REPRESENTING THE PROBLEM OF LEARNING TO TEACH: STUDENT TEACHERS' DEFINITIONS OF LEARNING, TEACHING AND THE STUDENT TEACHER ROLE

by

Janis Kristjansson

B.A. University of Toronto, 1968
B.Ed. University of Ottawa, 1976

A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF ARTS

in

THE FACULTY OF GRADUATE STUDIES

Department of Educational Psychology and Special Education

We accept this thesis as conforming to the required standard.

THE UNIVERSITY OF BRITISH COLUMBIA

July 1993

©Janis Kristjansson, 1993
In presenting this thesis in partial fulfilment of the requirements for an advanced degree at the University of British Columbia, I agree that the Library shall make it freely available for reference and study. I further agree that permission for extensive copying of this thesis for scholarly purposes may be granted by the head of my department or by his or her representatives. It is understood that copying or publication of this thesis for financial gain shall not be allowed without my written permission.
Teacher education is being reevaluated in light of current understandings of the ways in which education needs to be restructured. If the teacher is to assume a role primarily as a problem solver it may require a different approach than the current, largely atheoretical and fragmented approach. Teachers and student teachers identify the practicum as the most valuable aspect of teacher education, possibly because of the opportunity to solve real problems in the domain. This suggests that the practicum may play a pivotal role in learning to teach.

The way in which prepracticum student teachers represent the problem of learning to teach using their definitions of teaching, learning and the student teacher role was investigated in a problem solving and developmental context. The relationship between the quality of this problem representation and success on the practicum was determined. A combination of qualitative and quantitative methods were used.

The results suggest that student teacher may see teaching, learning and the student teacher role as three separate problems to be solved. For each
definition, the highest percentage of respondents were at the lowest level of Ammon & Levin's Levels of Pedagogical Conception, but level was not consistent across the definitions. There is a significant relationship between problem representation level and strategies listed. There was no statistically significant relationship between level of pedagogical conception and supervisor ratings of success on the practicum. Implications for teacher education and the applicability of Ammon & Levin's model are discussed.
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABSTRACT</td>
<td>ii</td>
</tr>
<tr>
<td>TABLE OF CONTENTS</td>
<td>iv</td>
</tr>
<tr>
<td>TABLES</td>
<td>vi</td>
</tr>
<tr>
<td>FIGURES</td>
<td>vii</td>
</tr>
<tr>
<td>ACKNOWLEDGEMENT</td>
<td>viii</td>
</tr>
<tr>
<td>CHAPTER I</td>
<td></td>
</tr>
<tr>
<td>INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>Purpose of the Study</td>
<td>5</td>
</tr>
<tr>
<td>Rationale</td>
<td>6</td>
</tr>
<tr>
<td>Teacher Education: A lack of consensus</td>
<td>6</td>
</tr>
<tr>
<td>Teaching: A unique profession</td>
<td>8</td>
</tr>
<tr>
<td>Becoming a Teacher: Solving a complex</td>
<td>9</td>
</tr>
<tr>
<td>problem</td>
<td></td>
</tr>
<tr>
<td>The Development of Expertise: Why look at</td>
<td>12</td>
</tr>
<tr>
<td>beginnings?</td>
<td></td>
</tr>
<tr>
<td>Summary</td>
<td>16</td>
</tr>
<tr>
<td>Research Questions</td>
<td>18</td>
</tr>
<tr>
<td>Definition of Terms</td>
<td>20</td>
</tr>
<tr>
<td>CHAPTER II</td>
<td></td>
</tr>
<tr>
<td>REVIEW OF THE LITERATURE</td>
<td>22</td>
</tr>
<tr>
<td>Introduction</td>
<td>22</td>
</tr>
<tr>
<td>The Nature of Expertise in Teaching</td>
<td>23</td>
</tr>
<tr>
<td>The Importance of the Practicum</td>
<td>24</td>
</tr>
<tr>
<td>The Development of Expertise as Problem</td>
<td>26</td>
</tr>
<tr>
<td>Solving</td>
<td></td>
</tr>
<tr>
<td>Problem Structure and Problem Representation</td>
<td>27</td>
</tr>
<tr>
<td>The Importance of Problem Representation</td>
<td>30</td>
</tr>
<tr>
<td>Novice-Expert Differences</td>
<td>34</td>
</tr>
<tr>
<td>Student teaching: A problem solving</td>
<td>35</td>
</tr>
<tr>
<td>perspective</td>
<td></td>
</tr>
<tr>
<td>Student teaching: A constructivist</td>
<td>39</td>
</tr>
<tr>
<td>perspective</td>
<td></td>
</tr>
<tr>
<td>Levels of Pedagogical Understanding: A</td>
<td>41</td>
</tr>
<tr>
<td>constructivist model</td>
<td></td>
</tr>
<tr>
<td>Summary</td>
<td>44</td>
</tr>
</tbody>
</table>
### CHAPTER III
**METHODOLOGY** ........................................ 46
- Design .................................................. 46
- Participants .......................................... 47
- Method .................................................. 48
- Instrumentation ....................................... 49
- Data Analysis ......................................... 63

### CHAPTER IV
**RESULTS** .................................................. 71
- Question 1 ............................................. 71
- Question 2 ............................................. 81
- Question 3 ............................................. 87

### CHAPTER V
**DISCUSSION** ............................................ 95
- Question 1 ............................................. 97
- Question 2 ............................................. 101
- Question 3 ............................................. 104
- The student teacher role: a developmental perspective ........................................ 112
- The student teacher role: A problem solving perspective ......................................... 114
- Conclusion ............................................. 116

References ................................................. 118
TABLES

Table 1: Levels of Pedagogical Conception. . . . . . . 42

Table 2: Contingency table showing relationship between learning definition level and best ways to learn . . . . . . . . . . . . . . . . . 74

Table 3: Crosstabulation of high frequency ways to learn by learning definition level . . . . . . . . . . . . 75

Table 4: Contingency table showing relationship between level of definition of teaching and best ways to teach. . . . . . . . . . . . . . . . . . . . 80

Table 5: Contingency table showing relationship between student teacher role level and specific role functions . . . . . . . . . . . . . . . . . . . 86

Table 6: Correlations among definition levels and supervisor ratings (Kendall’s Tau). . . . . . . . . . . 90

Table 7: Role of Teacher, Information, and Student at Different Levels of Pedagogical Understanding. . . 113
FIGURES

Figure 1: Level of learning definition. . . . . . . 72
Figure 2: Level of teaching definition. . . . . . . 72
Figure 3: Level of role definition. . . . . . . . . 82
Figure 4: Mean definition level (rounded) . . . . . 89
ACKNOWLEDGEMENT

I wish to thank my committee, Dr. Pat Arlin, Dr. Marshall Arlin, and Dr. Billie Housego for their support and for their almost instantaneous feedback on drafts of this thesis.

Dedication:
I dedicate this work to my father, who taught me research methodology at the dinner table and to the memory of my mother whose fine examples of perseverance and critical thinking will be with me always.

This work was supported, in part, by a grant from the Social Sciences and Humanities Research Council of Canada to Dr. Patricia Arlin.
CHAPTER I
INTRODUCTION

The current call for the restructuring of education in the United States and Canada (Carnegie Foundation, 1986; Goodlad, 1990a; British Columbia Department of Education, 1990) is somewhat different, in two ways, from those that have preceded it. Instead of a list of specific decrees to be implemented, there are broad guidelines for change. Instead of upper administration deciding the form of change, its shape is coming from schools and teachers. Here is a change in the educational power structure, in a way that has profound implications for teachers and teacher education.

In this new model, schools, rather than school systems, are to be the fundamental unit of change and teachers, rather than administrators, are to be the agents of change. Teachers will be the ones to establish goals for school improvement. They will identify the problems they face, choose, and implement strategies for solving them, and evaluate outcomes. This process is not envisaged as being a one-shot "fix-it" effort but rather as an ongoing response to the fluid, complex, situated nature of the educational
process. It requires that teachers actively formulate and solve complex problems in situations where the problem parameters are often not clear and where there is no clear best solution. There is some agreement that this view of the teacher, as reflective problem solver, operating in a complex domain, simply recognizes what many teachers actually do in classrooms, and that empowering teachers as agents of change merely offers appropriate scope for their expertise (Colton & Sparks-Langer, 1992; Edmundson, 1990; Goodlad, 1990b; Hollingsworth, 1992a;b; Lampert, 1985).

Perhaps in recognition of the complexity of what teachers actually do, the restructuring movement has also involved an examination of teacher education programs, and an assessment of ways in which they, too, need to change in order to provide adequate education for the teachers of the future. A recent survey of American teacher education programs (Goodlad, 1990b) found that the vast majority had no clear theoretical basis, and that they lacked coherence. As part of the same survey, Edmundson (1990) reports that only 3 of 29 institutions studied had teacher education programs
based on "a coherent, articulated and commonly shared vision of what it meant to be a teacher" (p. 718). Both authors strongly affirm the need for teacher education programs that prepare teachers for complex real-world problem solving in a changing environment.

