procedural knowledge. This form of knowledge is said to be stored in a series of production or "if-then" rules. Researchers have argued that declarative knowledge is the substance from which procedural knowledge is developed. Thus, in learning to apply knowledge, one first has to "know" it declaratively (Bereiter & Scardamalia, 1986; Thomas & Thomas, 1994).

Conditional knowledge. Conditional knowledge is defined by Alexander, et al. (1991) as **knowing when, where, and if** to apply declarative or procedural knowledge. In teaching, this might involve knowing when to change teaching strategies (e.g., knowing when to lecture, knowing if discussion is appropriate, etc.).

Structural knowledge. This domain of knowledge was not addressed by Alexander et al. (1991) but was proposed in the 1970's in several different forms, and later clarified by Jonassen, Beissner, and Yacci (1993). Like conditional knowledge, structural knowledge serves as a bridge between declarative and procedural knowledge. According to the authors, structural knowledge is **knowing why** and describes how declarative knowledge is interconnected. Jonassen et al. (1993) state that structural knowledge "mediates the translation of declarative

into procedural knowledge and facilitates the application of procedural knowledge" (p. 4). It is knowing how concepts within a given domain are interrelated (Diekhoff, 1983); this type of knowledge is associated with proficiency in a domain.

Types of teacher knowledge

In addition to these forms of knowledge, many types of knowledge have been discussed in the literature specifically related to teaching. The most often cited type is that of *content knowledge*, also referred to as *domain knowledge*, or *subject matter knowledge*. This type of knowledge is generally acknowledged as a necessity for all teachers. Indeed, most teachers would identify themselves by a disciplinary label (e.g., Mathematics, English, Sociology, Physics, etc.). The importance of this type of knowledge has lead researchers, such as Feiman-Nemser and Parker (1990), to state that the "understanding of subject matter is a sine qua non in teaching." (p. 40). At its simplest level, subject-matter, domain, or content knowledge can be conceptualized as being declarative in nature. Alexander et al. (1991) have defined content knowledge as the realm of knowledge that individuals have about a particular field of study.

There is some disagreement about the nature of this type of knowledge; some say that it is primarily gained through study (e.g., Alexander, et al., 1991), while others have argued that certain aspects of this type of knowledge are not studied but are acquired through experience (Leinhardt & Smith, 1985; Shulman, 1986b). Calderhead and Miller (1985) state that content knowledge is essential in allowing teachers to plan, evaluate, diagnose, address pupils' questions, and deal with unexpected classroom events. They also state that knowledge of

content is essential for teachers to be enthusiastic about what they teach. Thus, content knowledge appears to have many roles and plays a vital role in the classroom.

Aside from content knowledge, what other knowledge might teachers possess and draw upon to successfully carry out their work? In addressing this question, there appear to be two major perspectives outlined in the literature that address the relationship between content knowledge and other types of knowledge that may be relevant to the task of teaching.

The first perspective is that of Leinhardt and Smith (1985) who describe teaching (elementary level mathematics) as a cognitive skill made up of complex knowledge and interrelated sets of schemata or routines drawing on two core types of knowledge, lesson structure and subject matter knowledge (see Figure 2).

Lesson structure. This type of knowledge involves general teaching skills and includes "the skills needed to plan and run a lesson smoothly, to pass easily from one segment to another, and to explain material clearly" (p. 247).

Subject matter knowledge. This type of knowledge is domain specific and is said to develop through experience. This type of knowledge supports lesson structure and is the basis upon which the teacher selects content and generates explanations through a process of goal selection and integration. According to this view, subject matter knowledge constrains lesson structure and strongly influences how a lesson will be taught.

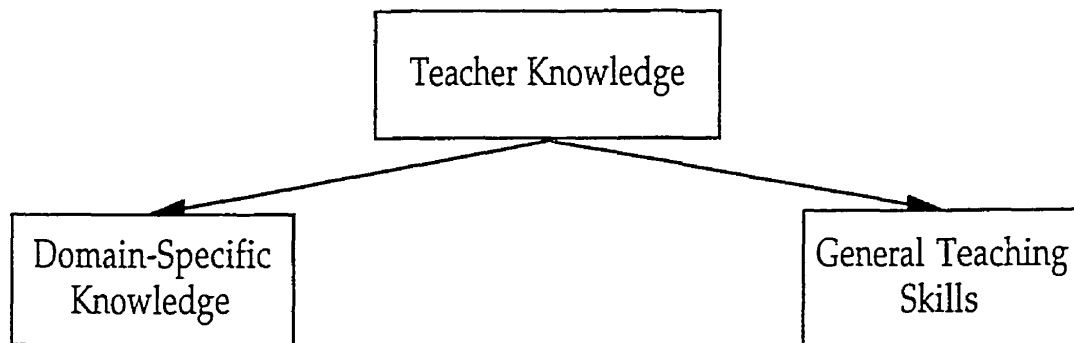


Figure 2. Graphic Representation of Knowledge of Teaching based on Leinhardt and Smith (1985)

The second perspective, proposed by Shulman (1986b), involves many different kinds of knowledge (see Figure 3). The super-ordinate categories of knowledge are general pedagogical knowledge and content knowledge. Below are some brief descriptions of some of the different types of knowledge outlined by Shulman (1986b):

General pedagogical knowledge . This type of knowledge is not domain specific. It is similar to general teaching skills as outlined by Leinhardt and Smith (1985) and includes knowledge of strategies for teaching and creating an environment that is conducive to learning, classroom management, basic beliefs about learning, learners, and teaching. According to this model, teacher knowledge also involves *content knowledge*, however, this type of knowledge can be broken out into several other subordinate types, one of which is the knowledge of the *subject matter*.

Subject-matter knowledge. This type of knowledge is defined by Shulman (1986b) in a similar fashion to other researchers; it is knowledge that teachers possess about an area as well as knowledge of its structure. However, he points out that subject-matter knowledge alone is not sufficient for teaching competence.

Pedagogical content knowledge. Shulman defines this type of knowledge as going beyond subject matter knowledge. It is knowledge of "the ways of representing and formulating the subject that make it comprehensible to others." (1986b, p. 9). It includes knowledge of the most often taught topics in an area as well as the most useful ways of representing those topics to learners including selecting the best examples, analogies, demonstrations, explanations, and so on. This type of knowledge has been called *subject-specific-pedagogical*

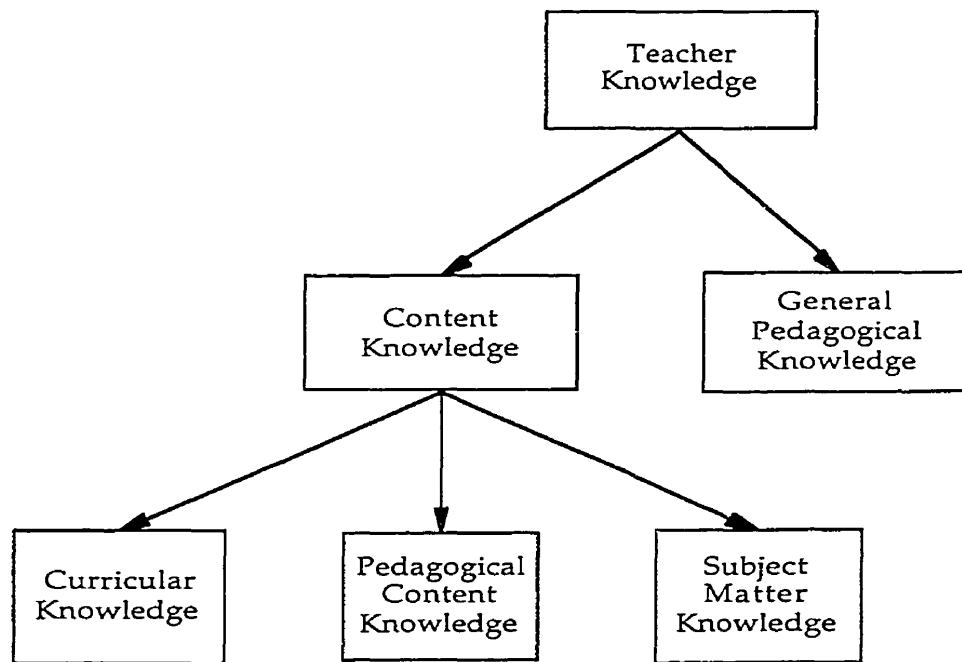


Figure 3. Graphic Representation of Shulman's 1986b Model of Teacher Knowledge.

knowledge by Reynolds (1992). Grossman (1989) elaborated Shulman's definition by labeling for central components of pedagogical content knowledge; a) overarching conception of teaching a subject which acts as a conceptual map for decision making, b) knowledge of instructional strategies and representations, c) knowledge of students' understanding and potential misunderstandings, and d) knowledge of curriculum and curricular materials (both within a grade level and in relation to what learners will encounter in the future).

Curricular knowledge. This type of knowledge refers to knowledge about the curriculum and the availability of a variety of instructional materials or resources.

Shulman's model is interesting because it clearly differentiates between general pedagogical knowledge and pedagogical content knowledge. This distinction seems of particular relevance in higher education where professors are subject matter experts and typically have not been formally trained in pedagogy, and where there is such a tremendous range of disciplines.

Some other types of knowledge, not yet mentioned, relate to the ways in which knowledge is represented and used. For example, Post and Cramer (1989) describe *conceptual knowledge* as "knowledge that is rich in relationship. It can be thought of as a connected web of knowledge, a network in which the linking relationships are as important as the discrete pieces of information." (p. 222). This type of knowledge sounds similar to structural knowledge as well as Leinhardt and Smith's (1985) schemas of classroom action. Other researchers have addressed *case knowledge* which can be defined as a "memorized repertoire of events or people which are highly significant for kinds of

tasks teachers face" (Calderhead, 1991, p. 272). This type of knowledge can assist the teacher with the problem formulation. Calderhead states that case knowledge can be thought of as *images* that are capable of storing a large amount of complex knowledge of classroom situations. Leinhardt's (1988) *Situational knowledge* is similar to case knowledge and includes knowledge or routines (a type of schemata) which are activities that teachers perform fluidly when confronted with a given situation (e.g., Leinhardt, 1993; Leinhardt, Weidman, & Hammond, 1987). These routines are "small, socially scripted pieces of behavior that are known by both the teachers and students" (Leinhardt & Greeno, 1991, p. 236).

Other types of knowledge have been addressed in the literature which emphasize the personal and tacit knowledge of professionals. For example, Elbaz (1983) and Conle (1996) speak of *practical knowledge* and Clandinin (1985), Connelly and Clandinin (1986), and Tamir (1991) speak about *personal-practical knowledge* which, simply stated, is the knowledge of how to do things which includes knowledge of the self, knowledge of the milieu of teaching, knowledge of subject matter, knowledge of curriculum development, and knowledge of instruction and develops through experience. Similarly, Kagan (1990) speaks of personal-practical knowledge in terms of the "practical argument" as the reasons provided for the way one acts in a given way (e.g., Fenstermacher, 1994; Morine-Dersheimer, 1988). There is also Schön's (1982) *knowledge-in-action*, which is dynamic in nature and "attempts to put into explicit, symbolic forms a kind of intelligence that begins by being tacit and spontaneous....It involves a continuous on-line anticipation and adjustment of the activity" (Schön, 1991, p. 26).

All the different types of knowledge outlined above have been presented as discrete entities. Indeed even the work of Leinhardt and Smith (1985) and Shulman (1986b) attempt to delineate the otherwise amorphous nature of teacher knowledge. While it is clear that there are many forms and types of knowledge involved in teaching, it is somewhat unclear as to which are most important in making one a competent or more than competent teacher.

Methods used to Examine

Teacher Thinking and Knowledge

There are a number of alternative methods in examining teacher thinking, many of which originate from and are used in cognitive science. The literature on methodological approaches used in examining teacher thinking can be divided into two categories. The first category is research based and tends to use techniques that are time consuming, labor intensive, and are intended to further theoretical knowledge about teacher cognition (Kagan, 1990). The second category can be described as teacher assessment (e.g., Glaser, Lesgold, & Lajoie, 1988; Royer, Cisero, & Carlo, 1993). It is slightly more practical in nature and is intended for use on a more wide-scale basis. While these approaches are not mutually exclusive, this review will focus on research based approaches because of its pertinence to the present investigation.

While there are many methods that can be used to examine teaching thinking, there are also a number of limitations associated with them that must be addressed, or at least understood. The primary limitation is ontological and epistemological in nature; there is, currently, no way that we can know or experience exactly what is going

through the mind of someone else, how exactly it is stored, or how it is recalled (Ozmon & Craver, 1992). Moreover, there are limitations in the communication of existing thought. Teachers, especially inexperienced ones, may not have the language to express their thoughts (Calderhead, 1987). Teachers' thoughts are often held unconsciously or they may not be willing to share thoughts that portray them in a negative light (Calderhead, 1991; Clark & Peterson, 1986; Kagan, 1990; Leinhardt, 1990). Many of these issues are not exclusive to examining teacher thinking; all branches of cognitive science investigating thinking must contend with them. There is however, a major limitation to studying teacher thinking that not all investigations of thinking have to address; teaching is largely verbal and interactive in nature.

Accordingly, many of the methods used to study teachers' thinking require participants to continually utter their thoughts aloud which is not a suitable or an appropriate method in classroom situations where teachers interact with the students. Thus, a number of other methods have been used which range from pencil and paper tests, observations, interviews, scenarios, stimulated recall of actual classroom events, and several others. As Kagan (1990) points out, the way in which the researcher conceptualizes teacher thinking will influence the type of tool used to examine the process. She stresses the importance determining the specific aspect of teacher thinking which is of interest, as not all tools are appropriate for all research questions. The specific methods that are appropriate for measuring the types of knowledge outlined in the previous are discussed below.

Subject Matter Knowledge. If a researcher is interested in measuring a teacher's subject matter knowledge, the process is basically the same as assessing students' knowledge. Accordingly, direct and non-inferential tools, as Kagan (1990) has labeled them, can be used. These can include short answer tests, essays, syllogisms, and the like. Based on the literature on the assessment of cognitive skills (e.g., Royer, Cisero, & Carlo, 1993) evaluating a professional's knowledge might include several components. For example, the knowledge base and knowledge acquisition of teachers might be addressed by determining if the teacher has enough knowledge necessary to do the job. Another aspect that might be examined is the structure and organization of a teacher's knowledge in order to determine the degree to which knowledge is integrated, and thus can be used in a performance (i.e., real-world) situation. Such an assessment might involve posing problems or cases and tracking the solution (e.g., Lajoie & Lesgold, 1992). Kagan (1990) also speaks of the use of concept mapping techniques (e.g., Novak & Gowan, 1984) to address this type of knowledge. Copeland and colleagues (1994) examined subject matter knowledge in terms of the level of detail of topic knowledge, and knowledge of concepts in the discipline. They used a card-sorting task to determine the hierarchy of principles in the discipline and evaluated the connections participants made between the topic being taught to other related topics.

Pedagogical knowledge. This type of knowledge can be assessed using many of the methods that were outlined in assessing subject matter knowledge. Pedagogical knowledge has also been assessed using what Kagan (1990) has described as contextual analyses of teachers'

descriptive language through the use of interviews and journal keeping. For example Munby (1986), using interviews and stimulated recall, examined metaphors teachers used to define their practice. Another method that can be used involves taxonomies for assessing self-reflection or metacognition (Kagan, 1990). This involves using some sort of scenario that emulates salient features of a classroom situation. This line of research addresses how teachers process data about the problem, interpret the data in relation to appropriate concepts, define the problem, generate solutions, and anticipate the consequences of the solutions. Using simulated teaching situations, the think-aloud technique may be used for this purpose. This entails having the teacher verbalize all their thoughts while directly engaged in a task (e.g., planning for a class or responding to a scenario). Taxonomies of self reflection involve teachers' recall of thoughts which may be stimulated by an experimenter or by viewing video tapes. Overall, these techniques have been criticized by cognitive scientists for their retrospective nature as well as the problems with self-report that were mentioned earlier (Kagan, 1990).

Pedagogical content knowledge. As with the other types of knowledge outlined above, there appears to be no single method of choice for examining pedagogical content knowledge. The most promising approach is what Kagan (1990) has called the multi-method approach. This method usually includes some aspect of the other techniques mentioned above. The strength of this approach is that data are triangulated to get a better picture of the teachers' knowledge and beliefs. A good example of this approach can be found in the work of Peterson, Fennema, Carpenter, and Loef (1989); they used a Likert-type

scale, a structured interview, and an experimental task to determine the knowledge of mathematics teachers.

Teacher Growth

Based on the literature, it is evident that teachers change (i.e., grow, develop, etc.) as they progress through their careers (Berliner, 1988; Calderhead, 1991; Leinhardt & Smith, 1985). This evolution has been accounted for from several perspectives. For example, some researchers have proposed developmental stage models (e.g., Berliner, 1988; Kugel, 1993) while others have attempted to delineate differences based on theories and beliefs that individuals hold about teaching. For example, Ramsden (1992) has proposed alternative theories of teaching in higher education. Marland and Osborne (1990), have examined teachers' theories-in-practice. Bullough and Stokes (1994), Freeman (1994), and Ormell (1996) have examined differences in teachers' descriptions of their practice in the form of narratives or metaphors to determine professional growth.

In this section, three frameworks representing different approaches to teacher growth will be presented. These frameworks were chosen as they emphasize different aspects of teaching; the three frameworks together address Clark and Peterson's (1986) three aspects of teacher thinking. The first two frameworks were developed in higher education while the last, a cognitive skills approach, is applicable to teaching, and other domains, in general. The section concludes with a discussion of the three approaches and highlights their contribution to making meaning of teaching at the post-secondary level.

Emphasis in Teaching

Kugel (1993) outlined a five-stage model of the emphasis that college professors place on teaching based on many years of informal observation. According to this approach, teachers progress through these stages as their concerns at one stage have been dealt with and concerns of the next stage emerge. Kugel points out that satisfying the concerns in one stage does not necessarily mean that the teacher will progress to the next stage. Indeed, there may be no next stage, and the teacher may not complete the stages in any particular order. Clearly, the model is limited in terms of its predictive power; however, it does outline a number of shifts in teaching that may occur in an individual's approach to post-secondary teaching.

Stage One - Self. Teachers begin their careers with a focus on themselves in the classroom. Some of the concerns that teachers have at this level are to please students and to appear competent. Teachers feel it is important for them to be able to answer students questions, and base their opinions as to their ability as teachers on students' reactions (e.g., see them as applause meters).

Stage Two - Subject. The emphasis at this stage is on mastering the content of their courses. At this stage teaching is still thought of as telling and learning is seen as students' listening. However, teachers are now thinking about their course "much as cooks think about the courses they serve." (p. 318). Teachers are said to plan the order of the content in an attractive and exciting manner so that students might digest it better. At this stage teachers put a good deal of time and effort into their teaching and it is the content that drives the teaching. Also

at this stage, the teacher is teaching as dictated by the content, and the presence of the students seems almost irrelevant.

Stage Three - Student. At this stage the professor views students as individuals rather than an amorphous mass; s/he realizes that individual differences will have to be accounted for in teaching in order to get the material across and uses many approaches in teaching, hoping to meet the needs of all the students. This stage is typified by the professor searching for student interest and tailoring teaching accordingly. It requires a good deal of energy on the part of the teacher and a good deal of classroom action as well.

Stage Four - Student as Active. At this stage the teachers recognize the importance of students' thinking in learning and teach accordingly. Teachers no longer lecture and tend to integrate more questioning into their courses. At this stage, not only does the emphasis on how to teach change but so does the views of what to teach. Teachers are less concerned about covering the material, and may not answer questions hoping that this will encourage the students to find out the answers on their own which may, in fact, annoy students.

Stage Five- Student as Independent. According to Kugel, professors at this stage have a difficult choice. They have to decide how much control they want over assignments and classroom time. If they allow autonomous and group work and have students correct their own work, a new kind of more meaningful learning and teaching is said to be taking place. Kugel (1993) acknowledges that this is risky for teachers and can be difficult for learners.

According to this framework, the evolution of teaching is one in which the professors begin by trying to prepare and present material in the most effective and efficient manner possible. After they have evolved, to one extent or another, they are more likely to encourage students, themselves, to learn as much as possible by giving them more autonomy. This framework is useful in that it offers one account of how professors might develop and outlines some of the pitfalls that professors might encounter during the course of pedagogical growth.

Theories of Teaching

The second framework is a theory of post-secondary teaching which addresses the growth of professors in relation to the beliefs they hold about their task. According to Ramsden (1992) there are three such theories. Each of the three theories subsumes the beliefs of the preceding theory or theories. Theory one is that of "teaching as telling" where the teachers see their primary role as disseminating knowledge. Hand in hand with the role is the role of students which is to remain passive and receive the information.

According to Ramsden's (1992) theory two, teaching is "keeping students active" which assumes that there is a finite set of rules that will result in an ideal learning situation. While the emphasis in this theory moves away from the teacher towards the learner, the focus is the activity. The underlying assumption here is that by being active, learning will take place.

Lastly, theory three is "teaching as making learning possible." Here teaching is seen as a complex task which is inextricably linked to learning and content. The teachers see their task as helping learners change their understanding; this may involve the techniques

mentioned in theories one and two. However, professors working under this theory, realize that there are certain conditions that are favorable for learning that need to be adapted to meet the needs of different individuals, contexts, and content areas.

Ramsden's (1992) theory is similar in many ways to the stage model outlined by Kugel (1993). However, Ramsden's (1992) model is hierarchical; it implies that theory three, "teaching as making learning possible" is the most desirable theory under which professors may work.

Expertise and Skilled Performance

The literature in cognitive psychology indicates the importance of examining changes in skilled performance and the thinking that goes with it in any profession as an individual progresses from the status of neophyte to expert (e.g., Chi, Glaser, & Farr, 1988; Dreyfus & Dreyfus, 1986). A common strategy in approaching skilled performance in any field is to identify the "best performers" or so called experts (Means, 1993).

While past studies have addressed this question in relation to teaching, one issue that has plagued the research has been the difficulty in determining who is, or what is an expert pedagogue (Berliner, 1986). As Salthouse (1991) points out, popular definitions of expertise (e.g., anyone with a briefcase more than ten miles from home, anyone wearing a white lab coat, etc.) often do not emphasize that expertise is a relatively rare thing. Berliner (1986) agrees, and speaks of the task of finding expert teachers as being akin to looking for Big Foot or the Yeti. In this search, there is no doubt that many researchers have made the mistake of confusing experience, which is generally acknowledged as

necessary in becoming proficient in a domain, with expertise (Berliner, 1986; Ericsson & Smith, 1991; Ericsson & Lehmann, 1996; Grossman, 1989; Salthouse, 1991). Clearly, these two terms are not synonymous as is indicated in the literature outlined below.

Before discussing some of the findings from this research, it is useful to understand some of the terminology or labels that have been applied to skilled performance. Based on the work of Fuller (1969), Berliner (1988) outlined a five-stage model of teaching (based on primary and secondary teaching milieus) that used the same non-domain specific framework proposed by Dreyfus and Dreyfus (1986). Unlike the stages outlined by Kugel (1993), these stages are linear and it is assumed that all of the stages must be completed in order to become an expert. The five stages are outlined below.

Stage one-novice. At this stage, a teacher is new to the job and is busy labeling and learning each element of a classroom to assist in determining rules for determining actions based on these facts and features. Classroom teaching performance is rational and relatively inflexible, and requires purposeful concentration.

Stage two-advanced beginner: Berliner (1988) states that many second and third year teachers reach this stage which is characterized by the acquisition of episodic knowledge (recognizing similarities across contexts) and strategies knowledge (an understanding of when to ignore or break rules). Prior classroom experience and the contexts of problems begin to guide the teacher's behavior.

Stage three-competent. At this stage, the teacher knows what is and is not important based on prior experience. In addition, the teacher knows the nature of timing and can target errors. However,

performance is not yet fluid or flexible, but the teacher is able to make conscious choices about actions, set priorities, and make plans.

Stage four-proficient. According to Berliner (1988), teachers reach this stage in approximately their fifth year on the job. At this stage, the teacher has developed intuition and know-how that usually assist them in performance. They have an overall sense of similarities in and between classroom contexts, are able to pick up information for the classroom without conscious effort, and can predict events with some precision.

Stage five-expert. Clearly, not all teachers reach this stage of skilled performance. Experts are characterized as having an intuitive grasp of situations; they are able to size up situations and act fluidly and appropriately in a seemingly effortless manner. The ease with which expert teachers perform is rooted in the standardized and automated routines used to handle instructional and classroom management issues; they no longer make the conscious choices that their less expert colleagues must confront moment by moment.

Generally speaking, this framework has been supported in studies of teaching. Overall, inexperienced teachers (arguably stage one and two in Berliner's 1988 model) have been found to be preoccupied with classroom management and control concerns (e.g., Kagan, 1991; Veeman, 1984), generate fewer alternatives to classroom problems (Kagan, 1991), do not pick up on student cues or have little knowledge of student characteristics to plan and alter lessons (e.g., Fogarty, Wang, & Creek, 1983; Peterson & Comeaux, 1987; Westerman, 1991), focus on their teaching activities rather than emphasizing student learning (e.g., Carter, et al., 1987; Copeland et al., 1994), are not student centred (e.g.,

Strahan, 1989), and have less elaborated schemas, or monitoring and metacognitive skills (Gagné, 1985).

Experienced teachers (stages three and four) have been shown to have more complex cognitive schemas (e.g., Borko & Livingston, 1989; Peterson & Comeaux, 1987), see the relationship between lessons and the overall curriculum (e.g., Westerman, 1991), have a richer knowledge base (e.g., Calderhead, 1983), think about the learning task from the students' point of view (e.g., Westerman, 1991), are more able to link their actions to a larger number of instructional goals (e.g., Fogerty, Wang, & Creek, 1983), and interpret classroom situations in a more complex meaningful manner than do novices (e.g., Copeland, et al., 1994).

Clearly, "the expert knows a great many things the novice does not know and can rapidly evoke the particular items relevant to the problems at hand" (Carter, Sabers, Cushing, Pinnegar, & Berliner, 1987, p. 147). The literature indicates that expert teachers have elaborate and rich cognitive schemas that provide a framework to inform and facilitate action in complex classroom situations; overall, experts know what to expect in classroom situations (Bereiter & Scardamalia, 1986; Leinhardt, 1990). Experts are student centred in relation to academic, emotional, social aspects of classroom life, are more skilled at drawing inferences from student questions, can "look inside" students' work, and also possess superior metacognitive and monitoring skills (e.g., Gage & Berliner, 1984; Gagné, 1985; Strahan, 1989).

Descriptions of expertise in teaching are similar to characteristics of expertise in other domains outlined in the literature (Berliner, 1986, 1991; Livingston & Borko, 1989). Generally speaking, expertise is

domain specific (i.e., experts are not expert at everything, and expert teachers are not expert teachers of all content matter). Nonetheless, experts recognize and represent or encode problems or situations differently than non-experts, they recognize similarities in situations to prior experiences, they have superior short-term memories, they see the deeper or more principled aspects of situations rather than the surface information, they are faster and make comparatively fewer errors than non-experts, and they have strong self-monitoring skills (Chi, Glaser, Farr, 1988; Dreyfus & Dreyfus, 1986; Ericsson & Smith, 1991; Ericsson & Lehmann, 1996).

Integration of the Frameworks

In the section above, three frameworks representing different aspects of teacher growth were outlined. They addressed the emphasis that teachers place on their teaching, professors' theories of teaching, and the acquisition of skilled performance. These frameworks all emphasize the complex nature of teaching and the importance of the teacher, the learner, and content. Indeed, as Berliner (1991) noted, teachers must develop expertise in pedagogy and content, as well as in knowledge about how best to interact with learners in order to be an expert teacher. These three frameworks address the various aspects of teaching and teacher thinking outlined earlier in this chapter (e.g., Peterson & Clark, 1986) and are in accord with Shulman's (1987) model of pedagogical reasoning. Together, these approaches to teacher growth highlight the importance of what teachers know in relation to how they teach. Indeed as Veeman (1984) points out, beginning and expert teachers may well encounter the same problems but may deal with the problem in an entirely different manner.