In order to understand how teacher education might best be restructured, it is important to understand the ways in which education students already actively construct what it means to teach. There are three major sources of information that students use in this construction process. First, they have an understanding of the teacher role, constructed during years of experience as students in classrooms (Calderhead & Robson, 1991; Nespor, 1987), and perhaps, for some, as parents of children in school. It is important to note, however, that understanding teaching from the student or parent point of view may be quite different than understanding it from the teacher point of view (Lortie, 1975). Second, students have information gleaned from university courses on different aspects of education. Third, students have understandings constructed during the field experiences which form a part of their teacher education program.
Although all three sources of information interact, there is evidence that field experiences, such as student teaching, play a crucial part in the construction of what it means to teach (Feiman-Nemser & Buchmann, 1985; Zeichner, 1985).

The research on the effects of field experiences in teacher education is filled with contradictory results. Some suggest that it has powerful socializing effects (Hoy, 1967; Hoy & Woolfolk, 1990), while others say that the effects are weak and ambiguous (Zeichner, 1985). In spite of this, teachers at all levels of experience are consistent in their identification of student teaching as the most valuable part of their teacher education program (Feiman-Nemser & Buchmann, 1985; Lortie, 1975; Wideen & Holborn, 1990). The fact that cooperating teachers are not carefully screened, well-trained experts (Goodlad, 1990), but a rather random assortment of "the good, the bad and the ugly" makes this all the more puzzling.

The present study will suggest that the practicum is seen to be valuable because it offers an opportunity to construct an initial approximation of the teacher role through problem solving in the complex world of
the real classroom and furthermore that the way in which the problem of constructing the teacher role is solved, is related to the way it is represented.

A number of researchers (Chi, Feltovich & Glaser, 1981; Getzels, 1979; Schoenfeld 1983; Sinnott, 1989) have suggested that the nature and quality of problem representation affects problem solution. Knowledge, belief systems and developmental level, all play a part. For student teachers it is possible that domain specific levels of pedagogical conception may be one of the factors affecting the representation of the problem of learning to teach.

**Purpose of the Study**

In this study, a developmental model of pedagogical understanding (Ammon & Levin, 1991) is used in an attempt to answer the question "Is the way student teachers represent the problem of learning to teach related to their success on the practicum?"

This study has three purposes. The first purpose is to examine how student teachers represent the problem of learning to teach using their definitions of learning, teaching and the student teacher role. The
second purpose is to examine whether their definitions of learning, teaching and the student teacher role lead them to choose suitable strategies for solving the problem. The third purpose is to determine whether more advanced (according to Ammon & Hutcheson, 1989; Ammon & Levin, 1990) understandings of the problem of learning to teach lead to greater success on the practicum.

**Rationale**

Teacher Education: A lack of consensus

Calls for the restructuring of teacher education are cyclical, reaching peaks every ten or fifteen years. At no point, however, has there been agreement on a "best" method of educating teachers. In fact a number of researchers (Amarel, 1989; Edmundson, 1990; Zimpher & Howey, 1990) suggest that teacher education programs, in general, are "fragmented, atheoretical and intellectually flimsy" (Amarel, p.31). Sarason and his colleagues (Sarason, Davidson & Blatt, 1986) recently reissued, largely unchanged after 24 years, a book titled *The Preparation of Teachers: An unstudied problem in education*. Obviously they feel that little progress has been made during that time in studying
teacher education.

Even those who discuss different theoretical viewpoints in teacher education, while they may have their own preferred model, identify a number of strong contenders in the race for "best". Diamond (1991) identified four major movements in teacher education: competency based teacher education, personalistic teacher education, language and learning teacher education and perspective transformation teacher education. This last movement may be seen to include developmental teacher education since development by definition involves changes in perspective as one develops more advanced levels or stages of understanding.

Schools of education, themselves, have difficulty deciding on one focus. Michigan State University has five distinct teacher education programs, each with a different focus (Zimpher & Howey, 1990). These programs are: Standard Program, Academic Learning Program, Learning Communities Program, Heterogeneous Classrooms Program, and Multiple Perspectives Program. Why does teacher education seem to be so much more problematic and controversial than education for other
professions?

**Teaching: A unique profession**

Teaching is different from other professions in several important ways (Lortie, 1975). Virtually everyone who enters a teacher education program has had years of experience in the setting in which the profession is carried out. In addition, there have been extensive opportunities to observe skilled and unskilled practitioners in action in a variety of contexts. One might almost expect that, given the appropriate content, theoretical, and methodological knowledge, successful practical experience in the actual act of teaching would simply be a matter of applying what one had observed. This does not appear to be the case. Perhaps the problem is one of not noticing the important aspects of what is taking place (Bransford, Franks, Vye & Sherwood, 1989), or perhaps what is most important is not observable. For whatever reason, research suggests that student teachers find teaching to be a much more complex and problematic enterprise than they had previously supposed (Doyle, 1977; Ryan et al., 1980), and that their attempts to
deal with this complexity result, most commonly, in a change to more authoritarian approaches to the act of teaching (Hoy, 1967).

Obviously, teaching is not as simple as it looks. Clark and Lampert (1986) describe the dilemma in the following way:

How do teachers do so many things at once and make it look effortless and coherent? Teaching looks that way to observers.... Teaching even seems that way to the teacher, after an episode of teaching is finished.... Thus the teacher is in the difficult position of doing a cognitively and conceptually complex job, while hiding the complexity and uncertainty - making it look easy to teach. (p. 28)

**Becoming a Teacher: Solving a complex problem**

How then, can one begin to develop expertise in a domain where expert performance conceals, rather than reveals many of the essential components of competence and where the ability to solve multiple interactive, ill-structured problems is crucial? This is, indeed, a 'wicked' problem (Churchman, 1971). Wicked problems
are defined as ill-structured "problems for which there are conflicting assumptions, evidence, and opinion which may lead to different solutions" (Kitchener, 1983 p. 223). One has only to read any journal issue devoted to discussion of a particular problem in education, sit in on several university classes devoted to the same aspect of education, or listen to teachers discussing curriculum issues, in order to appreciate that virtually all educational issues are based on "conflicting assumptions, evidence and opinion" and that they inevitably lead to many different solutions.

Becoming a teacher is one such problem. In this case, student teachers use their varied understandings of the teacher and student teacher roles as a tool in arriving at their individual solutions to the problem of becoming a teacher (Johnston, 1992). This is not only an ill-structured problem but also one that is solved recursively as beginning teachers try to determine what teaching really is. Evidence of teachers' recursive attempts to understand the essence of teaching comes from a number of sources.

Ryan and his colleagues (Ryan et al, 1980) document a progression in the pedagogical conceptions
of first year teachers from "teaching as planning and presenting" to "teaching as control". Hollingsworth (1992b) reports a change in concern, in a discussion group of first year teachers, from classroom relationships, to diversity in values, to power and professional voice. From the Developmental Teacher Education Program at Berkeley comes a model of development in pedagogical understanding which suggests that individuals begin by understanding teaching as "showing and telling", progress through understanding teaching as "modeling and reinforcing", "providing hands on experience"; "guiding thinking within domains" to "guiding thinking across domains" (Ammon & Levin, 1991; Ammon & Hutcheson, 1989). In all of these progressions, the change in the nature of pedagogical conception is from the egocentrism of "what I do" to a more interactionist perspective. In none of these sequences are the initial concerns abandoned. Rather, it seems that as they are, in some sense, mastered, they are subsumed into the next level. The stage-like nature of these progressions strongly suggests that a developmental model may be appropriate to capture the change in teachers' ideas about teaching. An equally
appropriate approach may be to consider these developments from the perspective of research in expertise.

The Development of Expertise: Why look at beginnings?
Chi and Glaser (1988) in their recent book on expertise indicate that complex, ill-structured problems (such as the development of expertise in teaching) require further investigation. They state that there is a need for studies which examine "the mechanisms of problem space definition .... and redefining the space of ill-structured and difficult problems." (p. xxi) They also suggest that we "need to understand how expertise is acquired, how it can be taught, and how beginning learners can be presented with appropriate experience". The acquisition of expertise is a process of recursive problem solving in which the problem is to become more and more skillful in a role. This process involves definition and redefinition of basic terms (e.g. teaching and learning), the role of the expert (the goal state) and the role of the becoming-expert (the strategy for achieving that state).

In asking whether or not expertise can be taught,
Chi and Glaser may be asking the wrong question. It is quite clear that expertise cannot be transmitted from expert to novice (Bransford et al., 1989; Posner, 1988); the question ignores the importance of interacting with and solving real problems in the domain of interest. There seem to be no studies of people who have rich domain specific knowledge but are not good at solving problems in their domain. Even if one has extensive domain specific knowledge, one cannot be an expert without "appropriate experience" (Ericsson & Smith, 1991). It is important, therefore to look at the development of expertise in the problem-rich context of real-life experience.

In order to become an expert, one has to develop the ability to produce high quality solutions to problems within the domain. There is evidence from several sources that the ability to represent problems in productive ways is one crucial component in producing high quality problem solutions (Getzels, 1979; Getzels & Csikszentmihalyi, 1976; Schon, 1987).

Getzels & Csikszentmihalyi's longitudinal study of artists (Getzels, 1979; Getzels & Csikszentmihalyi, 1976) found that quality of problem finding (or problem
representation) as a novice is related to the quality of artistic production, both as a novice and as an experienced artist. This suggests that, right from the beginning, the quality of problem representation affects the quality of the solution.

Schon (1987) notes a similar phenomenon and suggests that the ability to reflect and rerepresent problems is an indicator and predictor of expertise. While he does not use the vocabulary of problem solving, it is clear that what he is describing is a process of recursive problem solving that focuses on the evaluation and problem (re)representation phases of the process.

Student teachers’ prepracticum definitions of their role can provide information about their representation of the problem of becoming a teacher. The level of pedagogical conception expressed, as well as the amount and kind of information about the teacher role that is included, can give an indication of the quality of that problem representation.

In most complex domains, the novice starts with a vague idea of the role to be acquired, then elaborates and refines this idea through experience until it is an
accurate representation of the actual role. While the initial role representations of novices in these domains may be vague and naive, there is a realization that this is so. In teaching, on the other hand, the vast majority of novices believe that they know the teacher role (from their years of experience as students).

Schoenfeld (1983) suggests that beliefs, as well as knowledge, play a powerful role in determining the quality of problem representation and solution. Beliefs are defined as individual understandings about some aspect of the world which affect the way one thinks and acts. These beliefs may be either explicit or implicit; conscious or unconscious. Looking at student teachers' own definitions of teaching and learning can provide information on their beliefs about the essential nature of the teaching/learning transaction. These understandings may affect the way in which they represent and attempt to solve the problem of becoming a teacher.
Summary

There is, at present, a strong movement toward the fundamental restructuring of education in ways that have profound implications for the role of the teacher. At the same time there is a demand for the restructuring of teacher education in order to better prepare teachers for complex problem solving in a changing environment. There is no agreement on one 'best' structure for teacher education, and in fact, many teacher education programs are fragmented and atheoretical (Amarel, 1989). Teachers, however, are in agreement that the practicum is the most (and in some cases, the only) valuable part of teacher education. It is important, therefore, to take another look at the practicum in order to better understand its perceived importance and ways in which education students may be better prepared to take advantage of this pivotal experience.

The practicum offers an important opportunity to solve real problems in the domain of teaching. In this process, problem representation is a crucial step that determines the quality of the problem solution. In order to represent the problem of learning to teach,
student teachers need to have an understanding of what learning is, what teaching is, and what strategies one might best use to accomplish learning and teaching. In order to assess the quality of student teachers' problem representation, a developmental model which delineates qualitatively different understandings, seems appropriate.

There are a number of ways one might evaluate the quality of the problem solution. The most immediate might be a measure of success on the practicum, such as supervisor ratings.

This study will seek to answer three interconnected general questions about student teachers' problem representation. These general questions are as follows:

1. How do students represent the problem of learning to teach?
2. Does this representation enable them to choose appropriate strategies for solving the problem?
3. Do more advanced or complex understandings of the problem lead to higher quality problem solutions as indicated by greater success on the practicum?
In order to investigate student teachers' problem representation, this study will look at their own definitions of teaching, learning and the student teacher role as well as their descriptions of the best ways to accomplish these goals. The following specific research questions will be used to shape the investigation:

**Research Questions**

1a. At what level of pedagogical conception (Ammon & Levin, 1991) do prepracticum education students define teaching and learning?

1b. Are the strategies (ways to learn, teaching methods) that prepracticum students choose consistent with their views of teaching and learning?

2a. At what level do prepracticum education students define their role as a student teacher?

2b. Are the specific student teacher role functions that prepracticum students list consistent with their overall view of their role as a student teacher?
3a. Is level of pedagogical conception consistent across definitions of teaching, learning and the student teacher role?

3b. Are level of pedagogical conception of teaching, learning, and the student teacher role, and/or adequacy of role definition related to success in the practicum as measured by supervisor ratings?

4. To what extent can the student teachers' problem representations be characterized as productive (Getzels, 1979)?
Definition of Terms

Problem: a question raised or to be raised for inquiry, consideration, discussion, decision or solution (Webster, as quoted in Getzels, 1979). A problem arises when a living creature has a goal but does not know how the goal is to be reached (Arlin, 1989).

Problem representation: A reframing of a presented problem or framing of a discovered problem, that yields the question to be answered. This representation includes the initial states of the problem and constraints, and suggests, although it does not absolutely determine, the goals and strategy choice.

Well-structured problem: a problem that has all parameters completely specified, and where there is consensus among the problem solving community on the optimal strategy and the correctness of the solution. Many problems in mathematics and physics are considered well-structured problems.

Ill-structured problem: a problem that has some parameters unspecified, where more than one goal and/or strategy are possible and where there may
not be consensus among the problem solving community on the optimal or correct goal and strategy selection. Problems in the social sciences and in everyday life are often ill-structured problems.

Practicum: practical experience in the actual act of teaching; specifically, a fulltime student teaching experience in a school, supervised by a cooperating teacher in the school, and a University practicum supervisor.
CHAPTER II
REVIEW OF THE LITERATURE

Introduction

It is clear that expertise in a domain is not something that appears overnight, given sufficient domain specific knowledge, but rather, it occurs over time and involves appropriate experience in problem framing and problem solving. Expertise in complex, ill-structured domains such as teaching is more difficult to define and assess than expertise in other, less complex, well-structured domains. Attempts to define expertise in teaching in terms of discrete behaviors have proven largely unsuccessful (Darling-Hammond & Sclan, 1992; Dreyfuss, Cistone & Divita, 1992). Feedback from teachers and the contextualized nature of teaching suggest that the practicum, which offers opportunities to solve real problems in the domain, may provide important initial experiences that may lead to the development of expertise.

Experts differ from novices in the way they represent problems. The development of expertise involves a process of problem solving over an extended period of time. In this process, problem
representation and recursion play crucial roles. There is also some evidence (Sprinthall & Thies-Sprinthall, 1983) that developmental level plays a role in success, suggesting that there may be qualitative differences in the ways problems are represented. This review of the literature will provide an examination of the reasons for considering the practicum as an instance of complex problem solving. The suggestion is made that by understanding the differences in the ways that education students represent the problem of teaching, it may be possible to gain a better understanding of how they begin to develop expertise in this complex activity.

The Nature of Expertise in Teaching

Attempts have been made in the teacher effectiveness literature to define expertise in teaching in terms of measurable student outcomes such as time on task or achievement on standardized tests. While a number of teacher behaviors that are strongly correlated with student achievement are identified, little is accomplished beyond the specification of a generic competent teacher (Goodlad, 1990; Howey, 1983).
Teachers however do not teach in generic but rather in specific contexts (Ammon & Levin, 1991; Hollingsworth, 1992; Lampert, 1985). They deal with specific, contextualized problems which occur in complex, real-time situations ... "How do I plan this lesson for this particular class?" "How do I help this student who has difficulty while providing challenge for that one who already knows so much?" "How do I balance conflicting needs and wants?" "How do I encourage kids to have fun but not waste time?"

Not only are these problems complex, ill-structured and ill-defined, but they are multiple and interactive. Seldom is a teacher given the luxury of working on only one problem at a time, and as Lampert (1985) points out, most of the time what is arrived at is not really a solution, but rather a temporary rebalancing of demands.

The Importance of the Practicum

For decades it was generally assumed that several weeks of supervised practise in classrooms would be sufficient to produce teachers who were more than
adequately prepared to teach children, and that the process of learning to become a teacher was essentially complete upon certification. (Howey, 1983; Haberman, 1983). Teaching was seen to be a straightforward task of transmitting knowledge while maintaining an orderly classroom.

More recently, this view of teaching and the teacher has given way to one which recognizes the complexity of the teaching/learning transaction (Edmundson, 1990; Goodlad, 1990) and which concedes that teacher education provides only a beginning to the development of competence and expertise, in an extremely complex and ill-structured domain. If teacher education is only the beginning of an ongoing process, then it should provide essential tools which the teacher will use to construct competence in teaching. In this case, it is important that these tools be designed as well as possible for this purpose.

Perhaps the most problematic tool which teacher education offers the student teacher is the one which should be most useful; the opportunity for extended, observed, and reflective practice in the actual act of
teaching. The practicum provides an opportunity for the student teacher to receive feedback from adults experienced in the profession as well as from the students, and to reflect on this feedback.

Research on practicum effects on beginning teachers has produced conflicting results, but teachers and education students are consistently positive about its value in learning to teach (Feiman-Nemser & Buchmann, 1986; Zeichner, 1980). These contradictory results suggest that a different look at the practicum is needed. Since the practicum provides experience in solving problems in the context of a real classroom, and since its intent is to provide the first steps in the development of competence and eventual expertise in teaching, it would seem appropriate to examine the situation as an instance of problem solving, where the problem is the development of expertise.