Of particular importance in the literature on teaching and teacher growth is the general finding that a teacher's knowledge base (content, pedagogical, pedagogical content, etc.) has a profound effect on understanding, representing, solving, or dealing with classroom situations (Calderhead, 1988, 1991; Carter, Cushing, Sabers, Stein, & Berliner, 1988; Kagan, 1992; Kwo, 1994; Swanson, O'Connor, & Cooney, 1990). Copeland and colleagues (1994) make the general assertion that "as people gain education and experience in teaching, the understanding they express of classrooms they observe is characterized by an increase in the quantity and complexity of linkages among ideas and by a shift in the focus of these linked ideas toward issues more central to classroom teaching including content taught and learned, pedagogical processes used and experienced, and basic educational purposes." (p. 177). This assertion is based on the comparison of master teachers (those with more than 20 years experience and identified as experts), "laics" (individuals similar in key aspects to the master teachers, but without any educational training), and less experienced teachers. The study found that master teachers possessed a richer and more diverse knowledge base than the other two groups. Overall, the laics were found to be cognitively similar to less experienced teachers.

A number of other studies which contributed to Shulman's (1986b) model of teacher knowledge have reported similar findings reported by Copeland et al. (1994) (e.g., Ball, 1988; Grossman, 1988; Grossman & Richert, 1988; Wilson, 1988). The work of Hashweh (1987) is, however, of particular interest as it examined the role of the knowledge base for teaching using a counterbalanced design in which the same teachers taught lessons in their own domain in addition to

lessons in a related, less familiar, domain. Results from this study indicate that when teaching more familiar content (i.e., a situation in which the teacher presumably had more content knowledge and pedagogical content knowledge), teachers were more likely to detect student preconceptions, exploit opportunities for worthwhile digressions, and link students' insightful comments to the lesson. On the other hand teachers with less content knowledge, at times, reinforced students misconceptions. Teaching in the higher content knowledge condition also positively effected the number and quality of the representations (e.g., examples, anecdotes, etc.) that teachers used.

Summary

Teaching is a complex and multidimensional task in which the teacher makes meaning of content, transforms that content, teaches, evaluates, reflects, and arrives at a new understanding of the content. Studies of teaching indicate that knowledge of content alone, is insufficient in effective teaching. Indeed, teaching has been found to require a rich and diverse knowledge base that includes a number of different types of knowledge including, content knowledge, pedagogical knowledge, and pedagogical content knowledge. Past studies have indicated that teacher knowledge has a profound effect on how teachers understand, represent, and resolve classroom situations. These studies also indicate that teachers possess and can apply varying amounts of this knowledge at various points in their professional development. The bulk of this research has been carried out in primary and secondary setting which are markedly different from the milieu of higher education. Two major differences between these settings seem especially relevant in examining theories of teaching and teacher

knowledge. The first difference is related to the training of teachers in the various settings; few faculty in higher education have had formal teacher training. Another difference is in the content training of the teachers; faculty in higher education have typically had more years of education and are subject matter experts in their field. While research has indicated that effective teachers in primary and secondary settings draw on their knowledge of content, pedagogy, and pedagogical content knowledge, it is unclear if the same can be said for teachers in higher education. It seems feasible that the knowledge base for effective teaching in higher education may rely heavily on content, and pedagogical content knowledge. It is also possible that effective teaching in different disciplines of higher education may draw more heavily on one aspect of knowledge than another.

Theoretical Framework

This study draws on a number of the theoretical frameworks which were outlined above including teacher thinking (e.g., Clark & Peterson, 1986; Shulman, 1987), knowledge and types of teacher knowledge (e.g., Leinhardt & Smith, 1985; Shulman, 1986b), methods for assessing teaching thinking (Kagan, 1990), and work on teacher growth (e.g., Dreyfus & Dreyfus, 1986; Kugel, 1993; Ramsden, 1992). The study addresses university teachers' thinking and the goal of the study is to contribute to the development of a theory of university teaching. It addresses the structure of university teachers' knowledge base based on the accounts of the various types of knowledge outlined in the literature. Particular reference is made to the work of Leinhardt & Smith (1985) and Shulman (1986b) who posit that knowledge of teaching and pedagogy and knowledge of content are separate types of

knowledge. The study draws on the methods for investigating knowledge outlined in the literature in cognitive psychology which highlights the importance of knowledge (Anderson, 1983) of varying types (e.g., Shulman, 1986b) and the ways in which it is represented (e.g., Glaser, 1989) and examined (e.g., Kagan 1990). The study also draws heavily on the frameworks of teacher growth, primarily work based on novice, experienced, and expert teachers (e.g., Berliner, 1986; Copeland et al., 1994) that embrace change in the professional lives and knowledge base of teachers as they learn and progress through their careers. These theoretical frameworks guided the selection of an appropriate method for capturing the many different types of knowledge that may make up a knowledge base for university teaching. The *critical incident* method was selected and has distinct basis in the methodological literature that will be addressed in depth in the next chapter.

Research Questions

Based on the literature outlined above two main research questions are posed to examine teacher knowledge in higher education.

- 1) What types of teacher knowledge are drawn upon in teaching in higher education?
- 2) Are there differences in the knowledge base, and the knowledge drawn upon by inexperienced, experienced, and award winning professors?

CHAPTER TWO

Method

Introduction

The ways in which teachers observe, understand, represent, solve, and act in classroom situations are related to their knowledge base of teaching and the changes they undergo as they gain more experience and expertise (e.g., Carter et al., 1988; Copeland et al., 1994). Existing theories of teacher knowledge emphasize several aspects of knowledge including content, pedagogical, pedagogical content knowledge, among others (e.g., Shulman, 1986b). This study examines the types of knowledge inexperienced, experienced, and award-winning university faculty draw on in their classroom teaching and, ultimately seeks to contribute to the development of a theory of teaching in higher education.

Selection of Methods

As noted in chapter one, there are many tools available to examine teachers' thinking (e.g., Kagan, 1990). As knowledge is the principle aspect of teachers' thinking being addressed, the critical incident method, described later on in this section, was selected because it emphasizes the day-to-day experiences of faculty through the recollection and exploration of memorable events of classroom teaching. A questionnaire was used in conjunction with the critical incident method. This questionnaire was developed based on the literature on teacher knowledge and drew on findings of a pilot study conducted prior to the main study. The use of the critical incident technique in conjunction with a questionnaire is a multi-method

approach, which strengthens the account of teachers' knowledge and beliefs Kagan (1990).

The critical incident technique is rooted in a phenomenological approach and has been shown to yield data which identify the underlying assumptions related to thoughts, actions, and beliefs (Brookfield, 1990). In addition, this method is strongly tied in with individual experiences and emphasizes events that are meaningful in a particular context. Moreover, it allows for the collection of both qualitative and quantitative data about classroom teaching and teaching thinking. Nonetheless, like all methods, this method is imperfect; it is retrospective in nature and does not capture perfectly thinking in the context of action.

Overview of Methodology

In this study faculty were asked to briefly describe two classroom incidents; one in which they thought they had done an exemplary job of teaching, and one in which they felt they had done a poor job. Once they had described one of the incidents (time, topic, students, etc.), respondents rated a series of questions which polled the influence of different types of knowledge they associated with the incident on a seven-point Likert-type scale. They rated both the extent to which they felt they consciously considered the type of knowledge as outlined in the item, at that particular time, and also rated the extent to which they felt the type of knowledge actually influenced their teaching at that time.

The data were examined in three ways. First, general characteristics of the sample and their responses were examined to determine respondents' teaching profile, training, disciplinary

background, and the nature of the critical incidents reported (e.g., recency, class size, level of students, etc.). Based on this information, respondents were grouped (i.e., inexperienced, experienced, and award winning) and differences in the groups were examined. Second, respondents' ratings of the types of knowledge associated with the critical incidents were analyzed to determine the types of knowledge, as outlined in the existing literature, drawn upon in teaching in the university classroom. These ratings were used to select incidents that typified the various kinds of knowledge. Lastly, group differences in the types of knowledge drawn on during teaching were examined, and the best predictor (e.g., group membership, teaching experience, discipline, etc.) was determined for each type of knowledge.

Organization of this Chapter

As this study is largely based on the use of the critical incident method and the exploration of memorable events of teaching, this method and the associated literature are outlined in the next section. This is followed by the description of broad findings of a pilot study conducted prior to the main study in order to explore the methodology and fine-tune the instrumentation and methods of the current study. Next, a description of the development of the instrumentation used in the study is outlined, followed by a description of the participants, the procedures, and methods of data analysis.

Critical Incidents

History of the technique

The critical incident technique was developed by Flanagan during World War II in order to study effective pilot performance (Flanagan, 1954). The technique is quite straight forward. Basically, job

incumbents, recognized as good performers, are asked to recall a time when they thought they were doing a good job. According to the technique outlined by Flanagan, the actions that constitute good performance are examined, and based on findings, psychologists or trainers can make informed decisions about how best to go about enhancing the performance of others to match that of the good performers. Although the technique has been criticized as being too strongly rooted in behaviorism, it continues to be used, more or less, as originally outlined by Flanagan. For example, recently it has been proposed as a technique that may be used in teacher evaluation (Regan, 1993). The technique has also been reported as a viable method for evaluating programs or for needs assessments in higher education (e.g., Lang, 1994; Jonassen, 1988).

New Uses for Studying Thinking

Critical incidents are also being used to study thinking. For example, Woolsey (1986) used the technique to evaluate counsellors' thinking in an effort to investigate and develop a variety of beliefs, constructs, and theories (e.g., self-esteem). The critical incident technique is appropriate for studying thinking as it is based on events (physical and mental) that have actually happened, and involve the factors that have significantly affected the process and outcome; thus, they constitute an ideal technique for accessing an individual's experience, assumptions, beliefs, and heuristics for thought and action (Brookfield, 1990). According to Benner (1984) critical incidents can also be used to help access the experts' masked knowledge. She states that experts' knowledge is not unlike a pearl locked away in an oyster. Benner describes a critical incident as one in which you feel your

intervention really made a difference in the outcome. The incident is one that went well, or one in which things did not go as planned. Although these incidents are very ordinary they also capture the quintessence of the professional activity.

Overall, the critical incident technique is superior to general survey methods for exploring respondents' experiences (Vispoel & Austin, 1995), as well as the assumptions that underlie their thoughts and actions (Brookfield, 1987; 1990). For example, Means (1993) outlines a form of the critical incident technique that has been used to study the thinking of air traffic controllers in particularly difficult situations (e.g., impending aircraft collision). No doubt, it would be difficult to begin an investigation of thinking of this sort using more traditional pencil and paper measures. As Brookfield (1990) states, if constructed properly, the critical incident technique can result in a rich description of a particular series of events, including the underlying thought, that are so graphic the audience can visualize clearly the events described.

Critical Incidents and Cases

The literature on the critical incident technique is not vast. However, a good deal has been written about the use of classroom cases as a teaching tool and research method for capturing practice (Kagan, 1993). A complete critical incident is in fact a narrative form of a classroom case; the technique is often used to generate these cases (J. Shulman, 1987). Although cases can take several forms (short, long, facts, narratives, etc.), as long as they provide enough realism, detail, and depth, they are "almost like a verbal video" (Bjerrum Nielsen, 1995, p. 5).

Cases are often used in teacher education (e.g., classroom cases) and in other fields as an instructional strategy that requires learners to apply knowledge (e.g., Brookfield, 1987; Shulman, 1992; Shulman & Colbert, 1989; Tripp, 1993). The case-based method gained its popularity at the schools of business, and it is often used in other professional schools such as law (e.g., reviewing court cases, moot court, etc.), and medicine (e.g., real or simulated patients) where it is currently one of the principle methods of instruction (Hewson & Hewson, 1990; Williams, 1992). Cases are popular as they have high face validity, and are of great pedagogical value as they present "real life" situations or "problems" (Weaver, Kowalski, & Pfaller, 1994).

Because of the real life aspect of cases, they have been used to evaluate teacher cognition and to research teacher thinking as they emphasize both the unique and normative qualities of teaching; thus they reveal particular thought processes as well as common ones (Elbaz, 1991; Kagan, 1993). When a learner reads a case, they engage in a process of abstractions that involves filtering or selecting the meaningful information (facts, context, etc.) from the situation based on their own values, beliefs, experience, and knowledge base (Kagan, 1993; Kowalski, 1993). Shavelson and Stern (1981) reviewed a number of studies that used a case based method to investigate teachers' pedagogical thoughts, judgments, decisions, and behavior. They concluded that this method is ideal for capturing the reality of teaching situations in which immediate action is required. According to these authors, after reading a case, a person extracts the information and builds a personal simplified model of the situation; this process of

selection and abstraction of information is of great interest in studying teachers' thinking.

Strengths and Weaknesses of Critical Incidents

As a method to investigate teaching and teacher thinking, the critical incident shares many of the strengths associated with case-based methods, and may have additional advantages. Clearly, critical incidents are strongly rooted in the individual's experience and thus, give teachers a "voice" that is often missing from much of the research on teaching (e.g., Cochran-Smith & Lytle, 1990; Reynolds, 1992). Since critical incidents are drawn directly from memorable experiences, they are bound to be more relevant and meaningful than cases which are based on the experiences of others. As Elbaz (1991) states "...we have to acknowledge that all of us retain stories of teaching, memorable or hair-raising moments which encapsulate something important about our work..." (p. 4).

One of the major drawbacks to using the critical incident technique is trying to make meaning of the incidents. Typically, incidents are reviewed post-hoc and analyzed thematically (e.g., Edwards, 1993; Rahilly & Saroyan, 1995; Schmelzer, Schmelzer, Figler, & Brozo, 1987). As this analysis tends to be labour intensive, data are rarely based on a large sample size. Accordingly, the generalizability of the findings is often questioned. In addition, methods like the critical incident are often criticized by researchers in cognitive science as being retrospective in nature, and thus, may not be ideal for capturing thinking in action (Kagan, 1992). In addition, the method is based on self-report, and as mentioned above, teachers may be reluctant to report anything that casts them in a negative light.

In the literature on reflective practice (e.g., Schön, 1982, 1991), practical knowledge (e.g., Bruner, 1995, 1996), metacognition in teaching (e.g., McAlpine & Weston, 1996, 1997), and postmodern research methods in education (e.g., Casey, 1995), these same weaknesses are seen as strengths as they yield accounts of teaching and teacher knowledge that may otherwise elude the more traditional or post-positivistic research methods associated with cognitive science.

Given the dynamic nature of teaching, no single method of research is sufficiently robust or adequate to account for different views of educational research; each individual method will have shortcomings. One appropriate solution is to use a variety of approaches to study teacher thinking (e.g., Kagan, 1990).

Innovative Uses of Critical Incidents

In a study by Vispoel and Austin (1995), the critical incident technique was used in conjunction with a more traditional survey instrument. The critical incident focused respondents on particular meaningful events in their lives while filling out a survey measuring attributions of success and failure. Using the critical incident in this manner seems an innovative approach for several reasons. First, the method lends new credibility to survey instruments that have been traditionally seen as being overly inferential by those investigating any sort of thinking in action; the data collected are more meaningful as they are based on the real-life experiences of the respondents. Second, this combination of methods allows for a great deal of flexibility on the part of the researcher in collecting both qualitative and quantitative data. For example, the researcher can choose to collect in-depth descriptions of the critical incidents or more surface descriptions that

may be used in conjunction with the data collected using questionnaires. Third, this method offers the opportunity for researchers to use critical incidents with large samples as well as the chance to test the generalizability of frameworks or taxonomies of thinking. It is precisely for these reasons that the method was selected for the current study.

Pilot Study

The pilot study was undertaken to generate a framework of the characteristics of knowledge, thinking, and action associated with the teaching experiences of relatively inexperienced university teachers, experienced faculty, and award winning professors as well as to test the possible use of the critical incident method to explore the knowledge base for teaching in higher education.

Thirty university instructors representing three groups took part in the pilot study. Participants were equally divided between Arts and Science faculties. Group one (n=10) had taught for less than five years, group two (n=10) had been teaching for ten years or more, and group three (n=10) were faculty who had been teaching for ten years or more and had won national teaching awards. Participants were selected at random from published lists of award winning professors (e.g., 3-M Awards, CASE, etc.), and membership directories of national organizations such as the Society for Teaching and Learning in Higher Education (STLHE). Some of the members of the inexperienced group were selected based on the recommendation of award winning and experienced participants. Every effort was made to match the disciplinary background of each of the award winners with an experienced and inexperienced professor in the other groups; thus, the

groups were similar with respect to the range of disciplines represented.

Potential participants were contacted by mail or by electronic mail and asked to reply if they were willing to take part in the study and to indicate a convenient time for a telephone call of approximately 30-40 minutes which would be tape recorded. Data collection consisted of a structured telephone interview based on the critical incident technique outlined by Flanagan (1954) and Woolsey (1986).

Accordingly, participants were asked to recall a specific time when they thought they were doing a good job of teaching in the classroom.

Despite some initial difficulty by a few respondents, every participant was able to answer the question. During the response to the question the interviewer actively listened and only interrupted to clarify the response or to prompt for further information. A complete incident included the following information: a) a general description of the situation (conditions, class size, level, etc.), b) an indication of when the incident occurred, c) a description of classroom activity (e.g., what was going on?), d) a description of the professor's actions (e.g., what did you do?), e) an indication of what the professor was thinking at the time, f) a statement outlining the purpose or reason behind the professor's activity (e.g., a goal), an indication of the professor's criteria for determining if their goal had been met, and h) an indication of why they thought this incident was memorable. Once the participant had finished recounting a good teaching experience, they were asked to recount a bad teaching experience and to answer the same questions as the ones posed for the good incident.

Complete results are reported elsewhere (see Rahilly & Saroyan, 1995). Highlights include the findings that the inexperienced and experienced group were very similar in their thinking. Award winners, on the other hand, were different than the other two groups and had an in-depth knowledge base which encompassed a greater number of types of knowledge than the other two groups. Overall the results of the pilot study support past findings in various domains that suggest changes in thinking occur as professionals progress from the status of novice to experienced, and to expert. In addition, some broad disciplinary differences in thinking and action were also observed. Finally, results suggested that respondents' emotions during the actual teaching incident also seemed to influence their actions and their selection of good and poor teaching incidents.

With regard to the methodology, the pilot study indicated that the critical incident technique can be a viable method in exploring teachers' thinking and their knowledge base. All respondents could readily identify and discuss memorable incidents. They seemed quite comfortable recounting events that portrayed them in both a positive and negative light; most of the respondents, from all groups, recounted incidents that were less than flattering. With regard to the ordering of the exemplary and poor incident, Flanagan (1954) and Brookfield (1990) both recommend collecting the positive incident first. However, fine tuning of the order of questions in the pilot study indicated that respondents could more rapidly identify a poor or negative incident than a positive one. After having recounted a poor incident, identifying a good incident seemed far easier for them.

Findings from the pilot study were promising. The open one-on-one nature of the pilot study allowed for an in depth exploration of the critical incidents but was too labour intensive to be used for large number of participants; clearly, findings from the pilot study needed to be confirmed with a larger sample but the results could be used in the current study to fine-tune the instruments (e.g., type of questions asked of respondents) and the methodological approach.

Accordingly, the method of data collection was slightly modified for the main study to facilitate data collection and analysis from a larger sample of respondents.

Participants

Five-hundred questionnaires were mailed to full-time faculty at institutions of higher education across Canada and the United States. Names were randomly selected from university listings, phone books, membership lists of multi-disciplinary organizations for university faculty, and from published lists of national teaching awards. Additional assistance was sought from the staff of teaching improvement centres at a number of universities in identifying potential participants. Respondents were divided into three groups: 1) national or university teaching award winners, 2) experienced professors, and 3) inexperienced professors. While the grouping variable of award winning professors is easily determined, the exact distinction between experienced and inexperienced professors was based on the literature which suggests that it takes at least 10 years of experience before one may become expert (e.g., Erikson & Smith, 1991). The sample of non-award winners was examined and it was determined that the median number of years of teaching experience

was 10. Thus, the absolute cut-off for the experienced group was 10 or more years of experience, while all respondents in the inexperienced group had less than 10 years or less teaching experience with the vast majority of them possessing much less experience. The exact characteristics of the groups are reported in the results section.

Instruments

Two questionnaires were developed for use in this study. They are briefly outlined below (see Appendix C).

Critical Incident Questionnaire

The Critical Incident Questionnaire (CIQ) was developed based on Flanagan's (1954) original description of the critical incident technique in conjunction with Benner's (1984) description which emphasizes an incident as one in which the respondent felt their intervention made a difference (for the better or worse). The CIQ is composed of 12 questions that asks respondents to describe the circumstances of the incident (e.g., when, where, kind of class, topic, etc.). Ten of the questions are open ended and the other two are multi-part forced choice. A number of questions are based on the literature on problem solving (e.g., Hayes, 1989); thus respondents are asked to identify their teaching and learning goals, and to identify their actions, and to state what they "took" from the situation (i.e., did you learn anything). Lastly, the CIQ has one question which asks respondents about their feeling during the incident. This question was added based on results from the pilot study which indicated that emotion was a large element in determining if an incident was viewed as being positive or negative. The CIQ for the exemplary incident and poor incident are identical in format with the exception of one question. In

the exemplary incident, respondents are asked "what is it that you know that helped you in this incident", while in describing the poor incident they are asked "what is it you wish you had known that would have helped you in this incident?" (see Appendix C).

Influences of Teaching Questionnaire

The Influences of Teaching Questionnaire (ITQ) was developed based on the work of Shulman (1986b), Leinhardt & Smith (1985), and Reynolds (1992). Basically, all the different types of teacher knowledge that have been outlined were used to generate statements for the questionnaire. Types of knowledge represented include, content, learners, pedagogical content knowledge, role, pedagogy, strategies, context, processes, and goals. The questions are outlined according to the types of knowledge they represent in Appendix D. For example a question tapping pedagogical knowledge is "I needed to know a variety of teaching techniques." Questions based on the work of Ramsden (1992), Kugel (1993), Scardamalia and Bereiter (1989), as well as based on the pilot study (Rahilly & Saroyan, 1995) were also included as they indicate some of the factors associated with the professional growth of teachers. In total, the ITQ consists of 60 questions, 38 of which are based on knowledge of teaching. These questions were included to represent a range of descriptions of teacher knowledge and were listed in random order with no particular designation of the underlying constructs. Two rating scales appear beside the item and respondents were asked to rate each statement twice. In the first column they were asked to rate the extent to which the item was relevant and considered during the incident and in the second column, they were asked to rate the extent to which they felt the item actually influenced their teaching

at that time. Each item was rated on a seven-point Likert-type scale to indicate their response. A rating of one indicated a low rating, while a rating of seven indicated a high rating. The two columns were included in order to gather the necessary information to address the second research question dealing with differences among inexperienced, experienced, and award winning professors. In order to compare the knowledge they felt had influenced their teaching, it was important to first establish if respondents thought that this type of knowledge was relevant to the specific situation and if they had considered it. This first rating is a way of establishing if the particular item is in their knowledge base. The second rating, addresses if the type knowledge actually influenced their teaching. The complete questionnaire can be found in Appendix C.

Tasks

All participants received the same materials which can be found in Appendix C). Participants were guided through the process of:

- 1) The recall of a "poor" teaching incident
 - a) Keeping the poor teaching incident in mind, complete the Critical Incident Questionnaire (CIQ)
 - b) Keeping the poor teaching incident in mind, complete the Influences of teaching questionnaire (ITQ)
- 2) The recall of an "exemplary" teaching incident
 - a) Keeping the exemplary teaching incident in mind, complete the CIQ
 - b) Keeping the exemplary teaching incident in mind, complete the ITQ

- 3) They then were asked to complete a teaching profile (10 questions) including years of teaching experience, academic credentials, participation in faculty development activities, teaching load, recent student ratings, etc.).

Data Analysis

The data analysis took place in three phases. The first phase involved basic descriptive information about the sample, respondents teaching background, grouping of inexperienced, experienced, and award winners, and an examination of the characteristics of incidents reported. The second phase of data analysis involved the analysis of the ratings of the incidents from the ITQ to determine the types of knowledge drawn upon in teaching. The third phase addressed differences in the knowledge drawn upon by inexperienced, experienced, and award-winning professors.

Phase One - Respondents, Grouping, and Characteristics of the Incidents

Information about the sample was analyzed to provide information including the response rate and respondents' teaching backgrounds (e.g., years of experience, educational background, discipline, etc.), group composition, and characteristics of the incidents reported (time, place, etc.). Comparisons among respondents were made using the chi-square procedure to determine similarities and dissimilarities in the proportion of the groups reporting participation in faculty development activities. Analysis of variance (ANOVA) were calculated to determine differences in self-rating and student-rating of teaching as well as the circumstances reported for the teaching incidents (e.g., number of students in the class, number of times the

class had met, number of times the respondent had taught the same course, etc.). The main purpose of these analyses was to assure that comparing the groups was appropriate.

Phase Two - Types of Knowledge Drawn Upon

In order to address the first research question, the types of knowledge drawn upon in classroom teaching (by all groups), responses to the ITQ were examined in several ways.

First, principal components analysis was used to investigate underlying correlations, and patterns of correlations among the items (Tabachnick & Fidell, 1989). The aim of the analysis was to see which ITQ items formed relatively independent subsets of knowledge considered, and knowledge which influenced teaching. Moreover, this helped reduce the variables to a smaller subset of factors in order to operationally define different types of knowledge involved in teaching in higher education.

Completed ITQ results included ratings of items for both a poor and exemplary incident on two scales: 1) knowledge they felt was relevant and they considered it, and 2) knowledge that actually influenced their teaching. These two ratings were analyzed separately, using the same methodology. The results from the two separate analyses were used together to form working definitions of the different types of knowledge drawn upon in classroom teaching in higher education.

In order to complete this analysis, responses from each scale (i.e., relevant and considered knowledge, and knowledge that influenced teaching) were collapsed across incident types (i.e., poor and exemplary). Thus, the first analysis was based on the data from ratings

of knowledge respondents thought was relevant and considered from both poor and exemplary incidents and the second analysis was based on the data from ratings of knowledge that they indicated had actually influenced their teaching. Including both types of incidents in the same analysis resulted in a broader range of teaching situations, drawing on a broader range of knowledge than could be achieved by analyzing poor and exemplary events separately.

The methods used for this analysis were as follows. First, a correlation matrix was formed from each data set to examine the linearity of the relationships among the data. Next, a preliminary principal components analysis was generated and the resulting eigenvalues were used to generate scree plots (Catell, 1966) to determine the number of factors for extraction (Gorsuch, 1983). Subsequently, a second principal components analysis was conducted, specifying the appropriate number of factors as determined from the scree plots. An orthogonal varimax rotation was used to rotate the axes to maximize variance explained and to minimize the residual. This technique distributes variance among factors so that they are of relatively equal importance which helps in interpreting the factor structure.

The factor structures from ratings of relevant and considered knowledge and knowledge that actually influenced teaching were then compared in terms of the number of factors, and the items which loaded on the factors. There is some debate in the literature as to the appropriate cut off scores to select items for inclusion on a factor (e.g., Gorsuch, 1983; Tatsuoka, 1988). In the current study, a .5 loading was used, which is somewhat high. It was understood that this may have

resulted in some moderately correlated items not loading on the factor but would be beneficial in that it would help distinguish between the factors. Resulting factors were named based on the set of items from which they were comprised. These factors represent the types of knowledge drawn on in the incidents described by the respondents. Exploratory analysis was then undertaken to examine the structure of each of the factors and to determine if subsequent analyses of ITQ scores were appropriate at the factor or item level.

The final method used in this analysis, at this phase, involved using the factors to score the respondents' ratings on the ITQ for each incident in order to identify incidents that typify the type of knowledge described by each of the factors. The method chosen to generate factor scores in this study is the regression method which resulted in factor scores that are easily compared as they have a mean of zero and a standard deviation of one (Tabachnick & Fidell, 1989). The factor coefficient scores were used to select teaching incidents that typify the types of knowledge (factors). For each factor, teaching incidents with factor coefficient scores one standard deviation above the mean were selected to help define the factor or type of knowledge by reviewing respondents' descriptions of the incidents as outlined on the CIQ. Descriptions from the CIQ were used to confirm and extend findings based on the items that loaded highly on the factors.