The Development of Expertise as Problem Solving
From the very beginning, the study of expertise has been closely tied to the study of human problem solving (Newell & Simon, 1972). The study of expertise has been primarily a study of the differences between the
ways in which novices and experts solve (presented) problems in specific domains. Initially the problem domains studied were well structured ones such as physics (Chi, Feltovich & Glaser, 1981) and chess (Chase & Simon, 1973), but more recent work has extended the investigation to ill-structured domains such as medicine (Elstein, Shulman & Sprafka, 1978; Johnson et al., 1981), law (Lawrence, 1988), and education (Berliner, 1988; Carter, Cushing, Sabers, Stein & Berliner, 1988; Carter, Sabers, Cushing, Pinnegar & Berliner, 1987). Well- and ill-structured domains differ in a number of ways, the most obvious of which is the nature and variety of the problems to be solved.

**Problem Structure and Problem Representation**

In well-structured domains, most problems except those at the most advanced levels and those in new areas of research (Voss & Post, 1988) have all parameters specified, and there is general agreement within the problem solving community as to the goal state and the best strategy for achieving it. In ill-structured domains such as education, there is a greater variation
in the degree of structuredness of the problems encountered. The well structured problems lend themselves to only one problem representation, but the ill-structured problems may be represented in a number of ways, leading to different solutions. This creates the additional task for the solver of assessing the degree of structure as a preliminary to forming a representation of the problem.

Well- and ill-structured problems do not form a dichotomy, but rather a continuum, and in fact the same problem may be well-structured for some solvers and ill-structured for others (Arlin, 1989; Wood, 1983). This difference in perceived structure may be due to level of expertise.

What presents as an ill-structured problem for a novice may be so routine and well structured for an expert that it doesn't really constitute a problem at all. On the other hand, a problem that a novice sees as being well-structured may be seen by an expert as being very ill-structured because of the richer knowledge and experiential base that the expert brings to the problem. For example, a novice in international affairs may think that the solution to famine in
Ethiopia is to send enough food to feed the people. An expert, on the other hand might realize that distribution problems, dietary differences, political unrest, overgrazing of traditional farming areas, and a number of other factors require more complex interventions which may or may not solve the problem. These differences in perception of the structuredness of the problem may result in differences in the way it is represented and solved.

In order to understand how problems are solved it is important to understand the steps in the problem solving process, and in particular the pivotal role played by problem representation in determining the goal state and strategy to be used. The evidence for problem representation as a critical step which leads to a particular problem solution, comes from a number of sources. Chi, Feltovich and Glaser (1981) outlined differences, between novices and experts in physics, in the way they represented problems. Getzels (1979) suggested characteristics of productive as opposed to unproductive problem representations. Sinnott (1989), working with subjects of differing ages on ill-structured problems, noted ways in which different
problem representations produced different outcomes. Schoenfeld (1983) found that beliefs as well as knowledge affected problem representation and solution. Getzels (1979) declared problem representation to be both a predictor and an indicator of expertise. In the next section, these findings are discussed in more detail.

The Importance of Problem Representation

Newell and Simon (1972) identified four steps in problem solving. These steps may be summarized as problem representation, strategy choice, enactment and reflection. There is general agreement that, at all levels of expertise, the problem representation chosen affects the choice of strategy and the degree to which the solution is successful. (Getzels, 1979; Sinnott, 1989). Chi, Feltovich and Glaser (1981) found that expert physicists represented problems at a more principled level than did novices. They were able to detect the essential features of the problem and represent it in a way that facilitated strategy selection and implementation.

Getzels (1979) suggests five specific
characteristics that distinguish productive problem representations:

1. There is a body of knowledge (concepts, data, techniques) within which the problem may be placed
2. The problem must be well-conceived in the sense that its background and presuppositions... are neither false nor undecided
3. The problem must be circumscribed; the question "what is Being?" is not likely to be a fruitful formulation
4. Conditions necessary to solving the problem must be available; that is the ability and opportunity to obtain the needed observations and perform the pertinent analyses are assured
5. Consideration should be given before settling on the problem to the possible kinds and forms of solutions that might be forthcoming. (p. )

Sinnott (1989), in a model for solution of ill-structured problems, noted that "respondent decisions about the nature of the problem were likely to be a systematic source of variation in the strategies employed" (p. 74). Choice of problem space and degree
of structure affected the number of problems that subjects were able to solve.

Schoenfeld (1983) found that not only knowledge, but also beliefs, affected the way in which people represented problems. Subjects who had adequate mathematical knowledge to solve a problem, failed to do so because of beliefs that solutions come from the dominant perceptual features of drawings and that mathematical proof is irrelevant to the answering of a mathematical problem. In another experiment, subjects persisted in what Schoenfeld called "pathological" (p. 348) attempts to solve the problem because they had represented the problem as a mathematical one requiring the use of geometry rather than as an estimation problem.

In this study, students' own definitions of teaching, learning and the role of the student teacher are seen as their problem representation, and their descriptions of the best ways to learn, best ways to teach and specific student teacher role functions are seen to be their choice of strategies for solving these very ill-defined problems.

Getzels (1979) stated that "the way the problem is
posed is the way the dilemma will be resolved" and further suggested that the quality of the problem formulation determines the quality of the solution. His work with Csikszentmihalyi (1976) on problem finding in artists revealed a significant correlation between the quality of problem finding and the quality of the drawing produced. The quality of problem finding was determined by the choice and arrangement of objects for a still life. The quality of drawing produced was evaluated by artist-critics who rank ordered the drawings on quality. This structure closely parallels that of the present study. In this case, quality of problem representation is evaluated based on developmental level and elaboration of student definitions of teaching, learning and the student teacher role. Quality of outcome is measured by supervisor ratings of success on the practicum.

Examinations of problem posing and problem solution by educational administrators (Getzels, 1979) confirmed the relationship between the quality of problem posing and the quality of problem solution. The oft-quoted statement by Albert Einstein "The formulation of a problem is often more essential than its solution"
Novice-Expert Differences

Experts are defined by their ability to solve problems in their field of expertise. They differ from novices in the way in which they pose the problems. They represent problems at a more principled level, using deep, rather than surface structure. They spend more time analysing the problem qualitatively, using their domain specific knowledge to decide what constraints should be added and how best to represent the problem. In addition, their superior self-monitoring skills enable them to estimate more accurately the difficulty of a problem, and make decisions about when to switch strategies or re-represent the problem (Chi & Glaser, 1988).

There is evidence from a number of sources that the process of representing or "transforming the input" (Newell & Simon, 1972) of presented problems plays an important role. The time that experts spend in understanding the problem can be seen as time spent in transformation. Sinnott (1989) identifies one of the
first steps in solving everyday problems as "deciding the real purpose". Schoenfeld (1983) discusses the outcome when university students transform an estimation problem into one in geometry. This transformation results in an initial representation which constrains strategy selection and partially determines the quality of the solution. These findings offer further evidence that the problem that the researcher presents is not necessarily the problem that is discovered and represented by the subject.

Another important aspect of problem solving is the role of recursion. Experts may attempt several problem representations and partial solutions before completing any solution, and continue to re-solve the same problem a number of times (Anzai & Simon, 1979). The fact that experts continue to improve over long periods of time may be due in part to this recursion and the improvement in problem representation over a number of trials.

**Student teaching: A problem solving perspective**

A central dilemma in teacher education is how to enable individuals to develop expertise (or at least
adequate performance) in the actual act of teaching. The courses in content, methodology, and theory that an education student takes are an attempt to provide the domain specific knowledge necessary to enable the student to solve problems, but only experience in the actual act of teaching provides the context, the constraints, the problem(s) and information on the success or failure of a particular solution attempt.

Student teaching provides an extended opportunity to begin to solve the problem of becoming a teacher, and provides feedback on the quality of the solution attempted from four sources; students, cooperating teachers, university supervisor, and self. The empirical literature related to student teaching is contradictory. A number of researchers (Dow, 1979; Sarason, Davidson & Blatt, 1986) suggest that practical experience in schools should be the focal point of teacher education programs, but other researchers (Lampert & Clark, 1990) suggest that "as teacher educators... we have rejected the idea of turning students over to practising classroom teachers for initiation to the status quo" (p. 22). Hoy and Woolfolk
(1990) report that student teachers’ sense of "personal teaching efficacy improved as their sense of general teaching efficacy declined" (p. 279). In a review of the literature, Zeichner (1985) found that "researchers who have analysed the empirical literature related to field experiences in teacher education have consistently characterized the knowledge base related to the socializing impact of these experiences as weak, ambiguous and contradictory" (p. 44). In contrast to these varied viewpoints, teachers at all levels of experience consistently report that the student teaching experience was the most valuable part of their teacher education (Feiman-Nemser & Buchmann, 1985; Lortie, 1975; Wideen & Holborn, 1990),

Why do student teachers see the practical experience they receive as the most valuable part of their training? One might expect this result if, in their student teaching, they worked only with the most expert teachers. This, however, is not the case. There is little screening of cooperating teachers (Feiman-Nemser & Buchmann, 1987). What kind of experience the student teacher has, the type of
classroom he or she encounters, the models of teaching and feedback provided, the clarity of goals, the degree of responsibility, are all a matter of "the luck of the draw". Yet practising teachers, from those in their first year of teaching (Ryan et al. 1979), to those with years of experience (Feiman-Nemser & Buchmann, 1985) all identify practical experience in the actual act of teaching as the most valuable part of their teacher education program.

For an experience to be perceived as valuable it must meet felt needs. For education students, practical experience offers them evidence that they actually can teach "real kids in a real classroom." In this sort of statement the students are recognizing the situated nature of teaching (Brown, Duguid and Collins, 1989). They recognize that 'real' teaching does not exist outside of its context in the classroom. Lectures, laboratory experiences and microteaching are no substitute for the "contextual, interactive and speculative" (Clark & Lampert, 1986) act of real teaching.
Student teaching: A constructivist perspective

The fact that student teaching experience is perceived as valuable, even when the cooperating teacher is less than expert, suggests that it is the experience, itself, and not the primarily the supervision or coaching that is perceived as valuable. This view of the student teaching experience is one which is compatible with a constructivist orientation, in which the individual constructs his/her own meaning, learning and knowledge. It is not compatible with a transmissive orientation which places greater emphasis on the role of the "other" as authority. A transmissive view sees education as a process, in which the teacher has the knowledge, and through various teaching techniques, imparts it to largely passive students who absorb it.

It is interesting and somewhat surprising that education students have a constructivist perspective on the practicum, given their other sources of information on the nature of teaching. Most of them, in their experiences as students in primary and secondary schools, will have been exposed to "the learner as sponge" model of education. The lecture system at most
universities is an even purer example of this model. Even in schools of education there is seldom a consistently constructivist perspective on the teaching/learning process (Damon, 1989). It seems, that in spite of experiences in which the teacher is a transmitter of knowledge and the student a recipient, education students value the practicum for the opportunity to actively construct knowledge rather than passively absorb it.

If students from a wide variety of teacher education programs approach the student teaching experience from a constructivist point of view, it is important to frame student teaching in this context. In this way we may come to understand the ways in which student teachers actually learn, rather than the ways teacher educators might think they learn.
Levels of Pedagogical Understanding: A constructivist model

The Developmental Teacher Education Program (DTE) at Berkeley is founded on three basic principles of constructivism which are relevant in this context:

1) Understandings are constructed gradually ... evolving through gradations or stages
2) Understandings are constructed through one’s own activity
3) Understandings are constructed within various domains.... Consequently there must be stages of understanding that are domain specific (Ammon & Levin, 1991 p. 3)

Although they talk in terms of constructivist developmental theory, Ammon & Levin make it clear that they are not talking about a hard stage theory of teacher development but that their use of the term "is consistent with such everyday remarks as 'I understand that better now,' and 'You and I seem to have different understandings about this' "(p. 3).

The first two principles that they describe are implicit in the structure of the practicum, where the
focus is on developing an understanding of what it is to teach through one's own efforts in an actual classroom over a period of some weeks or months. Ammon, Levin and Hutcheson have suggested "levels of pedagogical understanding" (Ammon & Hutcheson, 1989; Ammon & Levin, 1991) which meet the requirement of the third principle. These levels and their concomitant views of teaching and learning are:

Table 1: Levels of Pedagogical Conception

<table>
<thead>
<tr>
<th>Qualitative level</th>
<th>Learning comes from:</th>
<th>Teaching is essentially:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Naive Empiricism</td>
<td>Experiencing</td>
<td>Showing and telling</td>
</tr>
<tr>
<td>2. Everyday Behaviorism</td>
<td>Doing (i.e., practising)</td>
<td>Modeling and reinforcing</td>
</tr>
<tr>
<td>3. Global Constructivism</td>
<td>Exploring</td>
<td>Providing hands-on experience</td>
</tr>
<tr>
<td>4. Differentiated Constructivism</td>
<td>Sense making</td>
<td>Guided thinking within domains</td>
</tr>
<tr>
<td>5. Integrated Constructivism</td>
<td>Problem solving</td>
<td>Guided thinking across domains</td>
</tr>
</tbody>
</table>

(Amon & Levin, 1991)

An important principle not specifically mentioned
by Ammon & Levin, is reflection on activity; an essential part of constructing understanding (Principle 2), since activity without thought contributes little of importance. Schon, in his book, *Educating the Reflective Practitioner* (1987) explains at length the important role played by guided reflection in the development of expertise in ill-structured domains. The practicum experience ought to offer many opportunities for such action and reflection on action.

Ammon & Levin’s model offers a useful developmental perspective on teacher education. It is important to note however, that the program which gave rise to the model is small (15 students admitted per year) and the data used to develop and test the model came from clinical interviews and journals of a small number of students (Ammon & Hutcheson, 1989). They have some evidence that the model applies in programs that are similar in basic philosophy (Kroll, 1991) and have suggested that it needs further confirmation in other settings. They mention that "it is not easy to find the development of constructivist understandings independent of support for them through instruction" (Ammon & Levin, 1991 p.8).
The participants in the present study were enrolled in a program in the process of change. In anticipation of change in curricula and focus mandated by the provincial government (British Columbia Department of Education, 1990), an attempt was made in the teacher education program at the university in question to move toward a more explicitly and consistently constructivist approach. At this point, however, the program was being evaluated, to determine what changes would be most desirable and the teaching in education courses did not reflect a consistently constructivist approach.

The application of Ammon and Levin's model of development to students in a program without a strong developmental focus, may serve three purposes. It may suggest the extent to which students develop constructivist understandings without a consistently constructivist education, it may suggest directions for change and it may shed further light on the wider applicability of their model.

Summary
Looking at the student teaching experience from both a problem solving and a developmental perspective may provide a richer, more accurate understanding than either approach taken alone. By focusing on the problem representation constructed by education students using their own definitions of teaching and learning, before they begin their student teaching experience, one may see the problem that student teachers intend to solve as opposed to the one that the Faculty of Education thinks that student teachers are going to solve. By examining their descriptions of best ways to learn and teach and their descriptions of specific student teacher roles one may see which strategies the student intends to use in solving the problem, and the relationship between the problem representation and strategy choice. By assessing the aspects of this problem representation that relate to success on the practicum it may be possible to see ways in which teacher education programs could assist education students in constructing more adequate understandings of what it really means to teach.
CHAPTER III
METHODOLOGY

Design
The study is descriptive in nature. It involves a combination of qualitative and quantitative methodologies. Participants replied in writing to written, open-ended questions. These questions asked them to define learning, teaching and the role of the student teacher. They were also asked to describe the best ways intermediate students learn, the best ways to teach and differences between the student teacher and teacher roles (see Instrumentation section for the exact questions). The written protocols were analysed, using principles outlined by Ericsson and Simon (1981). The study is qualitative, in that the first two general purposes of the study arise from the data, rather than being imposed upon it. It is quantitative, in that Ammon & Levin's categories are then used to structure the investigation and in that descriptive statistics are used to make patterns in the data more easily understood. Correlational methods are used to obtain the answer to the third research question (Are level of pedagogical conception and/or
adequacy of role definition related to success in the practicum as measured by supervisor ratings?).

Participants

The participants were 55 education students, majoring in elementary education, enrolled in a twelve month post-graduate teacher education program at a large university in western Canada. At the time of the study, the participants had finished most or all of their methods courses and most of their other coursework. They had previously completed two practicum experiences. The first involved half days spent observing in schools. The second practicum was a full time experience lasting two weeks. The responsibilities during that practicum were supposed to be limited to small group and individual instruction, and to teacher and pupil observation. The participants were about to begin an extended 13-week final practicum, working in intermediate level (Grades 4 - 7) classrooms. During this time they would be expected to gradually assume responsibility for the majority of classroom planning and teaching.
Method

The present study is a part of a larger study examining the development of wisdom and expertise in teaching. Information for this study was gathered by questionnaire, at the same time that students were participating in a Faculty of Education review of the teacher education program. Students completed the questionnaire in one sitting, prior to the commencement of their final practicum.

Each of the 13 University supervisors evaluated the 6 to 13 students for which he/she was responsible. The supervisor completed two combined observation and rating forms on each student. The first was completed after the seventh week and the second after the twelfth week of the practicum. The end of practicum evaluations rank ordered the students, based on their performance during the first 12 weeks of the practicum. The supervisors were also asked to compare this group of advisees with other groups of student teachers supervised in the past. The 5-point scale used for this comparison ranged from "much better" to "much lower".
Since the supervisors ranged from no previous experience as a practicum supervisor to over 100 students supervised, this comparison was not used to weight the supervisor rankings.

**Instrumentation**

**Student Questionnaire**

The questionnaire, completed by the participants (student teachers) before the start of the practicum, had questions on the following topics: 1) definitions of teaching and learning 2) student teacher and teacher roles 3) individual differences in pupils 4) classroom management 5) pacing 6) curriculum and 7) planning. Each page had either one or two questions about a topic, with the rest of the page being blank space for free response. Elaboration was encouraged by instructions at the bottom of each page which said "Check here if you continue on the other side, to make sure we read it."