Phase Three - Group Differences in Knowledge Drawn Upon

In order to address differences among the groups in terms of the knowledge drawn upon in higher education, factor scores were used to compare inexperienced, experienced, and award winning groups. Stepwise multiple regression was used to determine variables

predicting factor scores. The level of alpha-to-enter and alpha-to-remove from the equation was set at .15. The primary independent variable of interest was difference among inexperienced, experienced, and award winning respondents. However, additional independent variables of interest were also included in order to determine if grouping according to experience and award winning is the most appropriate comparison among respondents. The other variables included were : 1) number of years the respondent had taught, 2) respondent's discipline (arts vs. science), 3) respondent's level of participation in faculty development activities, 4) reported student-rating of teaching, and 5) self-rating of teaching.

Summary

This study addressed the types of knowledge drawn upon in teaching in higher education and differences among professors who were relatively inexperienced, experienced, and those who had won national or university teaching awards. The study used the critical incident technique to stimulate respondents' recall of critical, memorable, and meaningful events in order to respond to a series of questions. In this study, the technique was used in conjunction with a more traditional questionnaire in an attempt to capture knowledge drawn upon at a specific time and place.

Respondents in this study were asked to recall two memorable teaching incidents, one in which they felt they had done a "poor" job at teaching and the other when they felt they had done an "exemplary job". Respondents were asked first to describe a poor incident, then to rate their responses according to a series of questions generated from the literature on teacher knowledge. Respondents rated each item

twice. First they rated the extent to which they felt they had considered this type of knowledge, and then they rated the extent to which they felt that this knowledge actually influenced their teaching at that particular time; both ratings were on a seven-point Likert-type scale where one was "not at all" and seven was "quite a lot".

Data were analyzed in order to determine characteristics of the sample, nature of the incidents, and the appropriateness of group comparisons among inexperienced, experienced, and award winning professors. The principle data source for addressing the research questions were respondents' ratings of types of knowledge considered and knowledge that influenced their teaching. Principal components analysis was used in order to determine the types of teacher knowledge drawn upon by all respondents. Factors were examined and named and results from the principal components analysis was used to score each respondent's description of each critical incident. Factor score coefficients were calculated to identify incidents that typified each factor or type of knowledge. Finally, a stepwise multiple regression was used to determine the variables that best predicted the factor scores. Variables in this analysis included group membership (i.e., inexperienced, experienced, and award winning), number of years taught, current teaching load (i.e., hours per year), respondents' teaching discipline (i.e., Arts or Science) reported ratings of teaching, formal training in teaching, and level of participation in faculty development activities.

CHAPTER THREE

Results

Introduction

In order to address the research questions, data were analyzed in three phases. The first phase addressed basic descriptive information about the sample, grouping of respondents, and characteristics of the incidents reported. The second phase addressed the types of teacher knowledge drawn upon in teaching. In this phase principal components analysis was used to analyze the responses to the Influences of Teaching Questionnaire (ITQ). Resulting factors were named and compared. Factor score coefficients were calculated based on respondents' ratings of each incident. These scores were used to select incidents that typified each of the factors and extended the descriptions of the factors beyond the items included on the questionnaire. In the third phase of data analyses, the groups of inexperienced, experienced and award winning professors were compared with regard to their factor scores to assess differences in the knowledge they drew upon in classroom teaching.

Phase-One

Information about the sample was analyzed to establish the response rate. Respondents were assigned to a group (i.e., inexperienced, experienced, or award winning). Groups were then examined for similarities and differences in terms of their composition with respect to broad disciplinary differences (e.g., arts vs. science), educational background, participation in faculty development experiences, information about the incidents reported (e.g., when they occurred, class size, etc.). The main purpose of these analyses was to

assure that grouping was appropriate and that further comparisons among responses to the Critical Incident Questionnaire (CIQ) and Influences of Teaching Questionnaire (ITQ) would be appropriate.

Response

Five hundred questionnaires were mailed to professors across North America. A total of 102 questionnaires were completed and returned by the date requested. Of the remaining questionnaires, 23 were returned with notes indicating an inability or unwillingness to participate in the study for a variety of reasons including time constraints, being on a sabbatic leave, a shift from teaching to administrative responsibilities, and a need to focus on recent life events. An additional 16 questionnaires were returned unopened marked return to sender, and 3 more were returned by departmental secretaries indicating recent retirement, or death of the addressee. One of the questionnaires was returned blank with a note indicating that it is an inappropriate instrument for reporting teaching in the domain of medicine. Three additional questionnaires were returned only partially completed and were not included in the data analysis. Excluding unopened returns and faculty who did not qualify to complete the questionnaire (i.e., those who had not taught in the past 2 years) the overall response rate was 22 percent. The exact response rate by group cannot be determined in the absence of completed demographic questions, but based on the method of identification of participants it is evident that inexperienced and award winners had a higher response rate than experienced professors.

Feedback on Instruments

The reaction of the participants to the questionnaire, its length, and its method was mixed. Six respondents requested further clarification of the instructions before completing the questionnaire. Twelve of the respondents included notes indicating they found the questionnaire to be extremely long and difficult to complete. Nine other notes included additional comments and reflections about teaching, and included "thanks" for having the chance to think about their teaching.

In order to further gauge faculty's reaction to the questionnaire, 10 professors who had received the questionnaire, but who had not completed it were contacted. Nine of these professors indicated that they chose not to complete the questionnaire due to its length while the other indicated some difficulty in selecting a critical incident of exemplary teaching.

Participants

Respondents represented a diverse group of faculty ranging in experience and disciplines taught. They were drawn from 38 different disciplines from the Arts, Sciences, Humanities, and the professions. Most disciplines were represented by one or two respondents, while others such as Psychology, Sociology, Nursing, and Math were well represented with six to nine respondents. The complete listing of respondents' disciplinary areas can be found in Appendix E.

Grouping Participants

Respondents were grouped according to two criteria, their years of experience, and whether they had won a national or university award for teaching. Group composition was further compared based

on a broad categorization of teaching disciplines (i.e., Arts vs. Science), current teaching load, educational background, participation in faculty development activities, and aspects of the teaching incidents they reported.

The first group were those faculty who had won teaching awards. The other two groups were formed by splitting the balance of the faculty at the median of years teaching, which was determined to be 10 years (see Tables 1 and 2).

In addition to years teaching, teaching load, in hours per academic year, is also indicated in Table 2. Despite a trend towards a lower teaching load for award winners, there was a great deal of variance within groups and there was no statistically significant difference among the groups.

In order to aid in data analysis and compare group composition, respondents' were initially grouped by teaching discipline based on an Arts and Science dichotomy. Categorizing respondents, even at this broad level, was difficult especially in the case of disciplines that have a tradition in both the Arts and Science (e.g., Psychology). In particularly difficult cases, coding was also based upon the respondents' educational training (i.e., having Arts or Science degrees) as well as accordingly to the content of the critical incident they reported.

Respondents' educational background is outlined in Table 3. In addition to their disciplinary background, some respondents had completed certification programs in teaching. The bulk of these respondents (80%) currently teach in faculties of education or teach languages or literature.

Table 1

Number of Respondents in each Group by Discipline

Group	Arts	Science	Group Total
Award Winners	16	24	40
Experienced	16	13	29
Inexperienced	16	17	33
Discipline Total	48	54	102

Table 2

Number of Years of Teaching Experience and Current Teaching Responsibility
by Group

	Number of Years Experience		Current Teaching load ^a	
<u>Group</u>	<u>M</u>	<u>SD</u>	<u>M</u>	<u>SD</u>
Award Winners	19.5	7.6	160.50	114.43
Experienced	18.79	7.36	197.67	123.11
Inexperienced	5.77	2.8	190.91	175.76
Overall sample	14.68	8.79	180.91	139.01

^aHours per academic year

Table 3

Respondents' Educational Background by Percentage of Group

<u>Group</u>	<u>Ph.D.</u>	<u>Masters</u>	<u>Other^a</u>	<u>No Resp.</u>	<u>n</u>	<u>Teacher Training^b</u>
Award Winners	70.00	17.50	2.50	10.00	40	(7.50)
Experienced	68.96	17.24	10.34	3.48	29	(17.24)
Inexperienced	78.78	18.18	0.00	3.00	33	(21.21)
Total	72.54	17.65	3.92	5.88	102	(14.71)

^aOther=MD and other professional degrees and qualifications.

^bNumber of respondents having completed a certificate in teaching in elementary or secondary education) in addition to other academic credentials.

Respondents were asked about their experiences with regard to faculty development activities. The number of activities in which they had participated is presented in Table 4. Most respondents reported that they had engaged in faculty development activities ranging from workshops, discussion groups, mentor-mentee dyads, reading about teaching, or leading faculty development activities. Only 17.65 percent of respondents reported not participating in any kind of faculty development activities. The groups did significantly differ with respect to proportion of faculty development activities in which they had participated [χ^2 (6, $n=102$)=6.33, $p=.39$]. Moreover, a relationship was detected with respect to the number of years teaching and the number of faculty development activities in which respondents had participated ($r=.20$, χ^2 (1, $n=102$)=4.172, $p=.041$].

Respondents were asked to report recent student evaluations on a scale of 1 (poor) to 10 (excellent) of their teaching as well as to assess their own teaching using the same scale. While no significant differences in respondents' self rating [F (2, 95) =2.62, $p=.08$] was observed, the groups did differ with regard to reported evaluations of teaching [F (2, 95) =5.82, $p<.01$]; multiple comparisons using Tukey honestly significant difference (HSD) indicate that award winners reported higher teaching evaluations than the experienced (-.65) and inexperienced (-.60) groups.

Grouping of respondents was conducted with the intention of obtaining groups of faculty with similar teaching responsibilities as well as in order to obtain a group of relatively inexperienced professors and two groups of experienced professors that differed only with respect to whether or not they had won teaching awards. Overall, this was a successful attempt; when the

Table 4

Number of Faculty Development Activities by Percentage of Group

<u>Group</u>	None	1-5	6-10	11 and higher
Award Winners	15.00	42.50	20.00	22.50
Experienced	13.79	41.38	27.58	17.24
Inexperienced	24.24	55.00	15.15	6.06

groups were compared with regard to current teaching load no differences were found [$F(2, 99)=0.72, p=.49$]. The experienced and award winners were compared with respect to years of experience and here too no significant difference was found [$F(1, 67)=0.15, p=.70$].

Teaching Incidents Reported

Respondents were asked to recount two memorable teaching incidents and answer two types of questions. First they were asked to indicate when the incident occurred, the number of students present, whether the course was required for students, the level of students (e.g., undergraduate, graduate, first year, etc.), and the number of times the respondent had taught this particular group of students. The responses to these questions are reported below.

The frequencies for the time at which the memorable event or incident occurred are outlined in Table 5. Seventy-three percent of the exemplary incidents reported occurred in the last academic year, while only 46 percent of the poor incidents reported occurred in the last year. It is noteworthy that the exemplary incidents were reported to have occurred recently while the poor incident had occurred at an earlier time. Based on the pilot study, it was clear that respondents had less difficulty selecting and reporting a poor incident. In this study, exemplary and poor incidents were collapsed in order to examine knowledge drawn upon across incidents that range both in terms of their recency and the extent to which they were memorable.

No differences between class size was found between poor and exemplary incidents for an effect for class size by incident by group [$F(2, 98) = 2.15, p=.12$]. The mean class size for the poor incident was 67.36 ($SD=88.48$) and for the exemplary incident it was 63.96 ($SD=92.57$); the

Table 5

Frequency of Poor and Exemplary Incidents by Time of Occurrence by Group

Group	This Semester	Last Semester	Last Year	Two Years Ago	n
Poor Incident					
Award Winners	27.50	12.50	30.00	25.00	40
Experienced	24.13	34.48	24.13	17.24	29
Inexperienced	21.21	21.21	33.33	24.24	33
Poor Incident Total	24.51	21.57	31.37	22.55	102
Exemplary Incident					
Award Winners	40.00	27.50	20.00	12.50	40
Experienced	48.28	24.14	13.79	13.73	29
Inexperienced	48.48	30.30	12.12	9.09	33
Exemplary Total	45.09	28.43	15.69	11.76	102
Grand Total	34.80	24.51	23.53	17.16	204

high standard deviations are attributable to a few individuals who reported teaching classes of between 500 and 600 students. Similarly, award winners, experienced, and inexperienced groups were similar with respect to the number of reported elective and required courses from which the critical incidents were drawn [$F(2, 98) = .31, p=.74$]. Eighty-seven percent of all incidents reported involved undergraduate teaching; there were no differences in the level of the students involved in the poor vs. the exemplary incident types or reported by the three groups of respondents [$F(2, 98) = 0.76, p=.12$].

An effect for the number of times the respondent had taught a course was found; in the case of all groups, courses from which poor incidents were reported had been taught fewer times by the respondent than courses from which exemplary incidents were drawn [$F(2, 96) = 5.57, p=.01$]. In addition, a difference was found between inexperienced and award winning groups indicating that award winners had taught the courses from which they drew their exemplary and poor incident significantly more times than had the inexperienced group [exemplary incident: $F(2, 98) = 5.49, p=.01$ and poor incident: $F(2, 97) = 4.27, p=.02$].

A significant difference was found between exemplary and poor incidents in terms of the number of times that respondents had taught that particular group of students [$F(1, 98) = 5.00, p=.03$]; the mean number of class meetings that had occurred prior to a poor incident occurring was 10.10 (SD=11.25) times was significantly different than the mean number of class meetings that had taken place prior to an exemplary incident occurring of 12.33 (SD=13.53) times.

Phase Two - Types of Knowledge Drawn Upon

The principle data source used to address the first research question concerning the types of teacher knowledge drawn upon by all respondents (e.g., inexperienced, experienced, and award winners) in classroom teaching in higher education are responses to the Influences of Teaching Questionnaire (ITQ).

Each question on the ITQ was based on the different types of knowledge reported in the literature as being relevant to teaching. In order to explore the organizational aspects of the different types of knowledge drawn upon in the teaching incidents, two principal components factor analysis were undertaken. Principal components factor analysis is a technique that can be used to investigate underlying processes that have created correlations, and patterns of correlations among variables (Tabachnick & Fidell, 1989) The analyses were exploratory in nature, and accordingly, an orthogonal varimax rotation was used. This procedure is used to rotate the axes to maximize variance explained while minimizing the residual. This technique distributes variance among factors so that they are of relatively equal importance which helps in interpreting the factor structure.

Two separate factor analyses were calculated on the data from the ITQ. The first was on the respondent's ratings of the extent to which the items were deemed relevant and were considered during the teaching incident. This data is an indication of a relevant knowledge base that can be attributed to the respondents. The second factor analysis was on respondents' ratings of the extent to which the items actually influenced the teaching during the incident. This data is an indication of the knowledge in use during the incident. In order to

complete the factor analysis, all the data from both poor and exemplary incidents were pooled. Theoretically, the same knowledge base is in place during any given teaching incident; by including all data, a greater range of data representing the complete knowledge base is achieved. Alternatively, poor and exemplary events could have been analyzed separately which would have resulted in a smaller number of observations in two separate analysis which would have diminished statistical power significantly.

The aim of the analysis was to reduce the variables to a smaller subset of factors to operationally define different types of knowledge involved in teaching in higher education. More specifically, the aim was to determine which ITQ items formed relatively independent subsets of teacher knowledge.

The method for both analysis was the same. A correlation matrix was formed to examine the linearity of the relationships among the data. At this stage two outliers were eliminated from the analysis; these were the first two items on the questionnaire which correlated only with each other and not with any other variables. This relationship may be caused by a "warm-up" effect. A preliminary principal components factor analysis was conducted and the resulting eigenvalues were used to generate scree plots to determine the number of factors for extraction (Gorsuch, 1983). Then a second principal components analysis was conducted specifying the number of factors, and varimax rotation. A factor loading of .5 was determined based on the literature and in order to distinguish between factors (e.g., Gorsuch, 1983; Tatsuoka, 1988) and then factors were named based on the items loading on them.

Each of the principal component analysis resulted in a four factor solution. The PCA for the knowledge that was relevant and considered accounted for 51.17 percent of the total variance, when the PCA for knowledge that actually influenced teaching accounted for 54.53 percent of the variance. Overall the solutions were quite similar. The results of each principal component analysis can be found in Appendix F. Summarized results of items loading above .5 on each factor are outlined in Table 6. In order to facilitate comparisons between the principal component analysis, similar factors from the two solutions have been placed next to each other in this table.

Exploratory Analysis of Factor Structure

The methods of data analysis used in this study, outlined in phase-one and phase-two above, were used to draw together composite scores of teacher knowledge that were based on a broad sample reporting on a large number of classroom events. This method resulted in a reduction of the data collected into a subset of items. This method is ideal in answering the first research question posed in this study concerning the types of teacher knowledge drawn upon in teaching in higher education. A reduced set of data is also appropriate for addressing the second research question posed in this study, the detection of differences across the three groups of respondents. However, one of the possible limitations of this method is the threat of pooled variance resulting from data reduction that may result in failing to detect specific items which may themselves represent a type of knowledge as well as failing to detect differences among the three groups of respondents when a difference should have been detected.

Table 6

Summary of High Loading ITQ Items from Principal Component Analysis of Knowledge Considered and Knowledge Influencing Teaching.

Analysis	Analysis #1- Knowledge Relevant & Considered	Analysis #2 - Knowledge Actually Influenced Teaching
	Pedagogical Content Knowledge	
Factor Name	Considered Pedagogical Content Knowledge and Evaluation of Teaching and Learning	Influenced by Pedagogical Content Knowledge
Factor Number	Factor 1	Factor 1
Percent of Total Variance Explained	16.41 %	16.22%
Shared Items	I had a well constructed plan of how I would teach and knew best teaching strategies, examples, analogies, sequencing, scope of material, and its application outside the classroom as well as, and knew how to manage time in class.	I had a well constructed plan of how I would teach and knew best teaching strategies, examples, analogies, sequencing, scope of material, and its application outside the classroom as well as, and knew how to manage time in class.
Unique Items	I knew how to evaluate learning on this material. Knew about students' learning styles or preferences, how students' went about learning the content, and how to evaluate my teaching.	I knew appropriate material and resources for teaching , its place in overall program of study. Knew students' current understanding of the content.

Table continues on next page

Table continued from previous page

Analysis	Analysis #1- Knowledge Relevant & Considered	Analysis #2 - Knowledge Actually Influenced Teaching
	Knowledge of Background and Appropriate Pedagogy	
Factor Name	Considered Knowledge of Learners' Background and Appropriate Pedagogy	Influenced by knowledge of Learners' Background, Appropriate Pedagogy, and Disposition Towards Teaching
Factor Number	Factor 2	Factor - 4
Percent of Total Variance Explained	12.76%	10.44 %
Shared Items	Considers students' social background, orientation to learning. Needed to know about classroom management, a variety of teaching techniques, and something about theories of learning and instruction.	Considers students' social background, orientation to learning. Needed to know about classroom management, a variety of teaching techniques, and something about theories of learning and instruction.
Unique Items	Knew how their conceptions of material can change over time.	Knew students' overall level of ability. I was aware of my own intellectual and personal disposition towards teaching.
Cumulative Variance Explained (four factors)	51.17%	54.53%

Table continued from previous page

Analysis	Analysis #1- Knowledge Relevant & Considered	Analysis #2 - Knowledge Actually Influenced Teaching
	Knowledge of Content	
Factor Name	Considered Knowledge of Content	Influenced by Knowledge of Content
Factor Number	Factor 3	Factor 3
Percent of Total Variance Explained	13.19%	13.19%
Shared Items	I had to have a comprehensive knowledge base in my field, know "good" and "bad" work, its relationships to other subjects, and its "culture", and my own intellectual dispositions toward the content.	I had to have a comprehensive knowledge base in my field, know "good" and "bad" work, its relationships to other subjects, and its "culture", and my own intellectual dispositions toward the content.
Unique Items	I was aware of the place of material in the overall program of study.	I was knowledgeable about current research in my field.

Table continues on next page

Table continued from previous page

Analysis	Analysis #1- Knowledge Relevant & Considered	Analysis #2 - Knowledge Actually Influenced Teaching
	Current Knowledge of Learners	
Factor Name	Considered Current Knowledge of Learners	Influenced by Current Knowledge of Learners and Evaluation
Factor Number	Factor 4	Factor 2
Percent of total Variance Explained	8.81%	15.23 %
Shared Items	I felt knowledgeable about students' expectations and study habits in this class.	I felt knowledgeable about students' expectations and study habits in this class.
Unique Items	I was aware of students' current understanding of the content, and their overall level of ability.	I based my teaching on what I know about students' learning styles or preferences, about ways in which students went about learning the content. I knew some ways to evaluate students' learning (in general), knew how to evaluate their learning on this particular content, and knew how to evaluate my teaching.

Table continues on next page

Accordingly, each of the PCA solutions was examined further by submitting each of the factors to a factor analysis in order to determine their structure. In order to aid interpretation as well as be consistent with the methods used to generate the factors, varimax rotation was used. Results indicated largely unchanged factors.

In order to further examine each of the factors to detect individual items or a series of items from the ITQ that might be used to better describe a type of knowledge or compare the groups, un-rotated solutions were generated. These solutions were difficult to interpret as they resulted in a few ITQ items that tended to be largely unrepresentative of the factor being examined. Accordingly, subsequent analyses of the knowledge drawn upon in higher education were done at the factor level as the factors were found to best describe ITQ responses.

Types of Knowledge not Included

As outlined earlier, the ITQ consisted of 60 items, 38 of which were based on the many accounts of teacher knowledge in the current literature phrased as statements and presented in random order for the respondents to rate. The other 22 items were partly drawn from the pilot study (Rahilly & Saroyan, 1995) and included aspects of the cognitive "processes" associated with teaching (e.g., "I was aware that I was thinking about my actions while teaching"), and partly from Ramsden's (1992) theories of teaching (e.g., "I knew I wanted to teach in a way that would make learning possible."). While all 60 items were included in the analysis, none of 22 process/theory questions were found on the factors, nor were they explicitly evident in the open ended descriptions of the teaching incidents provided on the CIQ.

With a few notable exceptions, the rest of the ITQ items were included on one of the factors resulting from the principal components analysis.

Of the 38 knowledge items, the items presented as number one and number two on the questionnaire were not included on any of the factors. Preliminary analysis indicated little variance or inter-correlation among respondents' ratings; this finding can be attributed to some kind of warm-up effect of completing the questionnaire.

Another notable exception to inclusion on either of the PCA solutions was the item "I had a routine to effectively manage my teaching". This item fell just below the cut off score for inclusion on the pedagogical content knowledge factor for the PCA of knowledge that was relevant and considered at the time of the teaching incident, and fell well below the criterion for inclusion on the pedagogical content knowledge factor for the PCA of knowledge that actually influenced teaching at that time.

The ITQ item "I knew which were the most appropriate materials and resources to teach the content" was not found in the PCA for knowledge considered but was included on the pedagogical content matter factor for knowledge actually influencing teaching at the time of the incident.

Calculation of Factor Score Coefficients

The results of both principal component analyses were used to generate factor score coefficients for each respondents' responses to the ITQ. The method used for generating these scores involved a regression procedure which results in distribution of scores on each factor with a mean of zero and a standard deviation of one. Thus, it is possible to examine a respondent's rating of a given teaching incident

on any of the factors in comparison to scores from all other incidents that form a distribution of scores.

Selecting Incidents that Typify the Factors

Factor score coefficients were used to select incidents that typify each of the factors. For each incident selected, the corresponding responses to the Critical Incident Questionnaire (CIQ) were reviewed in order to broaden the descriptions of each factor to include information about the events that actually took place in the classroom. In addition to helping characterize the factors or types of knowledge, this analysis served as an indication of the validity of the method used in the study by examining the relationship between the numeric ratings and respondents' descriptions of each incident. The expectation was that incidents with a high factor score coefficient in a given factor would reflect that factor. If respondents' description of the incidents had not matched the factors scores, then the methodology used in the study would have been questionable. The exact procedure and results are outlined below.

First, factor scores coefficients were calculated for each of the factors for each incident (i.e., one poor and one exemplary). In total, each incident had eight factor coefficient scores, representing the four factors outlined in the PCA of knowledge relevant and considered as well as from the four factors from the PCA of knowledge actually influencing teaching, as was outlined above in Table 6. Starting with the first set of factor scores, knowledge relevant and considered, incidents were selected if they had a factor score coefficient of one or above. If the incident had another factor score coefficient above one on the three other factors, it was not selected to characterize the factor as it

showed that two types of knowledge were involved. Next, the second set of factor scores, knowledge that actually influenced teaching, were reviewed using the same criterion. Finally, the incidents retained from the two sets of factors were pooled and incidents with only one factor score coefficient above one were kept. Incidents that had factor score coefficients of one or above on similar factors in the two solutions were also retained.

A total of 99 incidents (48.53% of all incidents) were identified as exemplars for the factors. A complete listing of the number of incidents identified as exemplars is presented in Table 7. Summaries of the responses to the CIQ were then compiled.

The summaries were used to generate the descriptions outlined in the following sections. A selection of summarized CIQ responses of the selected incidents follows each of the descriptions. The complete listing of summaries of selected incidents can be found in Appendix H.

Pedagogical Content Knowledge

Twenty-one incidents (9.85 of all incidents) loaded highly on pedagogical content knowledge factors. Five incidents were identified based on the PCA solution of knowledge that was relevant and considered. These incidents emphasized teaching students to think, analyze, detect misconceptions, and the preparation or lack of preparation involved in achieving this aim. Six incidents were identified based on knowledge influencing teaching, the majority dealing with planning and changes of plans in order to make a point and to respond to student interest or enthusiasm. Ten incidents were identified by high factor score coefficients on both PCA solutions. These incidents also highlighted preparation, changes in plans,

Table 7

Number of incidents Selected based on Factor Score Coefficients by Factor type by Group.

Factor	Group	Knowledge Considered	Knowledge Influencing	Both Solutions	Total
Pedagogical Content Knowledge	Award Winners	1	5	4	10
	Experienced	2	1	2	5
	Inexperienced	2	0	4	6
	Cell Totals	5	6	10	21
Current Knowledge of Learners	Award Winners	1	5	3	9
	Experienced	1	0	5	6
	Inexperienced	3	5	1	9
	Cell Totals	5	10	9	24

Table continues on next page

Table continued from previous page

Factor	Group	Knowledge Considered	Knowledge Influencing	Both Solutions	Total
Content Knowledge	Award Winners	3	2	7	12
	Experienced	3	2	3	8
	Inexperienced	1	5	1	7
	Cell Totals	7	9	11	27
Learners' Background	Award Winners	1	4	5	10
	Experienced	2	3	7	12
	Inexperienced	1	1	3	5
	Cell Totals	4	8	15	27
Total	Award Winners	7	16	19	41
	Experienced	8	6	17	31
	Inexperienced	6	11	9	27
	Totals	21	33	45	99

facilitation of student thinking, use of analogies and examples, knowledge of material that is particularly difficult for learners, and teaching in a way that encourages student interaction. Reviewing the incidents with high pedagogical content knowledge scores, they reflect demanding situations which seem to require a balance between the different demands of teaching (e.g., following the teaching plan including content, goals, strategies) with the ability to attend to feedback from students, and changing one's teaching based on the demands of the particular situation in such a way as to promote student understanding. Below is a selection of summaries of incidents which were selected based on their high factor score coefficients on pedagogical content knowledge.

Planning. My teaching strategy worked particularly well. I divided the class into 3 groups, everyone planning and writing a short essay in different environment to prove my point. It worked, it was well designed they were well prepared for it and it proved valuable to them (Q34E-I3).

Flexibility--Change of plan. Despite extensive planning, the demonstration (of basic optimal foraging theory) did not serve to make the points I had intended. I terminated the demo earlier than planned & generated a discussion instead (this did succeed!). I was frustrated, embarrassed (Q22E-A24)

Thinking. Teaching thesis defense practice, led them through a simulation and chaired the defense. It worked perfectly. I had underscored the defense process for the "inside" to alleviate (student) anxiety. (Q13E-A20)

Use of Examples and Analogies. Used visual rep of diet and exercise and did small group work. I could actually see the light going on! This is historically a difficult topic for students to grasp and this method was ideal (for this group). (Q92E-I4)

Student Interaction. Guided students to the improvements and stimulate discussion asked questions that led them to right direction. Experiential learning and simulation. Thinking they are "into it" and enjoying this and obvious understand and want more. (professor really into it too) (Q97E-I6)

Balancing requirements. A male student voiced negative and sexist views about woman alluding to the citadel case. I asked others to respond asked questions to provoke rethinking his view that were not capable of leadership. I felt anger but tried not to show it. The student was hostile. (Q96P-A15).

Current Knowledge of Learners

Twenty-four (11.86% of all incidents) loaded highly on current knowledge of learners factors. Five incidents were identified based on the PCA solution of knowledge that was relevant and considered. These highlighted situations when things did not go as expected and the interaction between the professor and the students. Four of these incidents involved questions from students which confused or challenged (in both a positive and negative sense) the professor. Ten incidents were identified based on knowledge influencing teaching which involved interaction between the professor and the students. Most of the interactions had to do with student reaction to teaching but also included situations in which the professor learned something about the learners (e.g., a misconception, hadn't done the reading, etc.).

Nine incidents were identified by high factor score coefficients on both PCA solutions. These incidents also dealt with interaction but seemed to emphasize communication, some methods that were used, and monitoring students for their understanding. Below is a selection of summaries of incidents which were selected based on their high factor score coefficients on current knowledge of learners.

Challenge (positive). Students challenged me and asked questions. I challenged them often in this class too. Very interactive. I gave analogies that helped them understand. Kept enthusiasm. (Q46E-I9)

Challenge (negative). A student asked "what the hell are you doing? I can't follow a dam thing you said". Fortunately this happened 10 minutes before end of class. Canceled rest of class. Felt embarrassed, angry, and defeated. Learned I must stay in tune with student understanding. (Q48P-A32)

Communication. It was highly interactive allowing me to directly address some misconceptions students had. I had prepared scenarios of sample problems/scenarios and got students to do as much on their own as possible, filling in when necessary. (Q68E-I2)

Interaction. An analogy I invented on the spot clarified the concept. I outlined the analogy and then had the students tell me how the physiology fit the analogy. The material was demanding, but I knew student's outside interests (sports) so analogy worked. Models work best if student build them. (Q73E-E28)

Monitoring. Instructed student to basics logic, strategy and tactics of hypothesis testing. I could tell that the students 'got it!' (This really

showed up on later tests). I was well prepared and presented the material exceptionally clearly. Feeling elation. (Q22E-A24)

Content Knowledge

Twenty-seven (13.2% of all incidents) loaded highly on content knowledge factors. Seven incidents were identified based on the PCA solution of knowledge that was relevant and considered. These incidents involved the presentation of content, including the appropriate amount of content, the emphasis placed on certain content knowledge, and the professors' understanding of material. All of these incidents were poor incidents. Nine incidents were identified based on knowledge influencing teaching which largely involved elements of pedagogy related to teaching the content. This included use of media, handouts, and use of discussions and questioning. There were also incidents reflecting student reaction to the content (e.g., enthusiasm, disbelief, and appreciation). One incident in this group seemed strangely out of place. It involved a case of the professor regretting being rude to a student. There is insufficient information to know exactly what occurred and if the interaction had to do with content in the course. Lastly, eleven incidents were identified by high factor score coefficients on both PCA solutions. These incidents were much like the ones previously mentioned but also included cases in which the professor had a new understanding of the material or conveyed her or his own beliefs about the material. Below is a selection of summaries of incidents which were selected based on their high factor score coefficients on content knowledge.

Appropriate amount of information. I rushed through complex concepts, I had 10 minutes left in class and tried to cover material

which required 1/2 hour. Must not assume that concepts which are basic to me are similarly so to my students. (74P-A14)

Emphasis on select content. I wanted students to consider the chemical principles in the course & not view it as mathematics. Students did not change as demonstrated in subsequent tests etc. Tried to show ridiculous examples. Frustration, need to rearrange the course organization (Q25P-A28)

Pedagogy. Through careful use of good examples done well on the blackboard teaching (content) worked out well. I rationalized a large amount of empirical data, summarized in very compact form. I saw the results on the final exam. Be prepared, think before grab chalk (Q26E-A25)

Presentation. Class appeared interested and some questions were asked. I used transparencies to relate basic information to support clinical skills. There was a good flow to the presentation and I conveyed a lot of information in 40 minutes. (Q37E-I3)

Professor's mistake. I was working through a problem and made a mistake. Student pointed it out and corrected me. I continued but was flustered, embarrassed. I should have checked my work (Q51P-I3)

Conveying own views of content. I was dealing with simplistic politically correct understanding & spoke from the depths of mind, heart and personal experience. Felt empowered and uplifted. Based on my complete understanding of (topic) and search for truth (about topic). It is important to speak honestly with care and passion. (Q58E-E15)

Student reaction (positive). I constantly and relentlessly integrated the math 'abstractions' with photographic problems they

have to solve. Some 'ex' engineering students discovered a new way to calculate and all students were excited. Test at end of session showed score of 90%. (Q56E-E32)

Student reaction (negative). There were several who chose to either make trouble or disbelieve the information I was attempting to impart regarding certain sounds (voice class). At first I ignored them trying, rather to gain the confidence of the majority... I asked two to leave other 4 left. (Q53P-I9)

Professor's new understanding. Teaching kinetics I departed from the goals or script to find a new analogy and example and told them (it was new) I felt some elation in balancing time requirements. (Q7E-A30)

Learners' Background and Appropriate Pedagogy

Twenty-six (13.2% of all incidents) loaded highly on knowledge of learners' background and appropriate pedagogy factors. Three incidents were identified based on the PCA solution of knowledge that was relevant and considered. Two of the incidents involved pedagogical methods, while the other involved a case of classroom management. Eight incidents were identified based on knowledge influencing teaching which involved elements of students background knowledge, and preparation for learning, pedagogical methods and their results. Fifteen incidents were identified by high factor score coefficients on both PCA solutions. These incidents also included elements of pedagogical methods and their results, students' background and preparation towards learning, enacting planned teaching, concerns about presentation, and classroom management. Below is a selection of summaries of incidents which were selected

based on their high factor score coefficients on learners' background and appropriate pedagogy.

Pedagogical methods. I modeled, provided guided learning package and each group selected new strategies, took risks to utilize them and facilitate group learning. Also learners were enthusiastic and integrated many concepts. Planning and organization (drawn on) knew student background. (Q99E-A20)

Classroom management. Feedback indicated I had singled out students who were talking and embarrassing them in front of class. They were rude and I showed them who was the boss. Didn't realize extent of my actions. (Q58E-E15)

Students' background. Teaching complex material and a student asks me how to calculate a percentage. I answered her question directly and moved on. I was angry she was hung up on 4th grade material. Shocked at how poorly prepared some students can be. (Q60P-A17)

Enacting planned teaching. In order to overcome the resistance between history and literature I began with a short lecture and discussion of reading for class and discussion of a poem set in this historical context. The students were highly emotional and intellectually engaged. I was delighted that there were carrying the discussion so well and had read so carefully. Based on organization and planning. (Q100E-E14)

Presentation. I was disappointed that I wasn't conveying the information clearly and as a result the students were doing miserably. I altered the course content to where I felt more comfortable. In my head, I was letting students down. Structure of the course and preparation an issue. (Q91P-I8)

Phase Three-Group Differences in Knowledge

To determine variables predicting factors scores, stepwise multiple regression was conducted for each of the factors from the principal components analyses. Independent variables included: a) group membership (inexperienced, experienced, award winning, b) number of years teaching, c) current teaching load (hours), d) discipline (Arts vs. Science), e) formal teacher training (e.g., teaching certificate), f) level of participation in faculty development activities, g) reported student-rating of teaching, h) self-rating of teaching, and i) the type of incident (i.e., poor or exemplary) from which the scores were drawn. Results of these analyses indicate that there were no group differences in the factor scores among inexperienced, experienced, and award winning professors.

Overall, each multiple regression resulted in a small squared multiple R accounting for between 8.9 percent to 20.1 percent of the variance in factor scores. Despite these low values, significant predictors of each of the factor scores were found. The most prominent variable predicting each of the factor scores was the incident type predicting between 1 to 16 percent of the variance of factor scores. Results of the stepwise multiple regression are outlined in Tables 8, 9, 10, and 11 and briefly described below.

Predictors of Knowledge Scores

Pedagogical Content Knowledge

The type of incident (exemplary or poor) was the only common predictor of knowledge considered and knowledge actually influencing teaching. In this case, exemplary incidents predicted higher pedagogical content knowledge scores.

Table 8

Summary of Stepwise Multiple Regression of Variables Predicting Pedagogical Content Knowledge Factor Scores.

Factor	Variable	<u>B</u>	<u>SE B</u>	β	R^2
Knowledge Considered					
Pedagogical Content Knowledge/ Evaluation of Teaching and Learning	Student Rating of Teaching	2.13	0.14	0.14	.089
	Incident Type (Poor/Exemplary)	7.80	2.00	0.27	
Knowledge Actually Influenced Teaching					
Pedagogical Content Knowledge	Discipline Taught (Arts/Science)	3.28	2.07	0.10	.201
	Self Rating of Teaching	2.93	1.05	0.28	
	Incident Type	12.65	2.04	0.40	

Table 9

Summary of Stepwise Multiple Regression of Variables Predicting Current Knowledge of Learners Factor Scores.

Factor	Variable	<u>B</u>	<u>SE B</u>	<u>β</u>	<u>R²</u>
	Knowledge Considered				
Current Knowledge of Learners	Current Teaching Load (hours)	0.00	0.00	0.11	
	Student Rating of Teaching	0.80	0.47	0.14	
	Self Rating of Teaching	0.64	0.44	0.12	
	Incident Type	1.87	0.74	0.17	
	Knowledge Actually Influenced Teaching				
Current Knowledge of Learners and Evaluation	Years Teaching	-0.18	0.09	-0.13	
	Current Teaching Load	0.01	0.01	0.16	
	Discipline Taught	2.76	1.64	0.12	
	Self Rating of Teaching	3.16	0.84	0.26	
	Incident Type	6.89	1.58	0.29	

Table 10

Summary of Stepwise Multiple Regression of Variables Predicting Content Knowledge Factor Scores.

Factor	Variable	<u>B</u>	<u>SE B</u>	<u>β</u>	<u>R²</u>
	Knowledge Considered				
Knowledge of Content	Participation in Faculty Development Activities	-0.91	0.55	-0.11	.137
	Student Rating of Teaching	1.69	0.66	0.21	
	Self Rating of Teaching	1.58	0.62	0.20	
	Incident Type	1.60	01.04	0.10	
	Knowledge Actually Influenced Teaching				
Knowledge of Content	Participation in Faculty Development Activities	-2.02	0.64	-0.21	.136
	Student Rating of Teaching	2.45	0.66	0.25	
	Incident Type	3.91	1.22	0.21	

Table 11

Summary of Stepwise Multiple Regression of Variables Predicting Knowledge of Learners' Background and Appropriate Pedagogy Factor Scores.

Factor	Variable	<u>B</u>	<u>SE B</u>	<u>β</u>	<u>R²</u>
Learners' Background and Appropriate Pedagogy	Knowledge Considered				
	Years Teaching	-0.12	0.07	-0.13	
	Current Teaching Load	0.01	0.01	0.11	
	Formal Teacher Training	3.93	1.74	0.16	
	Participation in Faculty Development Activities	1.03	0.62	0.12	
	Self Rating of Teaching	1.73	0.59	0.21	
	Incident Type	1.67	1.12	0.10	
					.138

Table continues on next page

Table continued from previous page

Factor	Variable	<u>B</u>	<u>SE B</u>	β	R^2
Knowledge Actually Influenced Teaching					
Learners' Background and Appropriate Pedagogy and Disposition Towards Teaching	Years Teaching	-0.14	0.08	-0.12	
	Current Teaching Load	0.01	0.01	0.17	
	Self Rating of Teaching	1.98	0.68	0.20	
	Incident Type	5.42	1.30	0.28	
					.151

Current Knowledge of Learners

Current teaching load, self rating of teaching, and the type of incident were common predictors of knowledge considered and knowledge actually influencing teaching. In this case, the higher the teaching load and self rating of teaching, the more professors reported drawing on their current knowledge of learners. Again, the same was true with regard to incident type; respondents reported drawing more on their current knowledge of learners during exemplary incidents. It is interesting to note that the number of years teaching, which is also associated with a lower teaching loads (see Table 2), was negatively associated with being influenced by this type of knowledge.

Knowledge of Content

Participation in faculty development activities, student rating of teaching and the type of incident were common predictors of knowledge of content. As with other types of knowledge, exemplary incidents were associated with higher ratings of knowledge drawn upon than were poor incidents. Content knowledge was also predicted by higher student ratings. With regard to participation in faculty development activities, it was found to be a negative predictor of content knowledge scores. In other words, respondents who reported increased levels of participation in faculty development activities reported drawing on content knowledge less when teaching.

Learners' Background and Appropriate Pedagogy

Years teaching, current teaching load, self rating of teaching, and incident type were common predictors of knowledge considered and actually influencing teaching. Again, exemplary incidents were predicted higher ratings of this type of knowledge. Teaching load, and

self rating of teaching were positively associated with drawing on learners' background and appropriate pedagogy while the number of years teaching was found to be negatively associated with considering and being influenced by this type of knowledge.

CHAPTER FOUR

Discussion and Conclusion

Introduction

This study addressed two research questions; 1) What types of knowledge do university professors draw upon in classroom teaching, and 2) Are there differences in the knowledge drawn upon by inexperienced, experienced, and award winning professors.

In order to address these questions, two critical incidents of classroom teaching were collected from 102 professors from 38 different disciplines. Professors were asked to recall two memorable incidents; one where they thought they had done a poor job of teaching and one where they had done an exemplary job of teaching. Respondents completed 12 open-ended questions on the Critical Incident Questionnaire (CIQ) to activate their memory of the events and to provide a detailed explanation of the circumstances, their thoughts, and actions at that time. Respondents were then asked to rate their response to a series of questions on a seven-point Likert-type scale. The questions were based on the existing literature addressing teacher knowledge and were designed to gauge the extent to which respondents considered and were influenced by different types of knowledge at the time of the memorable event.

The purpose of this chapter is to summarize the findings presented in the previous chapter, interpret the results, elaborate on their potential meaning, and relate them to the existing literature on teacher knowledge. Additional sections of this chapter will address the strengths and limitations of the study and will include suggestions for the direction of future research in the area.

Research Question One: Types of Teacher Knowledge

To date, the literature on teacher knowledge has addressed the relationship between content knowledge, considered essential in teaching (e.g., Feiman-Nemser & Parker, 1990) and other types of knowledge including knowledge of pedagogy (e.g., Reynolds, 1992), knowledge of lesson structure (e.g., Leinhardt & Smith, 1985), knowledge of routines (e.g., Leinhardt, 1990), pedagogical content knowledge (Grossman, 1988; Gudmundsdottir, 1991; Marks, 1990; Shulman, 1986b; Wilson, 1988), and knowledge of curriculum (Calderhead, 1988; Elbaz, 1991; Shulman, 1987; Tittle, 1994). The items that made up the Influences of Teaching Questionnaire (ITQ), the principal questionnaire used in this study, were based on descriptions of knowledge from this literature. They were presented in a random order on the questionnaire.

Two separate principal components analysis (PCA) reduced the items from 60 into factor structures. The first set of factors were based on respondents' ratings of knowledge that was relevant and considered during the incident, and the second set of factors were based on ratings of knowledge that respondents believed had actually influenced teaching at the time of the critical incident. The PCA's yielded two very similar four factor solutions. Both sets of factors were used to score respondents' ratings of each critical incident by generating factor score coefficients. Incidents with factor score coefficients one standard deviation above the mean on a given factor, having no other factor score coefficient above one, were used as exemplars of that factor. Summaries of respondents' descriptions of the incidents were then selected on this basis.

In the previous chapter, each of the factors were outlined and differences in respondents' ratings of knowledge considered and knowledge actually influencing teaching were clearly indicated. In addressing the first research question, given the similarity in the factor structures, the two sets of ratings can be combined in order to give a broader sense of the types of knowledge drawn upon by professors in the classroom. Accordingly, four definitions of the types of knowledge drawn upon by professors in classroom teaching are outlined below. The definitions reflect the actual ITQ items that loaded on similar factors from both principal components analyses along with content extracted from the incident summaries selected based on factor score coefficients.

Types of Teacher Knowledge

In reviewing the four types of knowledge outlined below, it is important to recall that the factors were based on strong inter-correlations among respondents' ratings of the items but each item did have, to varying degrees, weaker relationships with the other factors. Similarly, respondents' descriptions of each of the critical incidents selected to typify a particular type of knowledge also indicate relationships with the other types of knowledge. In other words, no one type of teacher knowledge can be completely extricated from the others types of knowledge that form a complete knowledge base.

Content knowledge

The results of this study indicate that content knowledge in teaching in higher education entails having a comprehensive knowledge base in one's field. As the field evolves, so does the individual's knowledge base for teaching. It includes knowing the

culture of the discipline including "good" and "bad" work, knowing one's own disposition toward the content and its relationship to other subjects, and conveying one's own views of content to students. Content knowledge includes knowing which content needs to be emphasized and it guides one's selection of good examples during teaching. It also influences the degree of success in selecting and conveying the desired amount of content to students as well as the flow of the presentation. Finally, content knowledge helps avoid mistakes and maintain credibility with students while eliciting their interest in the field.

This definition of content knowledge is broader than most definitions that have been generated from studies conducted in elementary and high school settings (e.g., Bates, 1993; Leinhardt & Smith, 1985; Rovegno, 1992). Whereas those studies suggest that content knowledge is primarily declarative knowledge of a discipline (e.g., Alexander et al., 1991) or knowledge that individuals have about a particular field of study that supports teaching, findings from the present study suggest that content knowledge in the context of teaching in higher education includes both declarative (i.e., knowledge of "what") and procedural (i.e., knowledge of "how") forms of knowledge. Furthermore, elements that are typically thought of as pedagogical content knowledge, and to some extent, even general pedagogical knowledge seem to be part and parcel of content knowledge (e.g., use of examples, flow of presentation, etc.).

Pedagogical Content Knowledge

The results of this study indicate that pedagogical content knowledge in teaching in higher education entails having a well

constructed, yet often flexible, plan of how to teach specific content. It involves teaching that is responsive to feedback from students and knowing how to strike a balance between following one's planned instruction and fostering student thinking and understanding. Pedagogical content knowledge includes knowledge of how to manage time in class, the scope of material that is relevant to the teaching situation, and its application outside the classroom. It entails knowledge of the best teaching strategies which facilitate interaction and overcome areas of common difficulty for learners through the use of the best examples, analogies, and effective sequencing of material to be taught.

Despite minor differences in the definition outlined above, overall the findings from this study support descriptions by researchers such as Shulman (1986b), Gudmundsdottir (1991), Marks (1990) as well as elaborations by Reynolds (1992). These researchers have suggested that pedagogical content knowledge entails representing or converting knowledge of content into a form that students can learn (e.g., Hashweh, 1987). They all highlight the importance of examples and analogies and teaching strategies in fostering student learning.

Of particular note is the inclusion of knowledge of students' understanding and potential misunderstandings in the definition above. Both Shulman (1986b) and Reynolds (1992) have reached the same conclusion. This particular element of knowledge has often been cited as the key difference between subject matter experts and subject matter experts who teach (Grossman & Richert, 1988; Hashweh, 1987; Shulman, 1986b; Sternberg & Horvath, 1995); the former said to draw

principally upon content knowledge, whereas the latter draws on both content and pedagogical content knowledge (e.g., Hashweh, 1987).

While the definition derived from the present study supports Grossman's (1989) conception of pedagogical content knowledge involving knowledge of the scope of material to include in teaching, it does not support her claim of the role this type of knowledge has in conceptual decision making. Perhaps tangentially, this is an indication that, in higher education, pedagogical content knowledge bears a similar weight to other types of teacher knowledge in collectively guiding teaching practice.

Also of note is that the definition includes knowledge of how to manage time in class. Time management is typically considered part of pedagogical knowledge (e.g., Reynolds, 1992) and its inclusion in pedagogical content knowledge is an example of the way in which knowledge of pedagogy seems to be distributed among the existing knowledge structures for teaching in higher education rather than forming its own type of knowledge.

Current Knowledge of Learners

The results of this study indicate that current or in-class knowledge of learners for post secondary educators entails knowledge of students' expectations as well as a continuous awareness and monitoring of their understanding. Moreover, it involves communication and interaction with students including challenging them and being challenged by them.

This type of knowledge seems conceptually different in content and scope than definitions found in the existing literature which only include elements of knowledge of learners as part of general

pedagogical knowledge (Reynolds, 1992; Shulman, 1986b) or as part of general pedagogical skills (Leinhardt & Smith, 1985). While the definition above does include aspects of pedagogy, it seems much closer to the elements of pedagogical reasoning (Shulman, 1987) and the cognitive skills of teaching (Clark & Peterson, 1986). For example, the definition of current knowledge of learners outlined in this study, emphasizes communication, an essential aspect of Clark and Peterson's (1986) description of interactive decision making while teaching. Similarly, the model of pedagogical reasoning outlined by L. Shulman (1987) clearly indicates that knowledge of learners and their characteristics is considered in the adaptation of material to meet student expectations. Further, the model of pedagogical reasoning also includes ongoing processes of monitoring students for their understanding, evaluating their learning, and reflecting on one's own teaching. Accordingly, this type of knowledge seems to primarily represent the knowledge gathered at the time of teaching rather than a specific body of knowledge about students, which is described in the definition that follows.

Knowledge of Learners' Background and Appropriate Pedagogy

The results of this study indicate that knowledge of learners' background and appropriate pedagogy entails considering students' social background and orientation to learning and combining it with one's knowledge of planning and enacting the appropriate teaching activities. It also draws on one's knowledge of classroom management and smooth presentation, knowledge of a variety of teaching techniques, and knowledge of theories of learning and instruction.

As with other definitions of knowledge derived from this study, this type of knowledge seems to go well beyond the established definitions of general pedagogical skills (Leinhardt, 1990; Leinhardt & Smith, 1985) general pedagogical knowledge (e.g., Reynolds, 1992; Shulman 1986b; Tittle, 1994), or knowledge of learners (Reynolds, 1992; 1986b). These existing definitions address learners' background, teacher's beliefs about learners, and knowledge of pedagogy separately. However, the results of the present study suggest that for those teaching in higher education knowledge of learner's background and pedagogical knowledge are combined. Indeed, of the four types of knowledge of university teaching found in this study, knowledge of learners' background and appropriate pedagogy had the most striking mix of two often cited types of teacher knowledge. The pedagogical nature of this factor supports the assertions made by Fenstermacher (1994) and Kagan (1992) that professors draw their notions of teaching from their own experiences "on the job". Further, it suggests that these experiences result in a different kind of knowledge base, structured differently for teaching in higher education, than that which is found or required in other educational milieux.

Overall, the scope of the definition of learner's background and appropriate pedagogy, like the definitions of content knowledge and current knowledge of learners described earlier, distinguish the knowledge base for teaching in higher education from the knowledge base for teaching in other settings.

Types of Teacher Knowledge not Found

Knowledge of teaching routines and knowledge of curriculum are prominent in the literature. However, in the present study they did

not emerge as factors or figure prominently in respondents' descriptions of their classroom teaching. Accordingly, they were not included in the definitions of knowledge outlined above.

Knowledge of Teaching Routines

Leinhardt (1990) and Leinhardt and Greeno (1991) have elaborated on earlier work (e.g., Leinhardt & Smith, 1985) on the knowledge base for teaching and lesson structure. They have referred to teaching routines and schemata for rapid on-line decision making and classroom management at a global level (e.g., checking student understanding) and on a smaller level (e.g., distributing teaching materials). The absence of this type of knowledge or explicit reference to lesson structure in the knowledge base for university teaching is conspicuous given the emphasis it has received in the literature.

One possible explanation for the absence of this item in the definitions could rest with the methodology used; by asking for a critical incident a non-routine classroom event might have been solicited. This possibility could be addressed if in another study, the same questionnaires were used to investigate day-to-day (i.e., non-memorable events) teaching. At the present time, the cause of the absence of this type of knowledge is unclear. Nonetheless its absence both in the current study and the pilot study may indicate that in higher education, classroom routines are not frequent or may play a different role in teaching.

Knowledge of Curriculum

Curricular knowledge is included in Shulman's (1986b) model of teacher knowledge and referred to as "the tools for the trade" in his 1987 model of pedagogical reasoning. Others such as Leinhardt (1990)

and Hashweh (1987) have cited knowledge of curriculum as influencing teachers' planning and classroom performance. Tittle (1994) suggests that knowledge of curriculum does influence classroom teaching and is a part of the knowledge base for teaching upon which teachers can be evaluated.

In this study, knowledge of curriculum and curricular materials had a weak association with pedagogical content knowledge on the ITQ but was completely absent from respondents' descriptions of teaching incidents. Overall, the findings from this study suggest that knowledge of curriculum is not drawn upon in teaching in higher education; this may be another distinguishing characteristic between the knowledge base for teaching in higher education and the knowledge for teaching in primary and secondary school settings.

A Model of the Knowledge Base for Teaching in Higher Education

Although the aim of this study was neither to test, nor generate a model for teaching in higher education, the findings can be summarized parsimoniously in this format. In doing so, the discussion below addresses some of the methodological issues that must be considered when interpreting findings from the existing literature and their influence on this study.

Methodological Issues

Much of the work on teacher knowledge outlined in the literature is based on data gathering techniques such as observation, journaling, and narratives which are typically analyzed using existing or hypothesized frameworks of teacher knowledge (e.g., Grossman, 1988; Munby, 1986, etc.). Many different methods have been used in order to reduce the data and attempt to make distinctions in the types

of knowledge drawn upon in teaching. The aim of this study was also to make distinctions among the types of knowledge drawn upon in teaching, at the university level, however the model of knowledge used to categorize types of knowledge was not imposed on the data; instead it emerged from the data.

Through the use of the critical incident method, respondents determined which elements of knowledge they considered and drew upon in their teaching. The strength of this method is that respondents' ratings are used to determine the elements that form a given type of knowledge, and the same ratings can be used to study the relationship among different types of knowledge involved in any given teaching incident. Recall in this study, once the types of knowledge were determined, factor score coefficients were used to compare the relative strength of each type of knowledge in each teaching incident. Using this method the influence of each type of knowledge in a given teaching incident becomes apparent allowing for a method of categorization that also recognizes the relationship among the different types of teacher knowledge.

At the outset, relationships among the factors or types of knowledge outlined in this study were expected since these types of knowledge collectively represent a complete knowledge base for teaching. These relationships were evident in the observation that approximately half of incidents collected in this study had factor coefficient scores indicating a high influence of more than one factor or type of teacher knowledge.

Like other studies reported in the literature (e.g., Grossman, 1988; Gudmundsdottir, 1991; Hashweh, 1987; Leinhardt & Smith, 1985;

Shulman, 1986b; etc.) the results of this study are outlined in a fashion that *may* suggest a clear delineation among different types of teacher knowledge. However, it would be extremely difficult to generate definitions that are mutually exclusive. Most professors do not "pick and choose" the type of knowledge that they will draw upon in a classroom situation. Instead, as Calderhead (1988) states, different types of knowledge may be drawn in a given teaching situation that interact and evolve.

The definitions of teacher knowledge outlined in this study indicate general guidelines or signposts for recognizing the different types of teacher knowledge; the definitions are not absolute and may vary from one discipline to another and among professors.