The specific questions from the questionnaire, considered are as follows:

1) What is your definition of learning? What is your view of the best way intermediate students learn?
2) What is your definition of teaching? What is your view of teaching and the best way to teach?
3) What is your view of yourself as a student teacher? Do you see it differently from your view of yourself as a full-time professional teacher?

**Supervisor Evaluations**

The university supervisors completed observation and rating forms on each student at the end of the seventh and twelfth weeks of the practicum. The topics covered included openness to advice, similarity or difference of views between student and school advisor, taking the child's point of view, meeting individual needs, pacing, planning and classroom management. In addition, at the end of the seventh and twelfth weeks each supervisor rank-ordered the students that he/she was supervising. Ratings on the basis of performance during the first 12 weeks of the practicum are used in this study as a measure of success on the practicum. Ratings were computed by dividing the number of students in the supervisors's group by the individual student's ranking within the group.
Coding Scheme

The first two questions from the survey were coded in two sections each; the first section being the "definition" part of the question and the second being the "best ways" part of the question. Question 3 was coded in two different ways. First, it was coded as a whole for overall developmental level of the student teacher role, then it was coded for different role functions identified. The information on degree of similarity or difference between the teacher and student teacher roles was not used in this study, because it added little or no information about the student’s representation of the problem of learning to teach.

The following section gives each question from the survey, followed by the descriptions of each level used in the coding.

Question 1

What is your definition of learning? What is your view of the best way that intermediate students learn?

Part a - What is your definition of learning?
The first section, "What is your definition of learning?" was coded as a gestalt. In other words the entire definition was read and considered, to the point where the respondent indicated that he/she was beginning to list best ways to learn, e.g. "The best ways students learn are...." Pedagogical level was assigned to the definition, based on a global impression of the answer. Descriptions of the levels, taken from Ammon & Hutcheson (1989) and Ammon & Levin, (1991) and used in coding are given below:

Level 1 (Naive Empiricism): acquisition of knowledge/concepts (no reference to understanding or application)

Level 2 (Everyday Behaviorism): acquisition of skills; acquisition and application of knowledge, skills, procedures.

Level 3 (Global Constructivism): gaining understanding, concepts; learner is active; no mention of individual differences.

Level 4 (Differentiated Constructivism): gaining understanding; explicit reference to an understanding or individual differences or that understanding may differ across individuals
Level 5 (Integrated Constructivism): learning to understand thinking; reference to interaction of content and structure, metacognition

Part b - "What is your view of the best ways that intermediate pupils learn?"

The responses to the second section, "What is your view of the best ways that intermediate pupils learn?" were categorized according to the Ammon & Levin level that they seemed to best represent and coded for type of activity mentioned. Those responses that were not obviously related to any one level (e.g. have the student actively involved) were coded as level 0. Up to five responses were coded for each participant. The comments that were coded and the levels to which they were assigned are listed below:

Level 0 (no level assigned) - Students learn best through:
- active involvement in learning; make students responsible for their own learning
- integration across subject areas
- taking risks
- real experiences/meaningful experiences
- supportive environment/ democratic environment
- having a positive attitude

Level 1 (Naive Empiricism) - Students learn best through:
- teacher explanation
- being given a variety of activities/ interesting activities/ multisensory activities
- different teaching methods
- step by step instruction

Level 2 (Everyday Behaviorism) - Students learn best through:
- competitive games
- practical application of knowledge/theory
- repetition; practice
- skills focus
- reinforcement; learning from mistakes

Level 3 (Global Constructivism) - Students learn best through:
- hands-on experience
- pursuing own interests/exploring/discovering
- discussion (not specified with whom)
- interaction with teacher; teacher guidance
- interaction with other students; cooperative groups; cooperative learning
- student interaction with information

Level 4 (Differentiated Constructivism) - Students learn best through:
- a sense of wonder, curiosity
- questioning (by students) of content
- student developing own framework
- all learners are different

Level 5 (Integrated Constructivism) - Students learn best through:
- thinking about thinking; metacognition

**Question 2**
What is your definition of teaching? What is your view of teaching, and the best way to teach?

**Part a - What is your definition of teaching?**
The first section of question 2, "What is your definition of teaching?" was coded as a whole according
to the levels of pedagogical understanding described by Ammon, Hutcheson and Levin. The entire definition was read and considered up to the point where the respondent begins to list best ways to teach, and a level was assigned based on the whole definition. Descriptions of the levels, taken from Ammon & Hutcheson (1989) and Ammon & Levin, (1991) and used in coding are given below:

Level 1 (Naive Empiricism): providing knowledge, information, sharing knowledge, show & tell; Facilitating (no mention of providing or structuring experiences as opposed to information)

Level 2 (Everyday Behaviorism): helping pupils develop skills, procedures; providing corrective feedback; providing practical experience

Level 3 (Global Constructivism): helping child to develop; structuring environment; providing learning experiences rather than information; facilitating with mention of child in active role

Level 4 (Differentiated Constructivism):
facilitating learning with consideration of individual differences; reference to interactive and/or complex nature of teaching, and to change affecting both teacher and pupil.

Level 5 (Integrated Constructivism): presenting the world in such a way that students become their own teachers; helping pupil to make connections

Part b - "What is your view of teaching, and the best way to teach?"

The responses to the second section, "What is your view of teaching and the best way to teach" were categorized according to the level that they seemed to best represent and for type of activity mentioned. Up to five responses were coded for each participant. Those responses that were not obviously related to any one level (e.g. have the student actively involved) were coded as level 0. Up to five responses were coded for each participant. The comments that were coded and the levels to which they were assigned are listed below:

Level 0 (no level assigned) - The best way to teach is:
- eclectic method; be flexible; different methods for different content; variety of methods; use direct and indirect methods
- make child active participant (unspecified method)
- encourage risk-taking; provide supportive atmosphere
- set goals and expectations; classroom management; make child responsible for own learning
- mutual respect; democratic classroom
- there is no best way

Level 1 (Naive Empiricism) - the best way to teach is:
- make it enjoyable/interesting/relevant
- be a facilitator (not specified or facilitator of knowledge); develop each child's potential
- know students to choose best methods (for whole class)

Level 2 (Everyday Behaviorism) - the best way to teach is:
- teach step by step; logical progression
- reinforce proper learning behavior; positive
reinforcement

Level 3 (Global Constructivism) - the best way to teach is:
- structure environment; provide resources
- encourage; guide; use questions to guide
- lead by example; teacher acts as role model; model desired attitudes, etc.
- use knowledge of child development
- discovery method; students find out; 1st hand experience
- cooperative groups; group activities
- hands-on; manipulatives; multisensory

Level 4 (Differentiated Constructivism) - The best way to teach is:
- match method to particular student
- take individual differences into account

Level 5 (Integrated Constructivism) - the best way to teach is:
- through interaction, provide scaffolding for student to help structure problems
Question 3.

What is your view of your role as a student teacher? Do you see it differently from your view of yourself as a full-time professional teacher?

Question 3a - What is your view of your role as a student teacher?

The role of self as student teacher was coded first as a gestalt, on the basis of overall level according to Ammon & Levin's levels of pedagogical conception. Since Ammon and Levin did not specifically describe levels in terms of perception of student teaching role, the author has created the descriptions, incorporating ideas of teaching, learning and behavior from Ammon & Hutcheson (1989) and Ammon & Levin, (1991). The level descriptors used in coding are listed below:

Level 1 (Naive Empiricism): absorbing information; carrying out and adapting to wishes of supervising teacher

Level 2 (Everyday Behaviorism): trying and assessing teaching methods; practising teaching skills; being assessed
Level 3 (Global Constructivism): "developing" as a teacher; using multiple sources of information including personal experience in the learning process; developing personal teaching style (not adopting a style)

Level 4 (Differentiated Constructivism): becoming a teacher as an ongoing process of which the practicum is only a part; acknowledges individual and situational differences i.e. suggests that there will be differences in student teaching experiences due differences in the individuals involved and teaching situations they are involved in

Level 5 (Integrated Constructivism): interactive process with conflicting demands on more than one level; mentions more than one contradiction inherent in student teaching situation, such as trying to operate in one's own way in another's classroom, conflict between experimenting and performing, and/or conflict between being a student and a teacher, etc.

The description of the student teacher role was
then coded for particular teacher role functions included. Role functions which were not specific to a particular level were coded as Level 0, the rest were assigned the Ammon and Levin level that they seemed to best represent. Up to five responses were coded for each participant.

Level 0 role functions:
- teacher
- manager; disciplinarian; coordinating administrative tasks and teaching

Level 1 role functions (Naive Empiricism):
- subordinate role; assistant; guest
- learner; apprentice

Level 2 role functions (Everyday Behaviorism):
- practising skills; trying techniques
- "scientist"; observing; experimenting
- being observed; being assessed; receiving feedback
- making mistakes

Level 3 role functions (Global Constructivism):
- growing; developing
- experiencing real teaching; taking on
responsibilities of a teacher

Level 4 role functions (Differentiated Constructivism):
- developing personal style; a personal learning or growth experience

Level 5 role functions (Integrated Constructivism):
- no level 5 role functions were identified since the nature of level 5 is to recognize multiple contradictions between roles e.g. "On the one hand I am a guest, while on the other hand I must treat the class as my own in order to take on the responsibilities of a teacher.