A Proposed Model

A proposed model of the inter-relation of the types of knowledge is outlined (see Figure 4) based on the results of the principal components analysis and the open-ended description of the memorable or critical incidents of teaching. The model is a composite of the possible knowledge bases for teaching in higher education but is not intended to represent every individual in the sample or every incident described. Instead, the model is based on the following features. First, it is based on general trends such as the dominance of content knowledge which, depending on the teaching situation, included aspects of pedagogical knowledge, current knowledge of learners, and knowledge of learners' background and appropriate pedagogy. Second, the presence of what is typically thought of as pedagogical knowledge is incorporated in other types of knowledge and not as a type of knowledge on its own. Pedagogical knowledge, in this

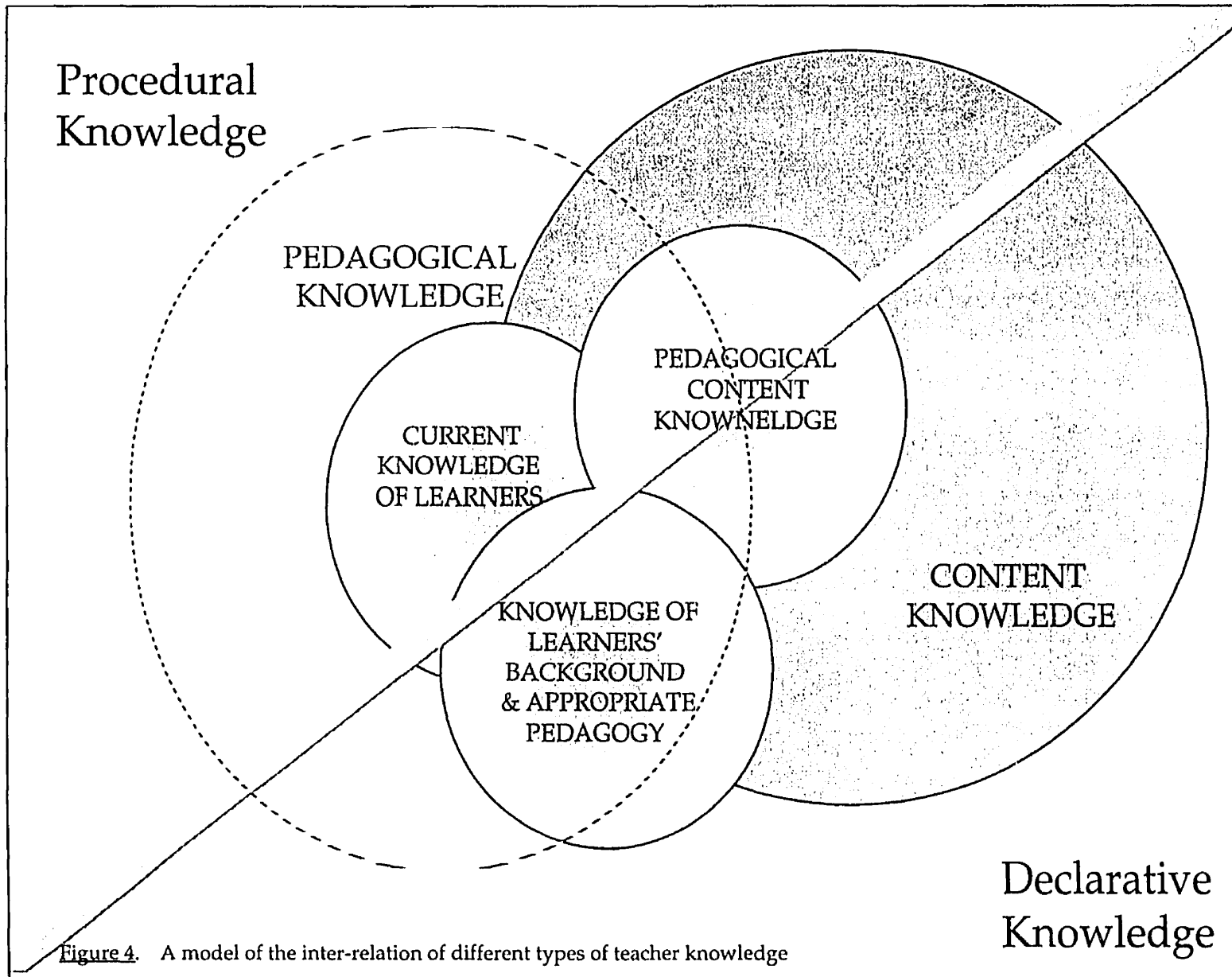


Figure 4. A model of the inter-relation of different types of teacher knowledge

form, appears to support teaching endeavors, but not drive it. Third, it indicates overlapping areas within the knowledge base for teaching in higher education that may at times be labeled as one type of knowledge or another by different individuals teaching in different contexts. Fourth, it indicates the presence of knowledge that is both declarative and procedural in nature for all types of knowledge.

This model could be elaborated by including specific elements of each of the definitions outlined in this study. At the present level of abstraction, it is meant as a guide to examine the knowledge base for teaching in higher education. However, if an element of knowledge such as "selecting examples" for teaching is placed in the model, where would it fit? In some cases, this might be completely a decision based on knowledge of content. In other cases it may be based on pedagogical content knowledge, current knowledge of learners, and knowledge of their background. Most likely, in any given situation, the influence of each of these types of knowledge would influence the professors' decision to some extent.

When compared to Leinhardt & Smith's (1985) model of teacher knowledge (see Figure 1), this model is more complex, yet does not include lesson structure or general teaching skills. In the present model, general teaching skills, which seem to be more procedural in nature, can be assumed to fall in the area of pedagogical knowledge, but only specific elements of general teaching skills would be reflected in the current model. Compared to Shulman's (1986b) model (see Figure 2), the current model contains a similar number of elements.

However, contrary to Shulman's (1986b) model, the elements in this model are not presented hierarchically and the divisions among the

types of knowledge are not as clear-cut. For example, general pedagogical knowledge is not completely separate from content knowledge. Moreover, the current model does not include curricular knowledge but does clearly indicate the inclusion of both procedural and declarative aspects of teacher knowledge.

Theoretical Significance of Findings

This study set out to address the knowledge base drawn on in teaching in higher education. The results of this study are an account of the knowledge base for teaching in higher education based on a methodology that addresses some of the methodological shortcomings of previous work. For instance, it used critical incidents drawn from actual classroom situations, involved a relatively large number of respondents from a variety of disciplines, and included faculty with a wide variety of backgrounds and teaching experiences.

Overall, findings support a different theoretical approach to teaching in higher education than outlined in the literature. Findings of particular theoretical significance are outlined below.

- 1) There are four types of knowledge in classroom teaching in higher education: a) pedagogical content knowledge, b) knowledge of content, c) current knowledge of learners, and d) knowledge of learners' background and appropriate pedagogy that are inter-related in a complex knowledge base.
- 2) There is a marked difference in the knowledge base for teaching in higher education than teaching in elementary and high school settings (e.g., Grossman, 1988; Leinhardt & Smith, 1985; Shulman, 1986b) which emphasize the significance of pedagogical knowledge. Results indicate that

the only elements of teaching typically defined as pedagogical knowledge (e.g., Reynolds, 1992) that were highly evident in the knowledge base for teaching in this study were knowledge of planning, general teaching strategies, and classroom management. These all inter-correlated with knowledge of learners' background to form one type of knowledge. Similarly, knowledge of curriculum or classroom routines, often cited as elements of the knowledge base for teaching, were not found to be part of the knowledge base for teaching in higher education.

- 3) The definition of content knowledge in teaching in higher education is broader than an understanding of declarative elements of subject matter (e.g., Alexander, et al., 1991). In the context of higher education, it also includes procedural elements of teacher knowledge which can be typically thought of as being indicative of pedagogical content knowledge, and to some extent even general pedagogical knowledge.

Overall, the findings from this study support claims that, like other teachers, university professors' knowledge of content is critical (Feiman-Nemser & Parker, 1990). However, the findings differ from other accounts of teacher knowledge in terms of the breadth, depth, and role of content knowledge (e.g., Reynolds, 1992; Shulman, 1986b, etc.). Findings also indicate a different relationship among the elements of the knowledge base for teaching in higher education than at other levels of education. This needs to be taken into account in understanding university teaching, its development, and the design

and delivery of faculty development activities. Finally, findings support dynamic accounts of teaching that indicate teachers draw on different types of knowledge, goals, lesson structures, and activities according to the academic level and content being taught (e.g., Kagan, 1988).

Research Question Two: Group Differences in Knowledge Drawn Upon

The literature on teacher knowledge highlights the importance of what teachers know in relation to how they teach (e.g., Calderhead, 1991; Carter, et al., 1988; Copeland, et al., 1994; Peterson & Clark, 1986; Shulman, 1987; Veenman, 1984). However, the results from this study did not indicate group differences in the knowledge base or types of knowledge drawn upon in teaching. Thus, the inexperienced, experienced, and award winning professors appeared to draw on similar knowledge bases for teaching.

This finding is inconsistent with past research outlined in the literature (e.g., Berliner; 1988; Calderhead, 1991; Kugel, 1993; Leinhardt & Smith, 1985) as well as with findings from the pilot study (Rahilly & Saroyan, 1995) in which differences in the knowledge base of inexperienced, experienced and award winning professors were evident, and worthy of discussion in order to contribute to future research efforts in this area.

There are several possible reasons for these conflicting findings. The first possible explanation is the null hypothesis; there are no differences in the knowledge base of the three groups of professors. In this case, no differences would be expected. A second possible explanation is that while there may be differences in the knowledge

base of individual professors, these differences may not be characterized in terms of experience or expertise. This explanation, however, seems unlikely given the plethora of research in countless disciplines that indicate a shift in an individual's knowledge base with professional growth (e.g., Chi, et al., 1988; Holyoak, 1991; Thomas & Thomas, 1994). A third possible explanation is that the analysis used were not sufficiently fine grained to detect differences. The issue of pooled variance was addressed in the previous chapters; although its effects were examined, it may have masked group differences. The fourth possible explanation has to do with the issue of the sample used in this study. As indicated earlier, the sample was comprised of professors who were willing to complete a lengthy questionnaire in order to share their experiences with interested researchers and colleagues. The demographic data indicated that the vast majority of respondents had participated in faculty development activities. Accordingly, the sample may not have reflected a cross-section of the professoriate to include those who may be less interested in participation in faculty development activities. These issues will be addressed in greater depth in the next section of this chapter.

It is clear from the results that the grouping variable of inexperienced, experienced, and award winning may not be the best way in which to divide the sample in order to detect differences in knowledge drawn upon in teaching. There is no agreed upon standard in the literature for the number of years of experience that categorically constitute being inexperienced, or experienced. Further, the distinction between award winners and experienced professors is not clear. Based on the accounts of teaching collected in this study, it is possible to have

inexperienced or experienced professors who have as of yet, not been recognized as being outstanding by winning a meritorious teaching award. In addition, as with human development, there are probably a few milestones of development of teacher knowledge, but for the most part, most people develop at their own rate and perhaps in different ways. Indeed, results of the multiple regressions indicate that there are a number of variables that influenced factor scores including prior training in teaching, and participation in faculty development activities, and situational factors including current teaching load and respondents' perception of the experiences as being exemplary or poor.

Theoretical Significance of the Findings

The results indicate similarities in knowledge drawn upon among the three groups in this study. Accordingly, no distinction in the knowledge base for teaching among the groups can be made. Thus it is possible to characterize the knowledge base for teaching in higher education of all respondents in this sample according to the types of knowledge found in the first part of this chapter.

These findings do not support the notion of knowledge growth with increased experience (e.g., Chi, et. al., 1988) or differences in the knowledge base between those who have been selected as award winners or seen as outstanding in their field versus those who have not (e.g., Ericsson & Smith, 1991). The significance of these findings must be tempered with an understanding of the analysis used in the study and respondents' who opted to take part in the study. Overall, findings highlight the importance of basic methodological issues in conducting research with this population. As with other limitations, these will be discussed in greater depth in the following section.

Strengths and Limitations of the Methods

The findings from this study must be interpreted with an understanding of the strengths and limitations of the methods used. The pilot study was used to identify both potential strengths and limitations associated with the use of critical incidents; modifications to the proposed methodology for this study were made after the pilot study to improve upon it. As with the pilot study, this study used a critical incident method in order to gather actual accounts of classroom teaching in higher education. While the pilot study used in-depth interviewing, the current study used a questionnaire which facilitated the collection of data from a much larger sample and a much larger number of memorable events or critical incidents. The data from the pilot study were analyzed thematically based on a framework derived from the existing literature while critical incidents collected in the current study were largely interpreted through respondents' own ratings of the types of knowledge they drew upon while teaching. Differences in the results of the two studies illustrate the balance between the use of a large sample and appropriate methods for analyzing a large amount of data collected and a small sample using the type of analysis appropriate for a smaller amount of data.

Strengths

Specific strengths of the methods used in the current study include the innovative use of a traditional questionnaire in conjunction with the critical incident method which directed the focus of respondents to specific teaching events. Data included both open-ended responses and numeric ratings. Numeric ratings were used as pointers to the open-ended data in order to allow respondents to

indicate their knowledge base and provide a framework for interpretation rather than "cutting up the pie" of teacher knowledge in higher education according to existing frameworks.

Limitations

Several methodological limitations of the study have already been addressed. These included the length of the questionnaire, the possible influence of pooled variance in the principal components analysis. The issue of timing of the incident, issues of sampling and grouping, and representativeness of the sample could also have had an effect on the findings of this study.

Timing of Incidents Reported

As outlined earlier in this study, the incidents collected were retrospective in nature. Indeed, approximately one-third of the incidents reported took place one or two years prior to the participants responding to the questionnaire. While one might be inclined to focus on the possible threat of distortion of the incident in terms of what actually happened, the true limitation is the possibility of change in the knowledge base for teaching that may have occurred after the incident which may have altered the ways in which respondents rated their past level of knowledge. This may have contributed to the non-significant difference in the knowledge base among the three groups of professors in this study. However, this is unlikely given there were no statistical differences among the timing of reported incidents among the groups.

Sample and Grouping

The sample used in this study was drawn randomly from university phone books, published lists from organizations with an interest in improving university teaching, through the

recommendation of faculty developers at teaching centres across North America, and from published lists of award winning faculty available in the public domain. Respondents were contacted by regular mail and electronic mail to solicit their participation. The response rate was 22 percent, which is relatively low when compared to Heberlein and Baumgartner's (1978) synthesis of survey research in which they report more than double this response rate for the typical first mailing of a questionnaire. This proportion of response warrants exploration of possible problems with the questionnaire or selection of respondents. Feedback from respondents and non-respondents indicated that the questionnaire took an hour or more to complete, which could have deterred many potential participants. Feedback from participants indicated that they were able to understand the tasks and typically could recall or select memorable or critical incidents of teaching. Thus, the major concern in interpreting the results from this study rests not with the methods used, but with the representativeness of the sample which is addressed in the next section.

The grouping process used in this study was successful given that the award winning and experienced groups were similar with respect to the number of years teaching (~19) and the inexperienced group all had been teaching for less than the 10 years often cited in the literature as the requisite number of years of experience, together with conscientious intentional practice, before one can become expert (Chi, Glaser, & Farr, 1988; Ericsson & Smith, 1991). All groups had similar teaching loads, formal educational backgrounds, and self-ratings of their teaching. The sample was also well proportioned in terms of the overall number of respondents from Arts and Science backgrounds.

However, there were clear imbalances in the number of respondents in the experienced professors from Science.

The groups did differ with respect to the extent of their participation in faculty development activities. Inexperienced professors had taken part in fewer activities, but this was expected given that they have had fewer opportunities (i.e., less time) to do so when compared to their more experienced colleagues. In a similar vein, inexperienced professors drew their critical incidents of teaching from courses they had taught a fewer number of times than award winners who drew both their poor and exemplary incidents from courses they had taught a number of times. The last difference among the groups was that award winners also reported slightly higher student evaluations than did respondents from the other two groups; the difference was only a tenth of a point on a 10 point scale, but this was statistically significant. This difference is not surprising given that many awards for teaching require some form of nomination from students in order for the faculty member to be considered.

Representativeness of the Sample

Overall, the sample had slightly fewer years of experience in teaching ($M=14.68$) than the US national average of 19 years (Blackburn and Lawrence, 1995). The sample also reported slightly higher student and self-ratings than those reported in the literature on student course ratings (e.g., Feldman, 1989); the mean of respondents self-rating was 8.54 ($SD=0.93$) on a scale of 10 and they reported a mean student rating of 8.19 ($SD=1.00$) on the same scale.

The award winning group in this study was probably the most representative of the groups in the sample. Since there is a

comparatively smaller population of award winners to draw from it is reasonable to expect that, proportionally speaking, they would be more highly represented. In addition, published lists of award winners were readily available and when contacted, these individuals were more interested and willing to participate than respondents from the other two groups; thus the proportion of non-responders was lower than for the other two groups.

There is evidence to suggest that the experienced group of professors in this study comprise a non-representative sample of the population as the response rate was relatively low and those who did participate tended to be involved in as many teaching improvement activities as the award winning group and reported high student and self ratings of their teaching. This group is probably the least representative of the groups as they were drawn from the largest population. They also were the least responsive when contacted and this was especially so in the case of experienced professors from science disciplines.

The inexperienced group is relatively representative given they were reasonably responsive and the sample used in this study was well balanced between the broad disciplines of Arts and Sciences.

Direction for Future Research

In order to improve upon the current research and follow up on its findings a similar study might be undertaken using a shorter questionnaire, thus drawing on a broader sample. Respondents could be asked to report only one incident, the number of questions could be reduced while still representing each type of knowledge, and the

emphasis could be placed on knowledge actually influencing teaching. By simplifying the questionnaire it may be easier to appeal to a larger sample. If a larger sample were used, the group variables used in this study could be examined and disciplinary differences might also be addressed. In addition to the groups used in this study, a group of identified expert professors could be added. The exact criteria for selection of participants would be difficult, however, this group of optimal performers holds an appeal to all researchers investigating the cognitive attributes of any profession (e.g., Ericsson & Lehmann, 1996).

Future research should also address the congruence of professors' reports of classroom events along with actual observation of their teaching. This study has focused on memorable events but the same methodology could not be used to examine every day teaching. This could be done by observing the classroom teaching and immediately following the class have the professors complete the ITQ.

There are also many possible ways in which the same data could be further analyzed. The current study used the ITQ ratings to select teaching incidents. The open-ended descriptions of the critical incidents could be analyzed separately and results could be compared.

Lastly, research could also address the model presented in order to elaborate a methodology to map the elements of teacher knowledge and their relationship (i.e., proximity of locations on the model) on a case by case basis or explore possible uses for the model in faculty development activities.

Contributions to Knowledge

This study has addressed the knowledge base for teaching in higher education which is a key construct involved in teachers' interpretation of their teaching task and their perception of classroom situations, and which influences their classroom action (e.g., Calderhead, 1983; Copeland et al., 1994; Shavelson & Stern, 1981). The major contribution to knowledge, based on the findings of this study, is primarily theoretical in nature. This study documents the knowledge base of university teaching and the ways in which it differs from accounts of teacher knowledge from other educational milieus. Findings indicate a composite knowledge base for teaching in higher education that includes many of the elements of teacher knowledge from primary and secondary school contexts. However, these elements are arranged in a conceptually different fashion to reflect the demands of the teaching situation as well as the breadth and depth of the different types of knowledge of professors who teach. The four types of knowledge found in this study were content knowledge, pedagogical content knowledge, current knowledge of learners, and knowledge of learners' background and appropriate pedagogy. The findings from this study can be used as part of the groundwork for constructing a theory of teaching in higher education.

Conclusion and Implications

Implications for Faculty Development

This study can inform faculty developers about the knowledge base of university professors and the model presented earlier can be used as a guide to interpret classroom teaching and the knowledge that is being drawn upon. Faculty development activities may neglect to

consider what their clients know and do not know. As with any other teaching and learning activity, it is imperative that the instructor, in this case the faculty developer, have a clear sense of the learner and work to foster meaningful learning. In order to do that, faculty development activities should recognize the differences in the knowledge base for teaching in higher education from that of other milieus and work from within the framework or knowledge base already in place.

A second implication pertains to the observation that faculty development activities have often focused on improving the practice or skill of teaching and tend not to address the issue of conceptual change among faculty (e.g., Weimer & Lenze, 1991). Based on the findings of this study, emphasizing pedagogical knowledge and skills in faculty development activities may not be the most effective way to improve teaching. Instead, faculty developers might try to foster the development of pedagogical content knowledge which entails knowledge of how to teach specific content, strategies, and how to balance between a number of factors in the classroom. The implication of this suggestion is that faculty developers can not always address teaching in general (i.e., addressing teaching devoid of any mention of subject matter). In order to do this, it means that faculty developers must involve people from specific subject domains in planning and delivering faculty development activities.

Lastly, results from this study suggest that the critical incident technique is a potentially useful activity for focusing faculty on their teaching in order to understand their current knowledge base, their approach, and even specific strategies used in teaching. Needless to say

that in order to foster change and bring about improvement in teaching, faculty need to understand the knowledge base they are drawing on, their mental models of teaching, and the connection between what they think and believe about teaching with their actual classroom practice (e.g., Strauss, 1996).

Conclusion

"The essence of good teaching is to adapt it to the particular context in which it is provided in such manner as to promote the student's inevitable search for meaning." (Dressell, 1992, p. 8)

As indicated in the quote above, university teaching, like any other kind of teaching, requires adaptation to the circumstances in which it occurs. The role of this adaptation, this "teacher thinking" can not be understated as it drives the professors classroom action. This study has examined one element of teaching and teacher thinking in higher education, the knowledge base for teaching. Results indicate four types of knowledge based on accounts of critical or memorable teaching events.

The knowledge base for teaching in higher education reflects the role that university professors undertake in society, namely that of contributing to knowledge, and communicating that knowledge to younger generations; a slightly different role than teachers in primary and secondary school contexts. Accordingly, it is not surprising that these individuals, when teaching, would draw heavily on their knowledge of content which is highly elaborate and includes elements described as part of pedagogical knowledge and pedagogical content knowledge for those teaching in elementary and high school settings.

References

- Alexander, P. A. (1992). Domain knowledge: Evolving themes and emerging concerns. Educational Psychologist, 27(1), 33-51.
- Alexander, P. A., Schallert, D. L., & Hare, V. C. (1991). Coming to terms: How researchers in learning and literacy talk about knowledge. Review of Educational Research, 61, 315-343.
- Altbach, P. G. (1995). "Problems and possibilities: The US academic profession." Studies in Higher Education, 20(1): 27-44.
- Anderson, J. R. (1983). The architecture of cognition. Cambridge, MA: Harvard University Press.
- Anderson, L. M., Blumenfeld, P., Pintrich, P. R., Clark, C. M., Marx, R. W., & Peterson, P. (1995). Educational psychology for teachers: Reforming our courses, rethinking our roles. Educational Psychologist, 30(3), 143-157.
- Andrews, J., Garrison, D. R., & Magnusson, K. (1996). The teaching and learning transaction in higher education: A study of excellent professors and their students. Teaching in Higher Education, 1(1), 81-103.
- Ball, D. L. (1988). Knowledge and reasoning in mathematical pedagogy: Examining what prospective teachers bring to teacher education. Unpublished doctoral dissertation, Michigan State University, East Lansing.
- Bates, J. A. (1993, February). Content-Knowledge Structure Differences among Middle School, High School, and College Life Science Teachers. Paper presented at the Annual Meeting of the Eastern Educational Research Association, Clearwater Beach, FL.
- Benner, P. (1984). From novice to expert: Excellence and power in clinical nursing practice. Menlo Park, CA: Addison-Wesley.
- Benson, D., & Lewis, J. M. (1994). Students' Evaluation of Teaching and Accountability: Implications from the Boyer and the ASA Reports. Teaching Sociology, 22(2), 195-99.
- Bereiter, C., & Scardamalia, M. (1986). Educational relevance of the study of expertise. Interchange, 17(2), 10-19.

Berliner, D. C. (1991). Educational psychology and pedagogical expertise: New findings and new opportunities for thinking about training. Educational Psychologist, 26(2), 145-155.

Berliner, D. C. (1988). Implications of studies on expertise in pedagogy for teacher education and evaluation; New directions for teacher assessment: Proceedings of the 1988 ETS invitational conference, (pp. 39-68). Princeton, NJ: Educational Testing Service.

Berliner, D. C. (1986). In pursuit of the expert pedagogue. Educational Research, 15(Aug/Sept), 5-13.

Bjerrum Nielsen, H. (1995). Seductive texts with serious intentions. Educational Researcher, 24(1), 4-12.

Borko, H. B., & Putnam, R. T. (in press). Expanding a teacher's knowledge base: A cognitive psychological perspective on professional development. In T. Guskey & M. Huberman (Eds.) New paradigms and practices in professional development.

Borko, H., & Livingston, C. (1989). Cognition and Improvisation: Differences in Mathematics Instruction by Expert and Novice Teachers. American Educational Research Journal, 26(4), 473-98.

Boyer, E. L. (Ed.). (1990). Scholarship reconsidered: Priorities of the professoriate. Lawrenceville, NJ: Princeton University Press.

Brookfield, S. (1990). Using critical incidents to explore learners' assumptions. In J. Mezirow & Associates (Eds.), Fostering critical reflection in adulthood: A guide to transformative and emancipatory learning, (pp. 177-193). San Francisco: Jossey-Bass.

Brookfield, S. D. (1987). Developing critical thinkers. San Francisco: Jossey-Bass.

Brown, J. S., Collins, A., & Duguid, P. (1989). Situated cognition and the culture of learning. Educational Researcher, 18(1), 32-42.

Bruner, (1990). Acts of meaning. Cambridge, MA: Harvard University Press.

Bruner, (1986). Actual minds, possible worlds. Cambridge, MA: Harvard University Press.

Bruner, J. S. (1966). Toward a theory of instruction. Cambridge, MA: Harvard University Press.

Buchanan, S. R. (1993). University 101 for High School Students. Journal of the Freshman Year Experience, 5(2), 49-68.

Bullough, R. V., & Stokes, D. K. (1994). Analyzing personal teaching metaphors in preservice teacher education as a means for encouraging professional development. American Educational Research Journal, 31(1), 197-224.

Byrne, C. J. (October, 1983). Teacher knowledge and teacher effectiveness: A literature review, theoretical analysis and discussion of research strategy. Paper presented at the 14th annual convention of the Northeastern Educational Research Association, Ellenville, NY.

Calderhead, J. (1991). Representations of teachers' knowledge. In P. Goodyear (Ed.), Teaching knowledge and intelligent tutoring, (pp. 269-279). Norwood, NJ: Ablex Publishing Corporation.

Calderhead, J. (1988). The development of knowledge structures in learning to teach. In J. Calderhead (Ed.) , Teachers' professional learning, (pp. 51-64). The Falmer Press.

Calderhead, J. (1987). Developing a framework for the elicitation and analysis of teachers' verbal reports. Oxford Review of Education, 13(2), 183-189.

Calderhead, J., & Robson, M. (1991). Images of teaching: student teachers' early conceptions of classroom practice. Teaching and Teacher Education, 7(1), 1-8.

Carter, K., Cushing, K., Sabers, D., Stein, P., & Berliner, D. (1988). Expert-novice differences in perceiving and processing visual classroom information. Journal of Teacher Education, 38(May/June), 25-31.

Carter, K., Sabers, D., Cushing, K., Pinnegar, S., & Berliner, D. C. (1987). Processing and using information about students: A study of expert, novice, and postulant teachers. Teaching and Teacher Education, 3, 27-31.

Carnegie Foundation for the Advancement of Teaching (1990). National survey of faculty, 1989. In E. L. Boyer (Ed.), Scholarship reconsidered: Priorities of the professoriate, Lawrenceville, NJ: Princeton University Press.

Carpenter, T. P., Fennema, E. (1986). Cognitively Guided Instruction: A Knowledge Base for Reform in Primary Mathematics Instruction. Elementary School Journal, 97(1), 3-20.

Casey, K. (1995). The new narrative research in education. In M. W. Apple (Ed.), Review of Research in Education, (Vol. 21, pp. 211-254). Washington, DC: American Educational Research Association.

Cashin, W. E. (1988). Student ratings of teaching: A summary of the research (Idea Paper No. 20). Manhattan: Kansas State University, Center for Faculty Evaluation and Development.

Catell, R. B. (1966). The scree test for the number of factors. Multivariate Behavioral Research, 1, 245-276.

Centra, J. A. (1993). Reflective faculty evaluation. San Francisco: Jossey-Bass.

Centra, J. A. (1978). Types of faculty development programs. Journal of Higher Education, 49(2), 151-162.

Chi, M. T. H., Glaser, R., & Farr, M. J. (1988). The nature of expertise. Hillsdale, NJ: Erlbaum.

Clandinin, D. J. (1985). Personal practical knowledge: A study of teachers' classroom images. Curriculum Inquiry, 15(4), 361-385.

Clark, C. M., & Peterson, P. (1986). Teachers' thought processes. In M. C. Wittrock (Ed.), Handbook of research on teaching (3rd ed.), (pp. 255-296). New York: Macmillan.

Clarridge, P. B. (1990). Multiple Perspectives on the Classroom Performance of Certified and Uncertified Teachers. Journal of Teacher Education, 41(4): 15-25.

Collins, A., Brown, J. S., & Newman, S. E. (1989). Cognitive apprenticeship: Teaching the crafts of reading, writing, and mathematics. In L. B. Resnick (Ed.) Knowing, learning, and instruction: Essays in honor of Robert Glaser (pp. 453-494). Hillsdale, NJ: Erlbaum & Associates.

Collison, M. N. K. (1991). Big universities seek smaller classes, more contact with professors. The Chronicle of Higher Education, 37(17), A37-A40.

Conle, C. (1996). Resonance in preservice teacher inquiry. American Educational Research Journal, 33(2), 297-325.

Connelly, F. M., & Clandinin, D. J. (1986). On narrative method, personal philosophy and narrative unties in the story of teaching. Journal of Research in Science Teaching, 4, 293-320.

Conseil supérieur de l'éducation. (1991). La pédagogie, un défi majeur de l'enseignement. (Avis au ministre de l'enseignement supérieur et de la science). Québec: Conseil supérieur de l'éducation.

Conseil supérieur de l'éducation. (1994). Réactualiser la mission universitaire (Avis au ministre de l'éducation). Québec: Conseil supérieur de l'éducation.

Copeland, W. D., Birmingham, C., DeMeulle, L., D'Emidio-Caston, M., & Natal, D. (1994). Making meaning in classrooms: An investigation of cognitive processes in aspiring teachers, experienced teachers, and their peers. American Educational Research Journal, 31(1), 166-196.

Cranton, P. (1992). Students' perceptions of teaching skills and overall effectiveness across instructional settings. Research in Higher Education, 33(6), 747-764.

Cross, K. P. (1990). Teaching to improve learning. Journal of Excellence in College Teaching, 1, 9-22.

Cross, K. P., & Angelo, T. A. (1988). Classroom assessment techniques: A handbook for faculty. Ann Arbor, MI: National Centre for Research to Improve Postsecondary Teaching and Learning.

Cochran-Smith, M., & Lytle, S. L. (1990). Research on teaching and teacher research: The issues that divide. Educational Researcher, 19(2), 2-11.

Cunsolo, J., Elrick, M., Middleton, A., & Roy, D. (1996). The scholarship of teaching: A Canadian perspective with examples. The Canadian Journal of Higher Education, 36(1), 35-56.

Delandshere, G., & Petrosky, A. R. (1994). Capturing teachers' knowledge: Performance assessment, a) and post-structuralist epistemology, b) from a post-structuralist perspective, c) and post-structuralism, d) none of the above. Educational Researcher, 25(5), 11-18.

Dickinson, D. J. (1990). The Relationship between Ratings of Teacher Performance and Student Learning. Contemporary Educational Psychology, 15(2), 142-51.

Diekhoff, G. M. (1983) Relationship judgments in the evaluation of structural understanding. Journal of Educational Psychology, 75, 227-233.

Dillon, R. F. (1991). Additional steps toward a cognitive psychology of instruction. In R. F. Dillon & J. W. Pellegrino (Eds.) Instruction: Theoretical and applied perspectives (pp. 1-16). New York: Praeger.

Dinham, S. M., & Blake, V. M. (April, 1991). Influences on university teachers' course planning. Paper presented at the annual meeting of the American Educational Research Association, Chicago, IL.

Doyle, W. (1990). Classroom knowledge as a foundation for teaching. Teachers College Record, 91(3), 347-360.

Dressell, P. L. (1982). On learning and Teaching in College: Reemphasizing the roles of learners and the disciplines. San Francisco: Jossey-Bass Publishers.

Dreyfus, H. L., & Dreyfus, S. E. (1986). Mind over machine. New York: Free Press.

Dunkin, M. J., & Barnes. (1986). Research on teaching in higher education. In M. C. Wittrock (Ed.), Handbook of research on teaching (3rd ed.), (pp. 754-777). New York: Macmillan.

Edwards, J. C. (1993). Surgery Resident Selection and Evaluation: A Critical Incident Study. Evaluation & the Health Professions, 16(1), 73-86.

Elbaz, F. (1991). Research on teacher's knowledge: the evolution of a discourse. Journal of Curriculum Studies, 23(1), 1-19.

Elbaz, F. (1983). Teacher thinking: A study of practical knowledge. New York: Nichols Publishing

Erickson, G. (1986). A survey of faculty development practices. In M. Svinicki (Ed.), Teaching excellence: Toward the best in the academy, Stillwater, OK: Professional and Organizational Development Network in Higher Education.

Ericsson, K. A. & Lehmann, A. C. (1996). Expert and exceptional performance: Evidence of maximal adaptation to task constraints. Annual Review of Psychology, 47, 273-305.

Ericsson, K. A., & Smith, J. (Eds.). (1991). Toward a general theory of expertise. New York: Cambridge University Press.

Fayol, M. (1994). From declarative and procedural knowledge to the management of declarative and procedural knowledge. European Journal of Psychology of Education, 9(3), 179-190.

Feldman, K. A. (1989). Instructional effectiveness of college teachers as judged by teachers themselves, current and former students, colleagues, administrators, and external neutral observers. Research in Higher Education, 30(2), 137-194.

Feldman, K. A. (1988). Effective college teaching from the students' and faculty's view: Matched or mismatched priorities? Research in Higher Education, 28, 291-344.

Feiman-Nemser, S., & Parker, M. B. (1990). Making subject matter part of the conversation in learning to teach. Journal of Teacher Education, 41(3), 32-43.

Fenstermacher, G. D. (1994). The knower and the known: The nature of knowledge in research on teaching. In L. Draling-Hammond (Ed.), Review of Research in Education, (Vol. 20, pp. 3-56). Washington, DC: American Educational Research Association.

Fisher, C. W., & et al. (1981). Teaching Behaviors, Academic Learning Time, and Student Achievement: An Overview. Journal of Classroom Interaction, 17(1), 2-15.

Flanagan, J. C. (1954). The critical Incident technique. Psychological Bulletin, 51(4), 327-358.

Fogarty, J. L., C., W. M., & Creek, R. (1983). A descriptive study of experienced and novice teachers' interactive instructional thoughts and actions. Journal of Educational Research, 77(1), 22-32.

Fong, B. (1987). Commonplaces about Teaching: Second Thoughts. Change, 19(4), 28-34.

Freedman, M. (1979). Academic culture and faculty development. Berkeley, CA: Montaigne Press.

Freeman, D. (1994). The use of language data in the study of teachers' knowledge. In I. Carlgren, G. Handal, & S. Vaage (Eds.), Teachers' minds and actions: Research on teachers' thinking and practice, (pp. 77-92). London: The Falmer Press.

Gage, N. L., & Berliner, D. C. (1984). Educational psychology. Dallas: Houghton Mifflin.

Gagné (1985). The cognitive psychology of school learning. Boston: Little, Brown.

Glaser, R. (1990). The reemergence of learning theory within instructional research. American Psychologist, 45(1), 29-39.

Glaser, R. (1989). Expertise and learning: How do we think about instructional processes now that we have discovered knowledge structures? In K. K. D. Klahr (Ed.), Complex information processing: The impact of Herbert A. Simon, (pp. 269-282). Hillsdale, NJ: Lawrence Erlbaum Associates.

Glaser, R., Lesgold, A., & Lajoie, S. P. (1988). Toward a cognitive theory for the measurement of achievement. In R. Ronning, J. Glover, J. S. Conoley, & J. C. Wittrock (Ed.), The influence of cognitive psychology on testing, Buros/Nebraska symposium on measurement, Volume 3, (pp. 41-85). Hillsdale, NJ: Erlbaum.

Grossman, P. (1988). A study in contrast: Sources of pedagogical content knowledge for secondary English. Unpublished Doctoral, Stanford University, Stanford, CA.

Grossman, P. L., & Richert, A. E. (1988). Unacknowledged knowledge growth: A re-examination of the effects of teacher education. Teaching & Instruction, 4(1), 53-62.

Good, T. L., (1990). Building the knowledge base of teaching. In D. Dill and Associates (Eds.) What teachers need to know: The knowledge, skills, and values essential to good teaching, (pp. 17-75). San Francisco, CA: Jossey-Bass Publishers.

Gorsuch, R. L. (1983) Factor Analysis. Hillsdale, NJ: Erlbaum.

Gudmundsdottir, S. (1991). Story-maker, story-teller: narrative structures in curriculum. Journal of Curriculum Studies, 23(3), 207-218.

Gudmundsdottir, S. (1987, April). Learning To Teach Social Studies: Case Studies of Chris and Cathy. Paper presented at the American Educational Research Association, Washington, DC.

Handy, C. (1994). The age of paradox. Boston, MA: Harvard Business School Press.

Harnish, D., & Wild, L. A. (1994). Mentoring Strategies for Faculty Development. Studies in Higher Education, 19(2), 191-201.

Hashweh, M. Z. (1987). Effects of subject-matter knowledge in the teaching of biology and physics. Teaching and Teacher Education, 3(2), 109-120.

Heberlein, T. A., & Baumgartner, R. (1978). Factors affecting response rates to mailed questionnaires: A quantitative analysis of published literature. American Sociological Review, 43, 447-462.

Heppner, P. P. and J. A. Johnston (1994). "New horizons in counseling: Faculty development." Journal of Counseling & Development, 72(5), 451-453.

Higher Education Institute. (1991). The American college teacher: National norms for the 1989-90 H.E.R.I. faculty survey. University of California: Los Angeles.

Holyoak, K. J. (1991). Symbolic connectionism: Toward third-generation theories of expertise. In K. A. Ericsson & J. Smith (Eds.) Toward a general theory of expertise: Prospects and limits (pp 301-335). New York, Cambridge University Press.

Housner, L. D., & Griffery, D. C. (1985). Teacher cognition: Differences in planning and interactive decision-making between experienced and inexperienced teachers. Research Quarterly for Exercise and Sport, 56, 45-53.

Jackson, P. W. (1968). Life in classrooms. New York: Hold, Rinehart & Winston.

Jacobson, R. L. (1992). Colleges Face New Pressure to Increase Faculty Productivity. Chronicle of Higher Education, 38(32), A1,16-18.

Johnson, K. E. (1994). The Emerging Beliefs and Instructional Practices of Preservice English as a Second Language Teachers. Teaching & Teacher Education, 10(4), 439-52.

Jonassen, D. H. (1988). Using Needs Assessment Data to Design a Graduate Instructional Development Program. Journal of Instructional Development, 11(2), 14-23.

Jonassen, D. H., Beissner, K., Yacci, M. (1993). Structural knowledge: Techniques for representing, conveying, and acquiring structural knowledge. Hillsdale, NJ: Lawrence Erlbaum Associates, Publishers.

Kenny, A. J. P. (Ed.) (1969). Aquinas; a collection of critical essays. Garden City, NY: Anchor Books.

Kenny, A. J. P. (1993). Aquinas on mind. New York: Routledge.

Kenny, D. (1990). Stanford in its second century: Address to the Stanford Community. Academic Council Meeting, April 5th, Stanford University.

Kagan, D. M. (1993). Contexts for the use of classroom cases. American Educational Research Journal, 30(4), 703-723.

Kagan, D. M. (1992). Professional growth among preservice and beginning teachers. Review of Educational Research, 62, 129-169.

Kagan, D. M. (1990). Ways of evaluating teacher cognition: Inferences concerning the goldilocks principle. Review of Educational Research, 60(3), 419-469.

Kelly, G. A. (1955). The psychology of personal constructs. New York: W. W. Norton.

Kowalski, T. (1993). The case method and situational learning. New Directions in Educational Reform, 1(1), 27-30.

Kugel, P. (1993). How Professors Develop as Teachers. Studies in Higher Education, 18(3), 315-28.

Lajoie, S. P., & Lesgold, A. M. (1992). Systematic assessment of proficiency for solving procedural knowledge tasks. Educational Psychologist, 27(3), 365-384.

Lang, H. G. (1994). Critical Teaching Incidents: Recollections of Deaf College Students. American Annals of the Deaf, 139(2), 119-27.

Leinhardt, G. (1993). On teaching. In R. Glaser (Ed.), Advances in instructional psychology, (Vol. 4, pp. 1-54). Hillsdale, NJ: Lawrence Erlbaum Associates.

Leinhardt, G., & Greeno, J. G. (1991). The cognitive skill of teaching. In P. Goodyear (Ed.), Teaching knowledge and intelligent tutoring, (pp. 233-268). Norwood, NJ: Ablex Publishing Corporation.

Leinhardt, G. (1990). Capturing craft knowledge in teaching. Educational Researcher, 19(2), 18-25.

Leinhardt, G., & Greeno, J. G. (1986). The cognitive skill of teaching. Journal of Educational Psychology, 78(2), 75-95.

Leinhardt, G., & Smith, D. A. (1985). Expertise in mathematics instruction: Subject matter knowledge. Journal of Educational Psychology, 77(3), 247-271.

Leinhardt, G., Weidman, C., & Hammond, K. M. (1987). Introduction and integration of classroom routines by expert teachers. Curriculum Inquiry, 17(2), 135-176.

Levinson-Rose, J., Menges, R. J., (1981). Improving college teaching: A critical review of research. Review of Educational Research, 51(3), 403-434.

Lewis, R. (Ed). (1996, November, 25, 1996). The sixth annual ranking universities '96 [Special issue]. Maclean's Canada's Weekly Newsmagazine, 109 (48).

Livingston, C., & Borko, H. (1990). High School Mathematics Review Lessons: Expert-Novice Distinctions. Journal for Research in Mathematics Education, 21(5), 372-87.

Livingston, C., & Borko, H. (1989). Expert-novice differences in teaching: A cognitive analysis and implications for teacher education. Journal of Teacher Education, 40(4), 36-42.

Lucas, A. F. (1990). The department chair as change agent. In P. Seldin (Ed.), How administrators can improve practice, (pp. 63-68). San Francisco: Jossey-Bass.

Marks, R. (1990). "Pedagogical content knowledge: From a mathematical case to a modified conception." Journal of Teacher Education, 41(3), 3-11.

Marland, P., & Osborne, B. (1990). Classroom theory, thinking, and action. Teaching and Teacher Education, 6(1), 93-109.

Marshall, B. (1995). Emphasis on teaching [On-line]. Available at <http://www.iftech.com>

McAlpine, L. C., & Weston, C. B. (1997, March). Building a model of reflection: New Findings and Insights. Paper presented at the annual meeting of the American Educational Research Association, Chicago.

McAlpine, L. C., & Weston, C. B. (1996, April). Researching reflection: A metacognitive model. Paper presented at the annual meeting of the American Educational Research Association, New York City.

McKeachie, W. J. (1990). "Research on college teaching: The historical background." Journal of Educational Psychology, 82(2), 189-200.

Means, B. (1993). Cognitive task analysis a basis for instructional design. In M. Rabinowitz (Ed.), Cognitive science foundations of instruction, (pp. 97-118). Hillsdale, NJ: Erlbaum.

Merriam, S. B. (1987). Adult Learning and Theory Building: A Review. Adult Education Quarterly, 37(4), 187-98.

Millis, B. J. (1994). Faculty Development in the 1990's: What It Is and Why We Can't Wait. Journal of Counseling & Development, 72(5), 454-64.

Morine-Dershimer, G. (1988). Premises in the practical arguments of preservice teachers. Teaching and Teacher Education, 40(5), 46-52.

Murray, H. G. (1991). Effective teaching behaviors in the college classroom. In J. C. Smart (Ed.), Higher education: Handbook of theory and research, (Vol. 7, pp. 135-172). New York: Agathon Press.

Munby, H. (1986). Metaphor in thinking of teachers: An exploratory study. Journal of Curriculum Studies, 18, 197-209.

Novak, J. D., & Gowin, D. B. (1984). Learning how to learn. New York, NY: Cambridge University Press.

Ormell, C. (1996). Eight metaphors of education. Educational Research, 38(1), 67-75.

Ozmon, H., & Craver, S. (1992). Philosophical foundations of education (5th. ed.). Englewood Cliffs, NJ: Prentice-Hall.

Peterson, P. L., & Comeaux, M. A. (1987). Teachers' schemata for classroom events: The mental scaffolding of teachers' thinking during classroom instruction. Teaching and Teacher Education, 3(4), 319-331.

Peterson, P. L., Fennema, E., Carpenter, T. P., & Loef, M. (1989). Teachers' pedagogical content beliefs in mathematics. Cognition and Instruction, 6, 1-40.

Piaget, J. (1969). The psychology of the child (H. Weaver, Trans.). New York: Basic Books.

Placek, J., & et al. (1982). Academic Learning Time (ALT-PE) in a Traditional Elementary Physical Education Setting: A Descriptive Analysis. Journal of Classroom Interaction, 17(2), 41-47.

Pressley, M., Tanenbaum, R., McDaniel, M. A., & Wood, E. (1990). What Happens when University Students Try to Answer Prequestions that Accompany Textbook Material? Contemporary Educational Psychology, 15(1), 27-35.

Post, T. R., & Cramer, K. A. (1989). Knowledge, representation, and quantitative thinking. In M. Reynolds (Ed.), Knowledge base for the beginning teacher, (pp. 221-231). Oxford, UK: Peyamon.

Prawat, R. S. (1992). Teachers' beliefs about teaching and learning: A constructivist perspective. American Journal of Education, 100(3) 354-395.

Ramsden, P. (1992). Learning to teach in higher education. New York: Routledge.

Ramsden, P. (1994). Current Challenges to Quality in Higher Education. Innovative Higher Education, 18(3), 177-88.

Rahilly, T. J. & Saroyan, A. (1995, April). A job well done: Experienced and inexperienced faculty in the arts and science critical incident of teaching. Paper presented at the annual meeting of American Educational Research Association, San Francisco, California.

Regan, H. B. (1993). Integrated Portfolios as Tools for Differentiated Teacher Evaluation: A Proposal. Journal of Personnel Evaluation in Education, 7(4), 275-90.

Reynolds, A. (1992). What is competent beginning teaching? A review of the literature. Review of Educational Research, 62(1), 1-35.

Rovegno, I. C. (1992). Learning to teach in a field-based method course: The development of pedagogical content knowledge. Teaching and Teacher Education, 8(1), 69-82.

Royer, J. M., Cisero, C. A., & Carlo, M. S. (1993). Techniques and procedures for assessing cognitive skills. Review of Educational Research, 63(2), 201-243.

Scardamalia, M., & Bereiter, C. (1989). Conceptions of teaching and approaches to core problems. In M. C. Reynolds (Ed.), Knowledge base for the beginning teacher, (pp. 37-46). New York: Pergamon Press.

Salthouse, T. A. (1991). Expertise as the circumvention of human processing limitations. In K. A. Ericsson & J. Smith (Eds.), Toward a general theory of expertise, (pp. 286-300). New York: Cambridge University Press.

Schmelzer, R. V., Schmelzer, C. D., Figler, R. A., & Brozo, W. G. (1987). Using the Critical Incident Technique to Determine Reasons for Success and Failure of University Students. Journal of College Student Personnel, 28(3), 261-66.

Schön, D. (1991). Educating the reflective practitioner. San Francisco: Jossey-Bass Publishers.

Schön, D. (1982). The reflective practitioner. New York: Basic Books.

Schönwetter, D. J., (1993). Attributes of effective lecturing in the college classroom. The Canadian Journal of Higher Education, 23(2), 1-18.

Seldin, P. (1991). The teaching portfolio: A practical guide to improved performance and promotion/tenure decisions. Bolton, MA: Anker Press.

Shavelson, R. J. (1973). What is the basic teaching skill? Journal of Teacher Education, 24(2), 144-151.

Shavelson, R., & Stern, P. (1981). Research on teachers' pedagogical thoughts, judgments, decisions, and behavior. Review of Educational Research, 51(4), 455-498.

Sheridan, H. W. (1991). Ichabod Crane dies hard: Renewing professional commitments to teaching. In P. Seldin (Ed.), How administrators can improve teaching: Moving from talk to action in higher education. San Francisco: Jossey-Bass.

Sherman, T. M., Fowler, F., Armistead, L. P., Barksdale, M. A., & Reif, G. (1987). The quest for excellence in university teaching. Journal of Higher Education, 48(1), 66-84.

Shore, B. M., Foster, S. F., Knapper, C. K., Nadeau, G. G., Neill, N., & Sim, V. (1986). The teaching dossier: Its preparation and use : Canadian Association of University Teachers.

Shulman, J. H. (Ed.). (1992). Case methods in teacher education. New York: Teachers College Press.

Shulman, J. (1987). From veteran parent to novice teacher: A case study of a student teacher. Teaching and Teacher Education, 3(1), 12-28.

Shulman, J. H., & Colbert, J. A. (1989). Cases as catalysts for cases: Inducing reflection in teacher education. Action in teacher Education, 11(1), 44-52.

Shulman, L. S. (1986a). Paradigms and research programs in the study of teaching: A contemporary perspective. In M. C. Wittrock (Ed.), Handbook of research on teaching (3rd ed.), (pp. 3-22). New York: Macmillan.

Shulman, L. S. (1986b). Those who understand: Knowledge growth in teaching. Educational Researcher, 15(2), 4-14.

Shulman, L. S. (1987). Knowledge of Teaching: Foundations of the new reform. Harvard Educational Review, 57(1), 1-22.

Sirotnik, K. A., & Goodlad, J. I. (Eds.). (1988). School-university partnerships in action: Concepts, cases, and concerns. New York: Teachers College Press.

Smith, S. L. (1991). Commission of inquiry on Canadian university education. Ottawa: Association of Universities and Colleges of Canada.

Sorcinelli, M. D. (1994). Effective Approaches to New Faculty Development. Journal of Counseling & Development, 72(5), 474-79.

Statistics Canada (December 4, 1996). University enrollment. The Daily Statistics Canada. [On Line] Available at <http://www.statcan.ca/start.html>

Sternberg, R. J., & Horvath, J. A. (1995). A prototype view of expert teaching. Educational Researcher, 24(6), 9-17.

Strahan, D. B. (1989). How experienced and novice teachers frame their views of instruction: An analysis of semantic ordered trees. Teaching & Teacher Education, 5(1), 53-67.

Strauss, S. (1996). Confessions of a born-again constructivist. Educational Psychologist, 31(1), 15-21.

Swanson, H., Lee, & et al. (1990). An Information Processing Analysis of Expert and Novice Teachers' Problem Solving. American Educational Research Journal, 27(3), 533-56.

Tanner, D., & Celso, N. (1982). Teacher Knowledge/Ability and Pupil Achievement. Phi Delta Kappa, 63(8), 567.

The students' guide to selecting a college or university (1995). St. Martin's Press.

Thorndike, E. L. (1898). Animal intelligence: An experimental study of the associative processes in animals. The Psychological Review Monograph Supplements, 2, 4-160.

Thomas, K. T., & Thomas, J. R. (1994). Developing expertise in sport: The relation of knowledge and performance. Special Issue: Expert-novice differences in sport. International Journal of Sport Psychology, 25(3), 295-312.

Tillema, H. (1994). Training and Professional Expertise: Bridging the Gap between New Information and Pre-Existing Beliefs of Teachers. Teaching & Teacher Education, 10(6), 601-15.

Tittle, C. K. (1994). "Toward an educational psychology of assessment for teaching and learning: Theories, contexts, and validation arguments." Educational Psychologist, 29(3), 149-162.

Tripp, D. (1993). Critical incidents in teaching : developing professional judgment. London: Routledge

Veenman, S. (1984). Perceived problems of beginning teachers. Review of Educational Research, 54(2), 143-178.

Vispoel, W. P., & Austin, J. R. (1995). Success and failure in junior high school: A critical incident approach to understanding students' attributional beliefs. American Educational Research Journal, 32(2), 377-412.

Watson, G., & Grossman, L. H. (1994). Pursuing a Comprehensive Faculty Development Program: Making Fragmentation Work. Journal of Counseling & Development, 72(5), 465-73.

Weaver, R., Kowalski, T., & Pfaller, J. (1994). Case method teaching. In K. Pritchard & R. Sawyer (Eds.), Handbook of college teaching: Theory and applications. New York: Greenwood

Weimer, M., & Lenze L. F., (1991). Instructional interventions: A review of the literature on efforts to improve instruction. In J. C. Smart (Eds.), Higher Education: Handbook of theory and research, (pp. 294-333). New York: Agathon Press.

Westerman, D. A. (1991). Expert and novice teacher decision making. Journal of Teacher Education, 42(4), 292-305.

Wilson, R. C., (1987). Toward excellence in teaching. In L. M. Aleamoni (ed.). Techniques for evaluating and improving instruction, (pp. 9-31). New Directions for Teaching and Learning, Number 31. San Francisco, CA: Jossey Bass Publishers.

Wilson, S. M. (1988). Understanding historical understanding: Subject matter knowledge and the teaching of U.S. history. Unpublished doctoral dissertation, Stanford University.

Williams, S. M. (1992). Putting case-based instruction into context: Examples from legal and medical education. The Journal of the Learning Sciences, 2(4), 367-427.

Wood, S. (1991). A model of classroom processes: Towards the formalization of experienced teacher's professional knowledge. In P. Goodyear (Ed.), Teaching knowledge and intelligent tutoring, (pp. 297-313). Norwood, NJ: Ablex Publishing Corporation.

Woolsey, L. K. (1986). The critical incident technique: An innovative qualitative method of research. Canadian Journal of Counselling, 20(4), 242-254.

Wright, W. A., & O'Neil, M. C., (1994). Perspectives on improving teaching in Canadian Universities. The Canadian Journal of Higher Education, 24(3), 26-57.

Zuber-Skerritt, O. (1992). Professional development in higher education. London: Kogan Page Limited.

APPENDIX A
CERTIFICATE OF ETHICAL APPROVAL

APPENDIX B
CONSENT FORM

Your Rights as a Participant

I understand that the purpose of this research is to understand better the day-to-day classroom experiences of faculty in the classroom in order to contribute to the knowledge base about university teaching.

I understand that I will be asked to recount incidents of classroom teaching in which I feel I have done an exemplary job and a poor job of teaching. I also understand I will be required to complete descriptions of these incidents as well as rate the relevance of different types of knowledge in the incidents. I also understand that I will be asked general questions about my educational and teaching background.

I understand that my participation in this study is totally anonymous and confidential and that all data will be treated accordingly.

I understand that I may have a full description of the results of the study after it is complete.

I understand that the data from this study may be published using pseudonyms, changing details, thus protecting my identification as a participant.

I understand that I am free to withdraw my consent and to discontinue my participation at any time without negative consequences.

I understand that my participation is completely voluntary and that by signing and returning the consent form, I acknowledge that I have read this form and give my consent to participate.

If you choose not to participate, we would ask that you pass this copy of the questionnaire onto a colleague who might be willing to complete it.

Please print your name: _____

Signature: _____

Date: _____

APPENDIX C
QUESTIONNAIRE

Instructions

In order to respond to this questionnaire you will need to focus on **TWO** specific teaching incidents that have taken place in recent years. One of these incidents represents a time when you did your "best" teaching, the other represents a time when you did your "worst" teaching. Below are some guidelines to help you select these critical incidents:

- **Think of a time in the last two or three years when you felt that your actions as a professor made a difference in the classroom (for better and for worse).**
- **These incidents should stand out in your mind, but also reflect the day-to-day reality for you as a university professor.**
- **These incidents were probably particularly demanding on you as a professor**
- **Try to select one teaching incident in which you thought you did an exemplary job and one in which you did a poor job.**

In the pages that follow you are asked to describe each incident in general terms and then respond to some of the factors that may have influenced your thinking and actions in the classroom. If you have trouble recalling either a poor or exemplary incident, try to remember the most recent time you felt challenged as a classroom professor.

Please be sure to fill out the appropriate section of the questionnaire for both your "poor" and "exemplary" incident. On the next page, you are asked to recall the "poor" incident, if you wish, you may skip ahead and start with the "exemplary" incident. If you do this, please be sure you begin on page 9. Be sure to complete both incidents of the questionnaire.

Poor Incident

The purpose of this section of the questionnaire is to get a sense of what occurred during this incident when you felt you did a poor job. If you can't think of an incident easily, please take a moment to think of the last time you felt challenged as a teacher. Or you may think of a time in recent years when, despite your input and effort, things in the classroom just didn't go as you had wished.

Once you have selected an incident, fill out the questions below. If you can't recall specifics, then please do your best to answer the question. If the question does not apply, then please indicate this in the space provided.