Data Analysis

Reliability of Coding

Coding reliability for all sections was initially established by having 20% of the protocols recoded by a second coder. On this initial coding check, acceptable intercoder reliability was achieved for both sections of questions 1 (a. 92%; b. 88%) and 2 (a.92%; b.89%), but not for the developmental level of the student teacher role (question 3). As a result, for question 3, the descriptor for each developmental level was changed. These new descriptors (pp. 54-57) were used to
recode the question, then 100% of the protocols were recoded for all questions, by a third coder. Agreement ranged from 87% (question 3) to 94% (question 1). All items where there were discrepancies were discussed and agreement was achieved. Those items were then recoded to reflect the consensus.

Analysis of Data

The description of data analysis is arranged by research question.

Question 1

1a. At what level of pedagogical conception (Ammon & Levin, 1991) do prepracticum education students define teaching and learning?

Response frequencies and percentages were calculated for level of pedagogical conception of learning definition and for level of pedagogical conception of teaching definition.

1b. Are the strategies (ways to learn, teaching methods) that prepracticum students choose consistent
with their views of teaching and learning?

For the strategies (best ways) sections of questions 1 and 2, frequencies were first calculated separately for each way mentioned (first way mentioned to fifth way mentioned). First way was crosstabulated with definition level for each question. Categories were then collapsed, into LOW (Naive Empiricist level), MEDIUM (Behaviorist level) and HIGH (Levels 3,4,5) using the a priori levels assigned to each comment and definition. Chi Square analysis was used to examine patterns of response.

Total frequency for best ways to learn and best ways to teach was then calculated across all responses and crosstabulated. The crosstabulations were examined for patterns in the data that might be lost in Chi Square analysis. Categories were then collapsed. For best ways to learn the categories were LOW (Naive Empiricist level), MEDIUM (Behaviorist level) and HIGH (Levels 3,4,5) using the a priori levels assigned to each comment and definition. The LOW level represents a purely transmissive view of learning, the MEDIUM
level represents a behaviorist stimulus/response view, and the HIGH level represents various forms of constructivist views. The decision to call them low medium and high rather than (e.g.) simply transmissive, behaviorist and constructivist was based on Ammon & Levin's model which sees these levels as being a developmental sequence. For best ways to teach, because of the extremely low number of Behaviorist level responses, and because Behaviorist level can be considered a transmissive view, the categories were LOW (levels 1 & 2), MEDIUM (level 3 - basic constructivism) and High (levels 4 & 5 - advanced constructivism). Chi-square analysis was used to examine patterns of response.

Individual protocols were reexamined for particularly revealing responses and to capture information that may have been lost in the coding and quantitative analysis of the data.

**Question 2**

2a. At what level do prepracticum education students define their role as a student teacher?

Response frequencies and percentages were
calculated for level of pedagogical conception of the student teacher role.

2b. Are the specific student teacher role functions that prepracticum students list consistent with their overall view of their role as a student teacher?

Specific role functions mentioned were crosstabulated with level of pedagogical conception of the student teacher role and the crosstabulation examined for patterns of response.

Individual protocols were reexamined for particularly revealing responses and to capture information that may have been lost in the coding and quantitative analysis of the data.

Crosstabulation and Chi-square analysis was used to determine whether there was a statistically significant relationship between mean Level of Pedagogical Conception across definitions of teaching, learning and the student teacher role, and descriptions of best ways to learn and best ways to teach.

Question 3

3a. Is level of pedagogical conception consistent across definitions of teaching, learning and the
student teacher role?

Percentage agreement between each pair of definitions and across all three definitions was calculated. Data were examined for patterns in level shift between definitions. Mean level of pedagogical conception was then calculated across all three definitions and rounded to obtain a mean pedagogical level score.

3b. Are level of pedagogical conception of teaching, learning, and the student teacher role, and/or adequacy of role definition related to success in the practicum as measured by supervisor ratings?

Overall pedagogical level across the three questions was calculated for each participant by summing the pedagogical level scores. All scores that had been set to 98 (could not judge) were reset to 0. An adequacy score was calculated by finding a mean comment level score across best ways to learn, best teaching methods, and student teacher role functions. An inconsistency score was calculated by summing the absolute differences between each pair of definition
level scores. A performance score was calculated for each participant by dividing the number of students in that supervisor's group by the supervisor ranking for that student. Kendall's Tau was used to determine correlations between this performance score and overall pedagogical level, adequacy score and inconsistency score.

**Question 4**

To what extent can the student teachers' problem representations be characterized as productive (Getzels, 1979)?

This question was answered through a qualitative analysis of student teacher problem representation as it relates to Getzels' (1979) characteristics of productive problem representations:

1. There is a body of knowledge (concepts, data, techniques) within which the problem may be placed
2. The problem must be well-conceived in the sense that its background and presuppositions... are neither false nor undecided
3. The problem must be circumscribed; the question "what is Being?" is not likely to be a fruitful
4. Conditions necessary to solving the problem must be available; that is the ability and opportunity to obtain the needed observations and perform the pertinent analyses are assured.

5. Consideration should be given before settling on the problem to the possible kinds and forms of solutions that might be forthcoming. (p. 20)

The results of these analyses will be discussed in the next chapter.
CHAPTER IV

RESULTS

Results are organized by research question.

Question 1

1a. At what level of pedagogical conception (Ammon & Levin, 1991) do prepracticum education students define learning and teaching?

In this study, more students defined teaching and learning at Level 1 (Naive Empiricist level) than at any other level, followed by Level 3 (Global Constructivist level), Level 2 (Behaviorist level) and Level 4 (Differentiated Constructivist level), in that order. (See Figures 1 & 2). Naive Empiricist level responses predominated, with 36.4% of learning definitions and 47.3% of teaching definitions, falling at this level. Only 18.2% of participants, however, defined both teaching and learning at this level.

Global Constructivist level responses accounted for 21.8% of responses (learning definition) and 27.3% (teaching definition). Only 7.3% of participants were consistent in defining both teaching and learning at Global Constructivist level.
Figure 1: Levels of Learning Definition

Number of Respondents

Learning Definition Level

Figure 2: Level of Teaching Definition

Number of Respondents

Teaching Definition Level
Behaviorist and Differentiated Constructivist levels accounted for a smaller proportion of answers and only 2 participants (3.6%), both at level 4, defined both teaching and learning at the same level. There were no definitions of learning and only one definition of teaching at Level 5 (Integrated Constructivist level).

1b. Are the strategies (ways to learn, teaching methods) that prepracticum students choose consistent with their views of teaching and learning?

There is a significant relationship between level of learning definition and description of best ways to learn ($X^2(4)=10.16$, $p=.04$), when definition and comment levels are collapsed into Low, Medium, and High.

These results appear to be due to the fact that Behaviorist level comments were made primarily by people whose definitions of learning were at the Behaviorist level. Those people also made relatively fewer high and low level comments than other groups. (See Table 2.)
Table 2: Contingency table showing relationship between learning definition level and best ways to learn.

<table>
<thead>
<tr>
<th>COUNT COL PCT</th>
<th>LEARNING</th>
<th>DEFIN.</th>
<th>LEVEL</th>
<th>ROW TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>BEST WAYS TO LEARN</td>
<td>LOW</td>
<td>MEDIUM</td>
<td>HIGH</td>
<td></td>
</tr>
<tr>
<td>LOW LEVEL</td>
<td>7</td>
<td>3</td>
<td>6</td>
<td>16</td>
</tr>
<tr>
<td>MEDIUM LEVEL</td>
<td>3</td>
<td>7</td>
<td>1</td>
<td>11</td>
</tr>
<tr>
<td>HIGH LEVEL</td>
<td>23</td>
<td>13</td>
<td>26</td>
<td>62</td>
</tr>
<tr>
<td>COLUMN TOTAL</td>
<td>33</td>
<td>23</td>
<td>33</td>
<td>89</td>
</tr>
<tr>
<td>TOTAL</td>
<td>37.1%</td>
<td>25.8%</td>
<td>37.1%</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

Examination of the crosstabulation of best ways to learn by learning definition level yielded some interesting results. The most frequently mentioned way to learn was hands-on learning (17 instances), with the next three being using a variety of activities (10 instances); exploring one's own interests (9 instances) and working in cooperative groups (9 instances). (See Table 3).
Table 3: Crosstabulation of high frequency ways to learn by learning definition level

<table>
<thead>
<tr>
<th>WAY TO LEARN</th>
<th>LEVEL 1</th>
<th>LEVEL 2</th>
<th>LEVEL 3</th>
<th>LEVEL 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>HANDS ON</td>
<td>4</td>
<td>6</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>VARIETY</td>
<td>4</td>
<td>2</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>EXPLORE</td>
<td>2</td>
<td>4</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>GROUPS</td>
<td>5</td>
<td></td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

All (with the possible exception of variety of activities) are comments that fit well with current approaches to education in the local school districts and in curricula mandated by the British Columbia Department of Education. In addition, these comments are quite evenly spread across definition levels, as one might expect if their source was the current jargon rather than the belief system of a particular level. Working in groups, however, was not mentioned even once by respondents whose definitions were at the Behaviorist level, possibly because one would expect teacher, rather than peer, feedback to be an important source of learning according to those at this level.