1. Approximately how long ago did this incident occur?

This semester _____ Last semester _____ Last Year _____
Other (specify): _____

2. What was the situation?

a. How many students were in the class? _____

b. Title of the course (approximate):

c. Required course: _____, Elective course: _____, Mixed: _____

d. How many times had you previously taught the course? _____

e. Type of students?	Undergraduate:	Graduate:
	Freshmen _____	Masters _____
	Junior _____	P.h.D. _____
	Senior _____	Other: _____
	Mixed _____	_____
	Other: _____	_____

3. How many times (e.g., classes) had you taught this particular group?

4. What was the topic of the class (general description)?
5. What were you trying to accomplish (i.e., teaching goal)?
6. What did you want the students to learn (i.e., learning goal)?
7. What happened that made this incident memorable or critical?
8. What did you do (i.e., your actions and strategies)?
9. What were you thinking and feeling during this incident?
10. What do you feel was most demanding about the incident?
11. What do you wish you had known at that time?
12. Did you learn anything from the experience?

Influences of Teaching Questionnaire

Instructions:

Below are a series of items that outline many different considerations you may have had during the teaching incident that you have just outlined.

In order to complete the questionnaire, you are asked to rate each item twice. In the left hand column, rate the extent to which you **agree** your knowledge or consideration of this item was **relevant** to the incident you just described by circling the appropriate number. In the right hand column, please indicate the extent to which this item **actually influenced your teaching**. Please remember both of these columns refer to your thoughts and actions AT THE TIME OF THE INCIDENT you just described.

The rating scale for both columns is as follows:

- 1 - Not at all
- 2 - Slightly
- 3 - Somewhat
- 4 - Unsure one way or the other
- 5 - Moderately
- 6 - A lot
- 7 - Quite a lot

Example Question

	<u>RELEVANT & CONSIDERED</u>	<u>ACTUALLY INFLUENCED MY MY TEACHING ACTIONS</u>
a. During this incident, I thought about my plan	1 2 3 4 5 6 7	1 2 3 4 5 6 7

Thus, in this example, if I just outlined an incident that had something to do with planning and felt that I had a solid knowledge of how to plan my class, and had thought about it, I might indicate a rating of 6 or 7 in the left hand column. However, if in the end, I didn't really think about my plan or use it in the classroom, I might indicate a 1 or 2 in the right hand column. Please remember that your response should pertain to the incident you have just outlined.

POOR INCIDENT

4

POOR INCIDENT

SCALE: 1= Not at all, 2= Slightly, 3= Somewhat, 4= Unsure, 5= Moderately, 6=A lot 7= Quite a lot

DURING THIS INCIDENT...

		RELEVANT & CONSIDERED	ACTUALLY INFLUENCED MY TEACHING
1.	I needed to keep the students' academic background(e.g., past courses, major, etc.) in mind	1 2 3 4 5 6 7	1 2 3 4 5 6 7
2.	It was important for me to know why I was teaching this material at this particular time in this course	1 2 3 4 5 6 7	1 2 3 4 5 6 7
3.	I knew how to structure a class	1 2 3 4 5 6 7	1 2 3 4 5 6 7
4.	I was aware that I was thinking about my actions while teaching	1 2 3 4 5 6 7	1 2 3 4 5 6 7
5.	I knew I wanted to teach in a way that would make learning possible	1 2 3 4 5 6 7	1 2 3 4 5 6 7
6.	It was important that I have a clear understanding of the relationship of major concepts in my field.	1 2 3 4 5 6 7	1 2 3 4 5 6 7
7.	I considered the students' social background	1 2 3 4 5 6 7	1 2 3 4 5 6 7
8.	I knew which were the most appropriate materials and resources to teach the content	1 2 3 4 5 6 7	1 2 3 4 5 6 7
9.	I knew something about theories of learning and instruction	1 2 3 4 5 6 7	1 2 3 4 5 6 7
10.	I monitored students for changes in their emotions during instruction	1 2 3 4 5 6 7	1 2 3 4 5 6 7
11.	I wanted to meet the learning goal for the class	1 2 3 4 5 6 7	1 2 3 4 5 6 7
12.	I was trying to make my teaching more exciting than the teaching I had experienced as a student	1 2 3 4 5 6 7	1 2 3 4 5 6 7
13.	I had to know what "good" and "bad" work in my field of expertise was	1 2 3 4 5 6 7	1 2 3 4 5 6 7
14.	I knew I wanted to keep students' attention	1 2 3 4 5 6 7	1 2 3 4 5 6 7

POOR INCIDENT

5

SCALE: 1= Not at all, 2= Slightly, 3= Somewhat, 4= Unsure, 5= Moderately, 6=A lot 7= Quite a lot

DURING THIS INCIDENT...

		RELEVANT & CONSIDERED	ACTUALLY INFLUENCED MY TEACHING
15.	It was important that I know about students' orientation to learning	1 2 3 4 5 6 7	1 2 3 4 5 6 7
16.	I needed to know about classroom management	1 2 3 4 5 6 7	1 2 3 4 5 6 7
17.	I was aware of the time I had available to cover the content of the class	1 2 3 4 5 6 7	1 2 3 4 5 6 7
18.	I knew that if I presented the content well, students should be able to understand it	1 2 3 4 5 6 7	1 2 3 4 5 6 7
19.	I wanted to make sure that students in this class thought I was knowledgeable about the content	1 2 3 4 5 6 7	1 2 3 4 5 6 7
20.	I knew some ways to evaluate students' learning	1 2 3 4 5 6 7	1 2 3 4 5 6 7
21.	I felt knowledgeable about the ways in which my students' went about learning the content	1 2 3 4 5 6 7	1 2 3 4 5 6 7
22.	I knew the most appropriate ways to evaluate students' learning of this particular content	1 2 3 4 5 6 7	1 2 3 4 5 6 7
23.	I had to know my own intellectual and personal dispositions toward the content	1 2 3 4 5 6 7	1 2 3 4 5 6 7
24.	I felt knowledgeable about students' expectations of this class	1 2 3 4 5 6 7	1 2 3 4 5 6 7
25.	I knew the scope of the material I intended to teach in this course	1 2 3 4 5 6 7	1 2 3 4 5 6 7
26.	I knew how to evaluate my teaching	1 2 3 4 5 6 7	1 2 3 4 5 6 7
27.	I was aware of my own emotions while teaching	1 2 3 4 5 6 7	1 2 3 4 5 6 7
28.	I wanted to work with students to help them change their understanding	1 2 3 4 5 6 7	1 2 3 4 5 6 7
29.	I wanted to prepare students for future courses	1 2 3 4 5 6 7	1 2 3 4 5 6 7
30.	I wanted to communicate knowledge to students in a smooth fashion	1 2 3 4 5 6 7	1 2 3 4 5 6 7
31.	I was aware of my own intellectual and personal disposition towards teaching	1 2 3 4 5 6 7	1 2 3 4 5 6 7
32.	I had a well constructed plan in mind of how I would teach	1 2 3 4 5 6 7	1 2 3 4 5 6 7

POOR INCIDENT

6

SCALE: 1= Not at all, 2= Slightly, 3= Somewhat, 4= Unsure, 5= Moderately, 6=A lot 7= Quite a lot

DURING THIS INCIDENT...

		RELEVANT & CONSIDERED	ACTUALLY INFLUENCED MY TEACHING
33.	I based my teaching on what I knew about students' learning styles or preferences	1 2 3 4 5 6 7	1 2 3 4 5 6 7
34.	I was knowledgeable about how to apply the content I was teaching outside the classroom	1 2 3 4 5 6 7	1 2 3 4 5 6 7
35.	I was aware of students' current understanding of the content	1 2 3 4 5 6 7	1 2 3 4 5 6 7
36.	I was aware of the overall place of the material I was teaching in the program of study	1 2 3 4 5 6 7	1 2 3 4 5 6 7
37.	I wanted to create opportunities for students to engage in higher order thinking or problem solving	1 2 3 4 5 6 7	1 2 3 4 5 6 7
38.	I was knowledgeable about current research in my field	1 2 3 4 5 6 7	1 2 3 4 5 6 7
39.	I wanted to keep students actively involved and motivated to learn	1 2 3 4 5 6 7	1 2 3 4 5 6 7
40.	I thought I needed to be flexible in my approach to teaching	1 2 3 4 5 6 7	1 2 3 4 5 6 7
41.	I knew how to manage my time in class	1 2 3 4 5 6 7	1 2 3 4 5 6 7
42.	I knew which teaching strategies that were best for teaching the material	1 2 3 4 5 6 7	1 2 3 4 5 6 7
43.	I was aware of how students' conceptions of the material can change over time	1 2 3 4 5 6 7	1 2 3 4 5 6 7
44.	I felt knowledgeable about the study habits of the students in this class	1 2 3 4 5 6 7	1 2 3 4 5 6 7
45.	I had to have a comprehensive knowledge base in my field	1 2 3 4 5 6 7	1 2 3 4 5 6 7
46.	I knew the most appropriate examples and analogies that help students learn the content	1 2 3 4 5 6 7	1 2 3 4 5 6 7
47.	I knew of a variety of teaching techniques	1 2 3 4 5 6 7	1 2 3 4 5 6 7
48.	I had a routine to effectively manage my teaching	1 2 3 4 5 6 7	1 2 3 4 5 6 7
49.	I wanted to do everything I had planned to do in the class	1 2 3 4 5 6 7	1 2 3 4 5 6 7

POOR INCIDENT

7

SCALE: 1= Not at all, 2= Slightly, 3= Somewhat, 4= Unsure, 5= Moderately, 6=A lot 7= Quite a lot

DURING THIS INCIDENT...

		RELEVANT & CONSIDERED	ACTUALLY INFLUENCED MY TEACHING
50.	I had to know some of the common conceptions and misconceptions that students have of the content being taught	1 2 3 4 5 6 7	1 2 3 4 5 6 7
51.	I was knowledgeable about the relationship of my subject to other subjects	1 2 3 4 5 6 7	1 2 3 4 5 6 7
52.	I had an understanding of students' overall level of ability	1 2 3 4 5 6 7	1 2 3 4 5 6 7
53.	I watched students for cues to their understanding	1 2 3 4 5 6 7	1 2 3 4 5 6 7
54.	I wanted to create the right environment for students to learn	1 2 3 4 5 6 7	1 2 3 4 5 6 7
55.	I just wanted to survive until the end of the class	1 2 3 4 5 6 7	1 2 3 4 5 6 7
56.	My goal was to transmit my knowledge of the material or skill to the students	1 2 3 4 5 6 7	1 2 3 4 5 6 7
57.	I knew how to evaluate students' learning on the particular content I was teaching	1 2 3 4 5 6 7	1 2 3 4 5 6 7
58.	I knew the "culture" of my discipline (history, expectations of peers, traditions, etc.)	1 2 3 4 5 6 7	1 2 3 4 5 6 7
59.	I knew how best to sequence the material being taught	1 2 3 4 5 6 7	1 2 3 4 5 6 7
60.	I knew the value of the content I was teaching to everyday life	1 2 3 4 5 6 7	1 2 3 4 5 6 7

CONTINUE TO NEXT SECTION

POOR INCIDENT

8

NEXT INCIDENT

EXEMPLARY Incident

The purpose of this section of the questionnaire is to get a sense of what occurred during this incident when you felt you did an exemplary job. If you can't think of an incident easily, please take a moment to think of the last time you felt challenged as a teacher. Or you may think of a time in recent years when, due in part to your actions or efforts, things went very well.

Once you have selected an incident, fill out the questions below. If you can't recall specifics, then please do your best to answer the question. If the question does not apply, then please indicate this in the space provided.

1. Approximately how long ago did this incident occur?

This semester ____ Last semester ____ Last Year ____
Other (specify): ____

2. What was the situation?

a. How many students were in the class? ____

b. Title of the course (approximate):

c. Required course: ____ , Elective course: ____ Mixed: ____

d. How many times had you previously taught the course? ____

e. Type of students?	Undergraduate:	Graduate:
	Freshmen _____	Masters _____
	Junior _____	Ph.D. _____
	Senior _____	Other: _____
	Mixed _____	_____
	Other: _____	_____

3. How many times (e.g., classes) had you taught this particular group?

4. What was the topic of the class (general description)?
5. What were you trying to accomplish (i.e., teaching goal)?
6. What did you want the students to learn (i.e., learning goal)?
7. What happened that made this incident memorable or critical?
8. What did you do (i.e., your actions and strategies)?
9. What were you thinking and feeling during this incident?
10. What do you feel was most demanding about the incident?
11. What is it that you know that contributed to making this an exemplary incident?
12. Did you learn anything from the experience?

EXEMPLARY INCIDENT

SCALE: 1= Not at all, 2= Slightly, 3= Somewhat, 4= Unsure, 5= Moderately, 6=A lot 7= Quite a lot

DURING THIS INCIDENT...

		RELEVANT & CONSIDERED	ACTUALLY INFLUENCED MY TEACHING
1.	I needed to keep the students' academic background(e.g., past courses, major, etc.) in mind	1 2 3 4 5 6 7	1 2 3 4 5 6 7
2.	It was important for me to know why I was teaching this material at this particular time in this course	1 2 3 4 5 6 7	1 2 3 4 5 6 7
3.	I knew how to structure a class	1 2 3 4 5 6 7	1 2 3 4 5 6 7
4.	I was aware that I was thinking about my actions while teaching	1 2 3 4 5 6 7	1 2 3 4 5 6 7
5.	I knew I wanted to teach in a way that would make learning possible.	1 2 3 4 5 6 7	1 2 3 4 5 6 7
6.	It was important that I have a clear understanding of the relationship of major concepts in my field.	1 2 3 4 5 6 7	1 2 3 4 5 6 7
7.	I considered the students' social background	1 2 3 4 5 6 7	1 2 3 4 5 6 7
8.	I knew which were the most appropriate materials and resources to teach the content.	1 2 3 4 5 6 7	1 2 3 4 5 6 7
9.	I knew something about theories of learning and instruction	1 2 3 4 5 6 7	1 2 3 4 5 6 7
10.	I monitored students for changes in their emotions during instruction	1 2 3 4 5 6 7	1 2 3 4 5 6 7
11.	I wanted to meet the learning goal for the class	1 2 3 4 5 6 7	1 2 3 4 5 6 7
12.	I was trying to make my teaching more exciting than the teaching I had experienced as a student	1 2 3 4 5 6 7	1 2 3 4 5 6 7
13.	I had to know what "good" and "bad" work in my field of expertise was	1 2 3 4 5 6 7	1 2 3 4 5 6 7
14.	I knew I wanted to keep students' attention	1 2 3 4 5 6 7	1 2 3 4 5 6 7

EXEMPLARY INCIDENT

11

SCALE: 1= Not at all, 2= Slightly, 3 Somewhat, 4= Unsure, 5= Moderately, 6=A lot 7= Quite a lot

DURING THIS INCIDENT...

	RELEVANT & CONSIDERED	ACTUALLY INFLUENCED MY TEACHING
15. It was important that I know about students' orientation to learning	1 2 3 4 5 6 7	1 2 3 4 5 6 7
16. I needed to know about classroom management	1 2 3 4 5 6 7	1 2 3 4 5 6 7
17. I was aware of the time I had available to cover the content of the class	1 2 3 4 5 6 7	1 2 3 4 5 6 7
18. I knew that if I presented the content well, students should be able to understand it	1 2 3 4 5 6 7	1 2 3 4 5 6 7
19. I wanted to make sure that students in this class thought I was knowledgeable about the content	1 2 3 4 5 6 7	1 2 3 4 5 6 7
20. I knew some ways to evaluate students' learning	1 2 3 4 5 6 7	1 2 3 4 5 6 7
21. I felt knowledgeable about the ways in which my students' went about learning the content	1 2 3 4 5 6 7	1 2 3 4 5 6 7
22. I knew the most appropriate ways to evaluate students' learning of this particular content	1 2 3 4 5 6 7	1 2 3 4 5 6 7
23. I had to know my own intellectual and personal dispositions toward the content	1 2 3 4 5 6 7	1 2 3 4 5 6 7
24. I felt knowledgeable about students' expectations of this class	1 2 3 4 5 6 7	1 2 3 4 5 6 7
25. I knew the scope of the material I intended to teach in this course	1 2 3 4 5 6 7	1 2 3 4 5 6 7
26. I knew how to evaluate my teaching	1 2 3 4 5 6 7	1 2 3 4 5 6 7
27. I was aware of my own emotions while teaching	1 2 3 4 5 6 7	1 2 3 4 5 6 7
28. I wanted to work with students to help them change their understanding	1 2 3 4 5 6 7	1 2 3 4 5 6 7
29. I wanted to prepare students for future courses	1 2 3 4 5 6 7	1 2 3 4 5 6 7
30. I wanted to communicate knowledge to students in a smooth fashion	1 2 3 4 5 6 7	1 2 3 4 5 6 7
31. I was aware of my own intellectual and personal disposition towards teaching	1 2 3 4 5 6 7	1 2 3 4 5 6 7
32. I had a well constructed plan in mind of how I would teach	1 2 3 4 5 6 7	1 2 3 4 5 6 7

EXEMPLARY INCIDENT

12

SCALE: 1= Not at all, 2= Slightly, 3= Somewhat, 4= Unsure, 5= Moderately, 6=A lot 7= Quite a lot

DURING THIS INCIDENT...

		RELEVANT & CONSIDERED	ACTUALLY INFLUENCED MY TEACHING
33.	I based my teaching on what I knew about students' learning styles or preferences	1 2 3 4 5 6 7	1 2 3 4 5 6 7
34.	I was knowledgeable about how to apply the content I was teaching outside the classroom	1 2 3 4 5 6 7	1 2 3 4 5 6 7
35.	I was aware of students' current understanding of the content	1 2 3 4 5 6 7	1 2 3 4 5 6 7
36.	I was aware of the overall place of the material I was teaching in the program of study	1 2 3 4 5 6 7	1 2 3 4 5 6 7
37.	I wanted to create opportunities for students to engage in higher order thinking or problem solving	1 2 3 4 5 6 7	1 2 3 4 5 6 7
38.	I was knowledgeable about current research in my field	1 2 3 4 5 6 7	1 2 3 4 5 6 7
39.	I wanted to keep students actively involved and motivated to learn	1 2 3 4 5 6 7	1 2 3 4 5 6 7
40.	I thought I needed to be flexible in my approach to teaching	1 2 3 4 5 6 7	1 2 3 4 5 6 7
41.	I knew how to manage my time in class	1 2 3 4 5 6 7	1 2 3 4 5 6 7
42.	I knew which teaching strategies that were best for teaching the material	1 2 3 4 5 6 7	1 2 3 4 5 6 7
43.	I was aware of how students' conceptions of the material can change over time	1 2 3 4 5 6 7	1 2 3 4 5 6 7
44.	I felt knowledgeable about the study habits of the students in this class	1 2 3 4 5 6 7	1 2 3 4 5 6 7
45.	I had to have a comprehensive knowledge base in my field	1 2 3 4 5 6 7	1 2 3 4 5 6 7
46.	I knew the most appropriate examples and analogies that help students learn the content	1 2 3 4 5 6 7	1 2 3 4 5 6 7
47.	I knew of a variety of teaching techniques	1 2 3 4 5 6 7	1 2 3 4 5 6 7
48.	I had a routine to effectively manage my teaching	1 2 3 4 5 6 7	1 2 3 4 5 6 7
49.	I wanted to do everything I had planned to do in the class	1 2 3 4 5 6 7	1 2 3 4 5 6 7

EXEMPLARY INCIDENT

13

SCALE: 1= Not at all, 2= Slightly, 3= Somewhat, 4= Unsure, 5= Moderately, 6=A lot 7= Quite a lot

DURING THIS INCIDENT...

		RELEVANT & CONSIDERED	ACTUALLY INFLUENCED MY TEACHING
50.	I had to know some of the common conceptions and misconceptions that students have of the content being taught	1 2 3 4 5 6 7	1 2 3 4 5 6 7
51.	I was knowledgeable about the relationship of my subject to other subjects	1 2 3 4 5 6 7	1 2 3 4 5 6 7
52.	I had an understanding of students' overall level of ability	1 2 3 4 5 6 7	1 2 3 4 5 6 7
53.	I watched students for cues to their understanding	1 2 3 4 5 6 7	1 2 3 4 5 6 7
54.	I wanted to create the right environment for students to learn	1 2 3 4 5 6 7	1 2 3 4 5 6 7
55.	I just wanted to survive until the end of the class	1 2 3 4 5 6 7	1 2 3 4 5 6 7
56.	My goal was to transmit my knowledge of the material or skill to the students	1 2 3 4 5 6 7	1 2 3 4 5 6 7
57.	I knew how to evaluate students' learning on the particular content I was teaching	1 2 3 4 5 6 7	1 2 3 4 5 6 7
58.	I knew the "culture" of my discipline (history, expectations of peers, traditions, etc.)	1 2 3 4 5 6 7	1 2 3 4 5 6 7
59.	I knew how best to sequence the material being taught	1 2 3 4 5 6 7	1 2 3 4 5 6 7
60.	I knew the value of the content I was teaching to everyday life	1 2 3 4 5 6 7	1 2 3 4 5 6 7

CONTINUE TO NEXT SECTION

Teaching Profile

Below are a series of questions that will help us understand your teaching background, approach, and beliefs.

1. How long have you been teaching at the post-secondary level? In your calculation, include all experience in which you worked autonomously as an instructor. _____
2. Have you ever taught anywhere other than in a college or university? If yes, please specify.
3. Please list your discipline and degrees and certificates. Please be sure to indicate if you have had any formal teacher training: (e.g., B.Sc. Chemistry, M.A., English Lit., B.Ed, etc.)

Any formal teacher training?: _____

4. Please list any faculty development activities in which you have participated (e.g., workshops, mentoring, training, personal reading, etc.)
5.
 - a. How many courses (approx.) do you typically teach in a year? _____
 - b. How many "classroom" hours in each course? _____.

6. Have you ever had any formal recognition for your skill as a teacher (e.g., teaching awards, merit pay, etc.)

7. Please indicate (approximate) your average rating on past student evaluations of your teaching (i.e., course evaluations). Using a scale of where 1 is poor, and 10 is excellent, where do you typically score?

1 2 3 4 5 6 7 8 9 10

8. Please rate yourself, overall, as a teacher. Using the same scale of 1 (poor) and 10 (excellent) how would you rate yourself?

1 2 3 4 5 6 7 8 9 10

9. Please list up to three things that have influenced the way in which you teach

1. -----
2. -----
3. -----

10. Currently, what percentage of your overall time on the job do you allot for the following activities?

Student supervision	-----
Teaching	-----
Committee or	
university service	-----
Community service	-----
Private consulting	-----
Research	-----

Other: -----

TOTAL =====
100 %

APPENDIX D

INFLUENCES OF TEACHING QUESTIONS BASED ON DIFFERENT TYPES OF KNOWLEDGE REPORTED IN THE LITERATURE

Scales within the ITQ

Knowledge of Learners

1. I needed to keep the students' academic background(e.g., past courses, major, etc.) in mind
7. I considered the students' social background
15. It was important that I know about students' orientation to learning
21. I felt knowledgeable about the ways in which my students' went about learning the content
24. I felt knowledgeable about students' expectations of this class
33. I based my teaching on what I knew about students' learning styles or preferences
35. I was aware of students' current understanding of the content
44. I felt knowledgeable about the study habits of the students in this class
52. I had an understanding of students' overall level of ability
57. I knew how to evaluate students' learning on the particular content I was teaching

Pedagogical Content Knowledge

2. It was important for me to know why I was teaching this material at this particular time in this course
8. I knew which were the most appropriate materials and resources to teach the content
22. I knew the most appropriate ways to evaluate students' learning of this particular content
25. I knew the scope of the material I intended to teach in this course
32. I had a well constructed plan in mind of how I would teach
42. I knew which teaching strategies that were best for teaching the material
43. I was aware of how students' conceptions of the material can change over time
46. I knew the most appropriate examples and analogies that help students learn the content
48. I had a routine to effectively manage my teaching
50. I had to know some of the common conceptions and misconceptions that students have of the content being taught
59. I knew how best to sequence the material being taught

Pedagogical Knowledge

- 3. I knew how to structure a class
- 9. I knew something about theories of learning and instruction
- 16. I needed to know about classroom management
- 20. I knew some ways to evaluate students' learning
- 26. I knew how to evaluate my teaching
- 31. I was aware of my own intellectual and personal disposition towards teaching
- 36. I was aware of the overall place of the material I was teaching in the program of study
- 41. I knew how to manage my time in class
- 47. I knew of a variety of teaching techniques

Content Knowledge

- 6. It was important that I have a clear understanding of the relationship of major concepts in my field.
- 13. I had to know what "good" and "bad" work in my field of expertise was
- 23. I had to know my own intellectual and personal dispositions toward the content
- 34. I was knowledgeable about how to apply the content I was teaching outside the classroom
- 38. I was knowledgeable about current research in my field
- 45. I had to have a comprehensive knowledge base in my field
- 51. I was knowledgeable about the relationship of my subject to other subjects
- 58. I knew the "culture" of my discipline (history, expectations of peers, traditions, etc.)
- 60. I knew the value of the content I was teaching to everyday life

Processes

- 4. I was aware that I was thinking about my actions while teaching
- 10. I monitored students for changes in their emotions during instruction
- 17. I was aware of the time I had available to cover the content of the class
- 27. I was aware of my own emotions while teaching
- 40. I thought I needed to be flexible in my approach to teaching
- 53. I watched students for cues to their understanding

Goals- Level One

- 14. I knew I wanted to keep students' attention
- 19. I wanted to make sure that students in this class thought I was knowledgeable about the content
- 30. I wanted to communicate knowledge to students in a smooth fashion
- 45. I had to have a comprehensive knowledge base in my field
- 46. I knew the most appropriate examples and analogies that help students learn the content
- 49. I wanted to do everything I had planned to do in the class
- 55. I just wanted to survive until the end of the class
- 56. My goal was to transmit my knowledge of the material or skill to the students

Goals-Level Two

- 11. I wanted to meet the learning goal for the class
- 18. I knew that if I presented the content well, students should be able to understand it
- 29. I wanted to prepare students for future courses
- 39. I wanted to keep students actively involved and motivated to learn
- 54. I wanted to create the right environment for students to learn

Goals-Level Three

- 5. I knew I wanted to teach in a way that would make learning possible
- 12 I was trying to make my teaching more exciting than the teaching I had experienced as a student
- 28. I wanted to work with students to help them change their understanding
- 37. I wanted to create opportunities for students to engage in higher order thinking or problem solving

APPENDIX E

RESPONDENTS' TEACHING DISCIPLINES

<u>Teaching Discipline</u>	<u>Number of Respondents</u>
Accounting	1
Anatomy	1
Anthropology	3
Asian Studies	1
Art/film history	1
Biology	1
Biochemistry	1
Business	1
Celtic Studies	1
Chemistry	3
Communications	1
Computer Science	2
Dentistry	2
Economics	2
Educational Psychology	2
Education (TESL, Teach Cert., Curriculum)	4
Engineering (civil, chem., metallurgical, mechanical)	4
Environmental Resource studies	1
Food science	1
French (Literature, and Language)	3
Geography	1
History	3
Horticulture	1
Linguistics	1
Math	8
Medicine (Basic Science, Family Med.)	4
Modern languages	1
Music	1
Nursing	7
Pharmacology	1
Philosophy	2
Photograph	1
Physics	4
Political Science	3
Psychology	9
Sociology	6
Speech Communication	1
Tourism	1

APPENDIX F
PRINCIPAL COMPONENT ANALYSIS

Principal Component Analysis #1
Respondents' Ratings of Knowledge Relevant and Considered

Factor 1 (Relevant and Considered)
Pedagogical Content Knowledge and Evaluation of Teaching and Learning.

Questionnaire Item		Factor Loading
32.	I had a well constructed plan in mind of how I would teach	0.73
42.	I knew which teaching strategies that were best for teaching the material	0.67
59.	I knew how best to sequence the material being taught	0.65
41.	I knew how to manage my time in class	0.65
46.	I knew the most appropriate examples and analogies that help students learn the content	0.57
25.	I knew the scope of the material I intended to teach in this course	0.54
26.	I knew how to evaluate my teaching	0.53
57.	I knew how to evaluate students' learning on the particular content I was teaching	0.52
33.	I based my teaching on what I knew about students' learning styles or preferences	0.52
34.	I was knowledgeable about how to apply the content I was teaching outside the classroom	0.51
22.	I knew the most appropriate ways to evaluate students' learning of this particular content	0.51
21.	I felt knowledgeable about the ways in which my students' went about learning the content	0.50
Percent of total variance accounted for by this factor =16.41		

Factor 2 (Relevant and Considered)

Knowledge of Learner's Background and Appropriate Pedagogy

	Questionnaire Item	Factor Loading
7.	I considered the students' social background	0.68
15.	It was important that I know about students' orientation to learning	0.67
9.	I knew something about theories of learning and instruction	0.61
43.	I was aware of how students' conceptions of the material can change over time	0.60
16.	I needed to know about classroom management	0.56
47.	I knew of a variety of teaching techniques	0.55

Percent of total variance accounted for by this factor = 12.76

Factor 3 (Relevant and Considered)

Content Knowledge

	Questionnaire Item	Factor Loading
51.	I was knowledgeable about the relationship of my subject to other subjects	0.70
45.	I had to have a comprehensive knowledge base in my field	0.55
58.	I knew the "culture" of my discipline (history, expectations of peers, traditions, etc.)	0.54
23.	I had to know my own intellectual and personal dispositions toward the content	0.53
36.	I was aware of the overall place of the material I was teaching in the program of study	0.51
13.	I had to know what "good" and "bad" work in my field of expertise was	0.50

Percent of total variance accounted for by this factor = 13.19

Factor 4 (Relevant and Considered)
Current Knowledge of Learners

Questionnaire Item		Factor Loading
52.	I had an understanding of students' overall level of ability	0.78
44.	I felt knowledgeable about the study habits of the students in this class	0.69
35.	I was aware of students' current understanding of the content	0.67
24.	I felt knowledgeable about students' expectations of this class	0.67

Percent of total variance accounted for by this factor = 8.81

Principal Component Analysis #2
Knowledge Actually Influencing Teaching

Factor 1 (Actually Influencing Teaching)
Pedagogical Content Knowledge

	Questionnaire Item	Factor Loading
41.	I knew how to manage my time in class	0.75
32.	I had a well constructed plan in mind of how I would teach	0.64
42.	I knew which teaching strategies that were best for teaching the material	0.62
34.	I was knowledgeable about how to apply the content I was teaching outside the classroom	0.60
36.	I was aware of the overall place of the material I was teaching in the program of study	0.58
35.	I was aware of students' current understanding of the content	0.58
3.	I knew how to structure a class	0.55
8.	I knew which were the most appropriate materials and resources to teach the content	0.54
46.	I knew the most appropriate examples and analogies that help students learn the content	0.51
59.	I knew how best to sequence the material being taught	0.51
Percent of total variance accounted for by this factor = 16.22		

Factor 2 (Actually Influencing Teaching)
 Knowledge of Learners, Expectations, and Evaluation

	Questionnaire Item	Factor Loading
21.	I felt knowledgeable about the ways in which my students' went about learning the content	0.76
22.	I knew the most appropriate ways to evaluate students' learning of this particular content	0.72
20.	I knew some ways to evaluate students' learning	0.70
24.	I felt knowledgeable about students' expectations of this class	0.65
44.	I felt knowledgeable about the study habits of the students in this class	0.60
57.	I knew how to evaluate students' learning on the particular content I was teaching	0.59
26.	I knew how to evaluate my teaching	0.51
33.	I based my teaching on what I knew about students' learning styles or preferences	0.51
Percent of total variance accounted for by this factor = 15.23		

Factor 3 (Actually Influencing Teaching)
Knowledge of Content

	Questionnaire Item	Factor Loading
51.	I was knowledgeable about the relationship of my subject to other subjects	0.69
45.	I had to have a comprehensive knowledge base in my field	0.68
13.	I had to know what "good" and "bad" work in my field of expertise was	0.66
38.	I was knowledgeable about current research in my field	0.65
58.	I knew the "culture" of my discipline (history, expectations of peers, traditions, etc.)	0.59
23.	I had to know my own intellectual and personal dispositions toward the content	0.53

Percent of total variance accounted for by this factor = 12.64

Factor 4 (Actually Influencing Teaching)
Knowledge of Learners' Background, Appropriate Pedagogy, and Disposition towards teaching.

	Questionnaire Item	Factor Loading
7.	I considered the students' social background	0.71
15.	It was important that I know about students' orientation to learning	0.63
9.	I knew something about theories of learning and instruction	0.56
31.	I was aware of my own intellectual and personal disposition towards teaching	0.54
47.	I knew of a variety of teaching techniques	0.51
52.	I had an understanding of students' overall level of ability	0.51
16.	I needed to know about classroom management	0.50

Percent of total variance accounted for by this factor = 10.44

APPENDIX G

COMPLETE LISTING OF CRITICAL INCIDENT SUMMARIES WITH FACTOR SCORE COEFFICIENTS ABOVE ONE

Pedagogical Content Knowledge

Considered Pedagogical Content Knowledge

- Q62P-E17 Four male students expressed discomfort in interviewing female patient on sensitive subject. Attempted to involve other students in discussion and examination of this issue, suggesting our professional role is to breakdown this barrier. One female student protested saying that female clients should be seen by women. Conversation escalated and I was frustrated that the situation became a "her" and "us" situation.
- Q87E-I7 Began with a "loss" exercise that focuses students to think about what the value is in life. Followed up by group sharing (involving a) story about personal loss. The students openly shared, expressed emotion and provided support and feedback to each other.
- Q34E-I3 My teaching strategy worked particularly well. I divided the class into 3 groups, everyone planning and writing a short essay in different environment to prove my point. It worked, it was well designed they were well prepared for it and it proved valuable to them.
- Q59P-A25 Guest lecturer didn't show up and I had no backup plan. Asked for questions on last lecture, went over some material from past week. Felt I had to look prepared.

Influenced by Pedagogical Content Knowledge

- Q20E-A12 I introduced topic in a general way (textbook) and class , on their own, asked for more lectures. I scheduled them in the evening. A responsive class! Rave! Class was a good cohesive group. It was enough to get me going for the next 10 years.
- Q65E-E20 After description I showed students photos of pathologic material with x-rays to match. They were deeply impressed. I felt good that I was able to link basic science with anatomy.

- Q22E-A24 Despite extensive planning, the demonstration (of basic optimal foraging theory) did not serve to make the points I had intended. I terminated the demo earlier than planned & generated a discussion instead (this did succeed!). I was frustrated, embarrassed.
- Q59E-A25 Showing stakes in Québec referendum. Questions from class were so numerous that I could not stick to my plan and cover material systematically. I answered all questions and recuperated to get my points across. Its great to teach without lecture, but its hard.
- Q3E-A33 Filled in for colleague with 5 minutes notice and was spontaneous, fun, interactive and established rapport with class
- Q43P-A23 I tried to include far too much material in the time allotted. I introduced live TV demo and there was not enough time. I tried not to overwhelm the students. I should have prepared the session better.

Considered & Influenced by Pedagogical Content Knowledge

- Q96P-A15 A male student voiced negative and sexist views about woman alluding to the citadel case. I asked others to respond asked questions to provoke rethinking his view that were not capable of leadership. I felt anger but tried not to show it. The student was hostile (more).
- Q66E-I9 Conducted lab in class and had students write it up. Said it was interesting. I reinforced their learning. Took planning of exact sequence of events if it failed, I would fail whole class. Does not have to be sophisticate to be interesting.
- Q43E-A23 I used a simple model to illustrate [topic] students were able to visualize a conceptually difficult phenomenon. It was obvious from their questions they were getting this, it was a great improvement over past years.
- Q67E-I3 Showed video and stopped them asking specific questions. They caught on that they were supposed to be able to answer questions. Needed to show them this and accept that I couldn't say this but needed to see what I was saying.

- Q13E-A20 Teaching thesis defense practice, led them through a simulation and chaired the defense. It worked perfectly. I had underscored the defense process for the "inside" to alleviate (student) anxiety.
- Q6P-E12 Teaching small group teaching techniques I was dull and tried to bring out group members and be enthusiastic, but leader can only do so much
- Q97E-I6 Guided students to the improvements and stimulate discussion asked questions that led them to right direction. Experiential learning and simulation. Thinking they are "into it" and enjoying this and obvious understand and want more. (Professor really into it too)
- Q6E-E12 Teaching effective clinical teaching the role play did not work as well as expected but I referred to original goal of group to make it relevant and got positive feedback from the group.
- Q92E-I4 Used visual representation of diet and exercise and did small group work. I could actually see the light going on! This is historically a difficult topic for students to grasp and this method was ideal (for this group).
- Q22P-A24 Despite extensive planning, the demonstration (of content) did not serve to make the points I had intended. I terminated the demonstration earlier than planned and generated a discussion instead, this did succeed. I was frustrated and embarrassed.

Current Knowledge of LearnersConsidered Current Knowledge of Learners

- Q83P-I1 Students were asking questions and I got lost in my own example trying to define various concepts. I prepared a core profile (IQ) and wanted to walk the class through it defining each concept relative to each measure of mean, median, mode. As things deteriorated I lost my confidence.
- Q49E-I4 Student asked a question that I was able to use to link the course material with broader material. I answered the question drawing on my own background in physics and as a researcher. The question at first blush was a non-sequitur; I might have brushed it aside
- Q13P-A20 During self-directed learning activity I joined a group as an equal member. One group did/could not complete the activity and the other got only part way through. I was very frustrated and worried about the activity and my role. When I am especially enthusiastic about a topic, I cannot assume the learners are equally enthusiastic--they have their own interests. I do know this, but don't always remember it act on it.
- Q46E-I9 Students challenged me and asked questions. I challenged them often in this class too. Very interactive. I gave analogies that helped them understand. Kept enthusiasm.
- Q85P-E15 One student was particularly aggressive. He was upset about the grading on a recent test and challenge my knowledge of the material. He frustrated me & my heart was not in rest of the class. Paused to recover also respond to student about what I thought was appropriate in the classroom, it was a long class

Influenced by Current Knowledge of Learner's

- Q79-I3 I failed to make subject interesting to student's. I lectured, group discussion, video. I was (wondering) why student's aren't more interested or talkative. I know this is a topic that means something to them. Wished I knew if this was a new topic for students.
- Q19P-A12 I lectured for approximately 20 minutes only to find out no one understood a thing that I had said. I revised the method of teaching these concepts and made it more palatable to arts students who have poor quantitative skills that need to be considered.
- Q19E-A12 Students were stirred by the lecture and made an effort to communicate that to me which enhanced the lecture considerably and made me more enthusiastic about the lecture.
- Q48P-A32 A student asked "what the hell are you doing? I can't follow a damn thing you said". Fortunately this happened 10 minutes before end of class. Canceled rest of class. Felt embarrassed, angry, and defeated. Learned I must stay in tune with student understanding.
- Q53E-I9 In order to get the student to accept her level of ability as higher than perceived I was reassuring comforting, firm and insistent re: accuracy, providing clues to pace and avoiding overzealous effort (performance). Student responded extremely positive in terms of both music and in reflection about herself. Had to be aware of her feelings.
- Q64E-A13 Related things they saw in everyday life explicit to different models. Students talked about it after class and remembered it vividly. Sometimes abstract theory can still be made interesting to students
- Q76P-A22 Breakdown of a student trying to do graft (plant) unsuccessfully (crying sobbing). Told the student that was a learning experience and that failure was part of process. Felt uncomfortable, didn't know why student crying (not graded). Had to respond without embarrassing her

- Q34P-I7 I discovered that none of the students had finished the book I told them I couldn't teach if they hadn't read it, gave a warning, told them they should have finished. I was angry. Faced with improvising, I panicked and opted out entirely.
- Q68E-I2 It was highly interactive allowing me to directly address some misconceptions students had. I had prepared a scenarios of sample problems/scenarios and got student to do as much on their own as possible, filling in when necessary.
- Q44P-I7 A student asked for a make up exam because they missed the mid term exam. I did not give a make up because the excuse was not legitimate. I don't know if I should have given the make up and be compassionate or kind. Concern for those with legitimate excuses if I give.

Considered and Influenced by Current Knowledge of Learners

- Q4E-E15 During final presentation planned straight forward evaluation plan for students, student performance was excellent, they learned a lot, and I felt I was able to communicate well and provide feedback.
- Q30E-I30 After discussion most student seemed to understand very well the parts of the assignment & links between case probs. I explained it on the board systematically including past difficulties students had. I was well prepared and confident students would understand.
- Q2P-A4 In a survey course I introduced broad areas in the field and get a basic interest in the field. Students' attitude and learning habits were not positive. I tried in many ways (including the use of transparencies and films) to change their hostile attitude. I felt frustrated and defeated.
- Q14E-E30 Tried to show students the preconceptions they had and critically analyze their beliefs. Students stated they never thought they would enjoy a physics course. Feeling exhilaration.

- Q2E-A3 I was trying to help students develop a critical attitude toward statistical argument and assumptions by having them learn a solid foundation of the basic statistics and make use of computers in addition to lectures. I gave them many homework assignments and examples, and tests and was available to students as much as possible.
- Q22E-A24 Instructed student to basics logic, strategy and tactics of hypothesis testing. I could tell that the students 'got it!' (This really showed up on later tests). I was well prepared and presented the material exceptionally clearly. Feeling elation.
- Q73E-E28 An analogy I invented on the spot clarified the concept. I outlined the analogy and then had the students tell me how the physiology fit the analogy. The material was demanding, but I knew students' outside interests (sports) so analogy worked. Models work best if students build them.
- Q71E-E11 I kept challenging them with more examples and I kept encouraging them. They were using the (computer) to verify their analysis of the problems and there was an excitement created by the total understanding of the concept.
- Q71P-E11 Even though I had prepared for the lesson when I started the demo I lost sight (of content) 1/2 way through. I tried to work from the beginning again to determine where I went awry & asked students to bear with me. Difficult to accept that I had made a mistake.

Content KnowledgeConsidered Content Knowledge

- Q80P-E4 I used a case study from text that seemed to steer students away from what I thought was important for them to learn. I was deluged with questions from students. I tried to steer their thought processes towards the major concepts by answer questions. Frustrated, panicky wish I had known the case study was not going to be effective.
- Q66P-E9 I didn't introduce the topic well, I went much too fast and student's looked bewildered. Tried to go back to beginning and do it again. Anxiety and disappointment because material is what I find most interesting in the course. I wish I had thought through the presentation more.
- Q94P-E15 All but one of the student had not read the assignment & could not respond to questions or take a stand. I lectured for half the period then discussed with them the advantage of reading obviously angry. I was angry and they feigned total boredom with the issue. Wanted to motivate them.
- Q74P-A14 I rushed through complex concepts, I had 10 minutes left in class and tried to cover material which required half an hour. Must not assume that concepts which are basic to me are similarly so to my students.
- Q51P-I3 I was working through a problem and made a mistake. Student pointed it out and corrected me. I continued but was flustered, embarrassed. I should have checked my work
- Q99P-A20 The program chair and representative of professors' association were in attendance and students were bored, passive and I was board I looked out window to the beautiful sunrise and distracted the whole class. (Followed plan) but should have acted on my intuitive feelings and changed it.

Q25P-A28 I wanted students to consider the chemical principles in the course and not view it as mathematics. Students did not change as demonstrated in subsequent tests etc. Tried to show ridiculous examples. Frustration, need to rearrange the course organization.

Influenced by Content Knowledge

- Q44E-I7 I tried to improve my teaching focusing on research & analytical skills. Student's indicate they liked the course because of its emphasis on research and analytical skills development. I felt well rewarded. Gave clear guidance about how to write & formulate questions.
- Q35E-I4 Within the first five minutes, students were eager, participating plenty busy note taking, applauded at end of class. I was well organized, used overhead and visual, handout. I was animated moved all over lecture theater, clear communication of main points.
- Q52P-I10 Student quizzed me about details in a challenging manner; when I gave answer he said I was wrong because he had a book with different answers. In the end he was misreading his book. I felt flustered by the challenge (to my credentials) and like a young female performer.
- Q88P-A6 It was a big group and I thought lecture with limited discussion was the way to go. I worked way too hard at that vs. getting them to discover (content). One student wrote on the evaluation that she saw (content) in new light and didn't like what she saw...caused (professor) nausea.
- Q45E-A30 Students were curious and wanted to lead the questioning, were using me rather than expecting me to tell them. I interfered as little as possible consistent with keeping within the framework I had pre-arranged for this session. Tried not to destroy the interaction by coming in with the right answers.
- Q37E-I3 Class appeared interested and some questions asked. I used transparencies to related basic information to support clinical skills. There was a good flow to the presentation and I conveyed a lot of information in 40 minutes.
- Q53P-I9 There were several who chose to either make trouble or disbelieve the information I was attempting to impart regarding certain sounds (voice class). At first I ignored them trying, rather to gain the confidence of the majority... I asked two to leave other 4 left

- Q42P-E12 I was inexcusably rude to a student. The student had been repeatedly late and habitually walked across the front of the class. I made fun of him. I would never do that again.
- Q42E E12 I taught the poem in an exciting way using a free critical approach. A student who was visiting from high school decided to go into honour English as a result. I was engaging and excited about my subject

Considered and Influenced by Knowledge of Content

- Q92P-I4 I've used this (commercially available materials) before with excellent results, this time it (or I) bombed-this surprised me. This was only to be a group of 13, due to absence of other instructor I added her class to mine. I felt uncomfortable, tried to (correct) the situation.
- Q56E-E32 I Constantly and relentlessly integrated the math 'abstractions' with photographic problems they have to solve. Some 'ex' engineering students discovers a new way to calculate and all students were excited. Test at end of session showed score of 90%.
- Q18P-A30 I was demonstrating a destructive interference. I attempted a graphical solution of a problem I made up on the spot that got too complicated to solve fully. I admitted to the class I found the solution too difficult but was annoyed with myself ...
- Q26E-A25 Through careful use of good examples done well on the blackboard teaching (content) worked out well. I rationalized a large amount of empirical data, summarized in very compact form. I saw the results on the final exam. Be prepared, think before grab chalk .
- Q27E-A22 A student told me she had dropped... because my course was so depressing and that students need to be "talked down" from lectures (on devastation of nuclear war). I added a section on success of treaties to date. I realized I must empathize, not be analytical.

- Q58E-E15 I was dealing with simplistic political correct understanding & spoke from the depths of mind, hear and personal experience. Felt empowered and uplifted. Based on my complete understanding of (topic) and search for truth (about topic). It is import to speak honestly with care and passion.
- Q41E-A18 Introducing macro economics had a debate about deficit and debt. Timing (of class coincided) with federal budget. Took a chance and dealt with their perspectives.
- Q41P-A18 Text provided overheads with a mistake in the way they drew the graph. I explained the conceptual idea and told them I would have to get back to them on the graph. I was embarrassed for not having caught the error and not being able to fix it on the spot.
- Q18E-A30 In order to show students they must (master content) I gave back & discussed an exam where material was tested. I spoke my mind very freely - they had not provided all the necessary information... I was concerned about their lack of knowledge, I kept my emotions in check.
- Q7E-A30 Teaching kinetics I departed from the goals or script to find a new analogy and example and told them (it was new) I felt some elation in balancing time requirements.
- Q10E-E28 I wanted to teach the use of a psychological theory to analyzing film. I was enthusiastic and students expressed their pleasure grasping obviously difficult material. I was happy and excited at getting students personally involved with ideas.

Learner's Background & Appropriate Pedagogy

Considered Students' Background &...

- Q93E-E14 I gave out guidelines for the exercise and students followed my instructions and class went smoothly. The seemed to enjoy it & knew their role. I was pleased and glad I prepared so well.
- Q79E-I2 I allowed students to teach one another. Students reacted positively. I was happy it was going well. It was demanding to make sure they stayed on topic. Allowing students to assume the role of teacher increased their attention.
- Q58E-E15 Feedback indicated I had singled out student who were talking and embarrassing them in front of class. They were rude and I showed them who was the boss. Didn't realize extent of my actions.

Influenced by Learners' Background

- Q60P-A17 Teaching complex material and a student asks me how to calculate a percentage. I answered her question directly and moved on. I was angry she was hung up on 4th grade material. Shocked at how poorly prepared some students can be.
- Q60E-A17 I told students to reflect on the entire course and indicate how far they had come in the entire course in terms of their understanding of material since start of term. All said they had learned a lot and papers were extremely good.
- Q89P-A20 The students began attacking one another verbally. I tried to hold back and let them work it out. I was nervous that the incident would put a chill on further communication in the classroom. I wish I had known more about incidents that occurred outside
- Q38E-I5 Observation of small groups indicated students absorbed more of lecture material than I expected! I had presented a problem, split them into groups and mingled and got involved in discussion. Active participation by almost all student's including quiet ones.

- Q75E-E13 I had prepared a variety of handouts and gave the readings. I put them into groups (one method per group) and they discussed and made 5 minutes presentations then overall class discussion. They got it. I was happy to accomplish what I wanted to.
- Q38P-I5 Students didn't appear to have any clue to the meaning of ANOVA tables. I presented a table asked them to identify and explain the basics. When no responses I asked them to break into pairs to see if they could jog each other's memories. I felt I was back tracking.
- Q24E-I8 Students finally did the work! Discussed and applied their knowledge. I followed the recommendations they had given me recently when I asked them what they wanted me to do, not to do and to change. Breakthrough!
- Q33E-A19 High levels of student preparation, involvement, and enthusiasm, creative plans and insightful analysis. I had planned and conducted a review, explained the exercise, and debriefed. Reinforced my belief in experiential learning.

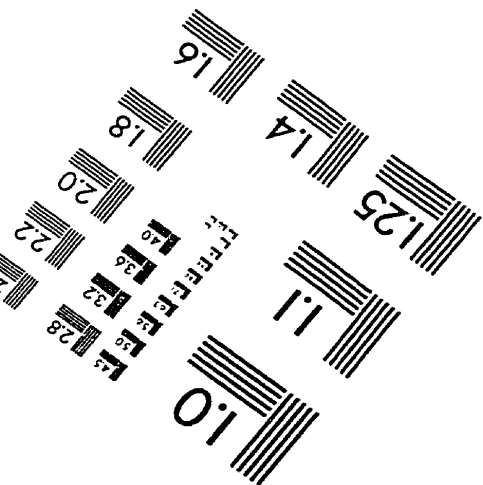
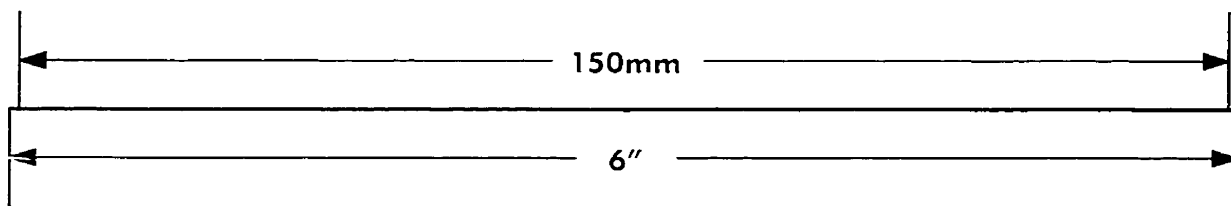
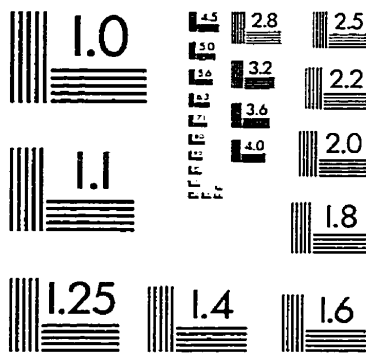
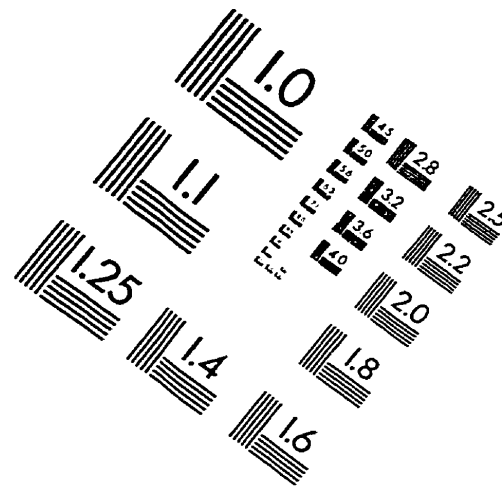
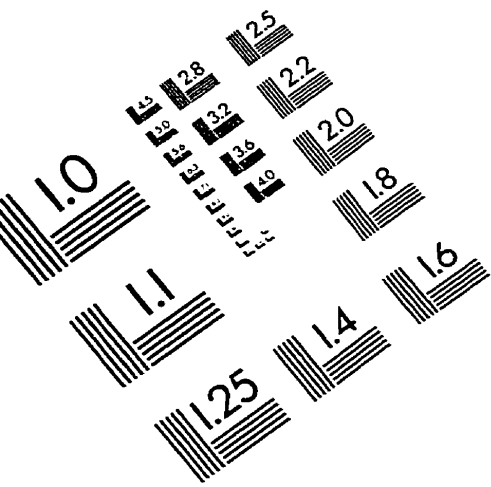
Considered and Influenced by Student's background

- Q35P-I4 Apathy, lack of participation in groups, students concern with "will this be on the exam" lack of energy and reluctance to engage in activity. I circulated attempted to provide encouragement, direction, stimulate discussion. Took (a lot) of energy on my part.
- Q69E-A25 Structured, nurtured, set previous draft deadlines for complete data collection plan. All on target-good! Demanding to work with so many diverse teams, had done this before and could anticipate possible problems.
- Q90P-A15 The students were almost all unprepared. Discussion was impossible because they hadn't done the reading. I tried to review previous material and elicit general comments with little result. I finally told them it was impossible to continue & ended class early.

- Q100P-E14 I was co-teaching with a sociologist who kept co-opting the literacy discussion and side-tracking it. Tactful use of question to redirect the discussion. I was angry- why was he being so arrogant and obtuse. Hard to control my feelings while bring students back.
- Q31E-E15 Taught (...) strategies. Excellent student response and work. Complemented student and provided further input.
- Q100E-E14 In order to overcome the resistance between history and literature I began with a short lecture and discussion of reading for class and discussion of a poem set in this historical context. The students were highly emotional and intellectually engaged. I was delighted that there were carrying the discussion so well and had read so carefully. Based on organization and planning.
- Q62E-E17 Drew on skills of students in class to provide suggestions in how to use skills in their practice. Based on knowledge of communication, strategy of involving students, and adult learning methods.
- Q91P-I8 I was disappointed that I wasn't conveying the information clearly and as a result the student were doing miserably. I altered the course content to where I felt more comfortable. In my head, I was letting students down. Structure of the course and preparation an issue.
- Q69P-A25 Campus computing had changed program and my notes and overlays were on an earlier version of system. Faked it-told students the instructions would be the system, but output would look a bit different than my overhead displays. Tried to keep students focused.
- Q31P-E15 Confrontation with unruly student - visitor. Removed student from class (gently), confronted him outside the door. Had to control temper and remain professional.
- Q90E-A15 Some student had misinterpreted the assignment and read prepared texts which I specifically told them not to do. I interrupted and led them through their presentation by prompting them with questions. I was very nervous as they panicked...I reassured. I learned I can push students.

- Q99E-A20 I modeled, provided guided learning package and each group selected new strategies, took risks to utilize them and facilitate group learning. Also learners were enthusiastic and integrated many concepts. Planning and organization (drawn on) knew student background.
- Q11E-E28 Class presentation of group research techniques went very smoothly. Students presented in a "hands on" style asking all present to translate a few lines. My work preceded the class (meetings with groups to define strategies, tactics, etc. I was elated.
- Q95E-E16 Issue of same sex marriage came up and student asked if I am married. I said no but they kept pressing for details. Asked them to ask the question they really wanted to ask (i.e., are you gay) but no one replied. One finally asked, I said I was gay and we had a happy exchange.

IMAGE EVALUATION TEST TARGET (QA-3)



APPLIED IMAGE, Inc
1653 East Main Street
Rochester, NY 14609 USA
Phone: 716/482-0300
Fax: 716/288-5989

© 1993, Applied Image, Inc.. All Rights Reserved