Most comments were found at more than one level,
with the exception of three (have the students take part in competitive games; focus on learning practical skills; and learning from mistakes) which were found only at Behaviorist level and two (students need to have a positive attitude and students learn through teacher explanation) which were found only at Naive Empiricist level.

Of the six comments categorized as not representing any particular level, two were found to cluster strongly around one level. *Children learn through active involvement* was found four times at Level 1, twice at Level 4, and once each at Level 2 and 3. As this is a comment one would expect to find at the level of Global Constructivism (Level 3) this is somewhat puzzling. If one examines the actual responses however, Naive Empiricist respondents made comments such as "Children need to be actively involved in absorbing the information", which although contradictory, fits well with a Naive Empiricist level understanding of learning. *Make it relevant* was found three times at Global Constructivist level with smaller numbers at Levels 4 and 2. The other four comments were evenly spread across several levels.
Of the three comments categorized at Naive Empiricist level (Level 1), *Make it interesting* and *use different teaching methods* were spread fairly evenly across a number of levels, and *students learn through teacher explanation* was found only once, at level one. Given the high percentage of level one definitions of learning (36.4%), this is a somewhat surprising result. One would expect that teacher explanation would play a larger role in the learning that is understood as "gain of information and knowledge". In methodology courses, however, the participants would have been told that students do not learn best by teacher explanation, and therefore, having "received" this knowledge themselves, they might be reluctant to express the opinion that teacher explanation is the best way to learn, even if it reflected their own belief system. Received knowledge might also explain the relatively high number of Global Constructivist level comments offered by respondents whose definitions were at Naive Empiricist level. Having been told that these were the ways students learn best, people at Level 1 would repeat what they had "learned".

In general, Behaviorist level ways, were found
almost exclusively in the comments of those whose definitions of learning were at Behaviorist level. The one exception is *Children learn by repetition or practice*, which was found almost exclusively at Naive Empiricist level.

Some of the ways that were coded as Global Constructivist level occurred at both Naive Empiricist level and Global Constructivist level, but not at Behaviorist or Differentiated Constructivist levels. Protocols were reexamined to see if there was any difference in the wording or emphasis between the two levels. None was apparent. For example, suggesting discussion as a way to learn, the Global Constructivist level respondents mentioned "talking about a concept" and "discussion periods". The Naive Empiricist level respondents mentioned "class discussions", "discussion" (2), participating in...discussions".

Only one of the Level 4 and 5 comments showed any tendency to cluster at a particular level or levels. "All learners are different" was evenly split between Levels 1 and 4. Naive Empiricist level respondents have undoubtedly absorbed the currently popular "all learners are different" from their courses while for
Differentiated Constructivist level respondents, individual differences are an essential part of their understanding of learning and teaching.

There is a statistically significant relationship between level of teaching definition and overall description of best ways to teach \( (X^2(4)=12.25, \ p=.02) \), when definition and comment levels are collapsed into three levels. Most of the Naive Empiricist and Behaviorist level comments were made by respondents whose definitions of teaching were also at these levels. Those whose definitions of teaching were at Global Constructivist level suggested mostly Global Constructivist level teaching methods. Those whose definitions were at Levels 4 and 5 made comments that were fairly evenly spread across all levels.
Table 4: Contingency table showing relationship between level of definition of teaching and best ways to teach

<table>
<thead>
<tr>
<th>COUNT</th>
<th>TEACHING LEVELS</th>
<th>DEFIN. LEVEL</th>
<th>LEVELS 4 &amp; 5</th>
<th>ROW TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>BEST TEACHING METHODS</td>
<td>1 &amp; 2</td>
<td>3</td>
<td>4 &amp; 5</td>
<td></td>
</tr>
<tr>
<td>LOW LEVEL</td>
<td>17</td>
<td>5</td>
<td>4</td>
<td>26</td>
</tr>
<tr>
<td>MEDIUM LEVEL</td>
<td>18</td>
<td>15</td>
<td>4</td>
<td>37</td>
</tr>
<tr>
<td>HIGH LEVEL</td>
<td>7</td>
<td>5</td>
<td></td>
<td>12</td>
</tr>
<tr>
<td>COLUMN TOTAL</td>
<td>42</td>
<td>20</td>
<td>13</td>
<td>75</td>
</tr>
</tbody>
</table>

Because of the large number of Global Constructivist level teaching methods suggested both by respondents whose definitions were at Naive Empiricist level and by respondents whose definitions were at Global Constructivist level, protocols were reexamined to determine if there were differences in wording between the levels. For the comment dealing with encouraging or guiding, the Naive Empiricist level respondents commented "questioning techniques can allow the children to find the answers"; "give the students the guidelines"; "the teacher acts as a guide"; "students learn with aid and guidance from... the
facilitator". Global Constructivist level respondents said "guiding students to learn"; "guiding students ... to make discoveries"; "guiding them to reach certain conclusions". Global Constructivist level wording may show slightly more focus on the student while Naive Empiricist level wording focuses more on the teacher.

For the comments related to the discovery method or first hand experience, Naive Empiricist level respondents said "let the children find the answers"; "let them discover things"; "giving the students the freedom to discover on their own"; "let them explore it". Global Constructivist level respondents suggested "have children discover information"; "let the students find out for themselves"; "providing ... chances to explore concepts". There seem to be no important differences in the wording of this comment.

In general, Global Constructivist level respondents do not differ from Naive Empiricist level respondents in the wording of their explanations of the same teaching method.
Question 2

2a. At what level do prepracticum education students define their role as a student teacher?

The highest percentage of prepracticum students defined the student teaching role at Naive Empiricist level (42%). The numbers of respondents decreases as the level of pedagogical conception increases (See Figure 3).

Figure 3: Level of Role Definition
This is not surprising, but in this instance there are no signs, either in the frequencies of roles listed or in the specific role functions listed, that preparation for the practicum in the form of expectations or goals, took place in a constructivist context. If anything, there seems to have been a Naive Empiricist level orientation which emphasizes the subordinate role of the student teacher and emphasizes learning to teach by absorbing knowledge from the sponsor teacher. There are none of the revealingly mixed messages that one finds in definitions of learning and teaching (e.g. "My definition of teaching is facilitating stuff. What stuff I'm not sure of yet!"). On the other hand, more than half of the respondents at each level mention the guest/subordinate role, suggesting that this is an aspect of their role that they have been told.

On reading the protocols, one is struck by the differences among prepracticum students at different levels as they try to conceive of their role as student teachers. The differences between levels are, perhaps, best expressed in the words of the respondents. A Naive Empiricist level respondent wrote "Follow your
advisor around like a sponge". Another wrote "At this point I view myself as a full time teacher who pays to teach instead of receiving payment for services." At the Behaviorist level, one respondent described the role as "learning and making mistakes and building on my past mistakes." At Global Constructivist level, a respondent said "My role as a student teacher is to see it as a learning and growing experience... and to experience what the teaching profession is all about in reality". At Differentiated Constructivist level one respondent wrote "the student teacher must observe and develop personal styles and techniques of teaching". An Integrated Constructivist level respondent wrote "My role as a student teacher is very ambiguous. I am a guest in the classroom... yet I am expected to and must treat the classroom as my own.... I am in the class to learn and make mistakes, yet on my faculty advisor's evaluations of me these mistakes will count against me.... My lesson plans and my behaviour reflect what the sponsor teacher and faculty advisor are looking for... and often do not reflect my true personality or behaviour." There are clearly qualitative differences in understanding between a view that sees the learner
as sponge and one which talks about conflicts inherent in the student teaching situation as does the level five example.

2b. Are the specific student teacher role functions that prepracticum students list consistent with their overall view of their role as a student teacher?

There was a strong correspondence between specific role functions listed and pedagogical level of the student's overall understanding of his/her role for those at lower levels of pedagogical understanding. Respondents who defined the student teaching role at Level 1 (naive empiricism) included more low level role functions than high or medium level functions. Those who defined the student teacher role at the behaviorist level identified primarily medium (behaviorist level) role functions. Those who defined the student teaching role at higher levels, however, identified primarily low level role functions (see Table 5). This is due to the high incidence of learner role functions identified (9/20). If one eliminates this role function, respondents at higher levels of pedagogical conception, list specific role functions that are evenly
distributed among all comment levels. Although they list the same specific roles as lower level respondents, it is done in a different context. A respondent at the level of general constructivism might say that they will experiment, but this experimentation is a part of developing a personal style (finding out what works for me) rather than a strategy that elicits external evaluation or feedback as at the behaviorist level. A respondent at the level of integrated constructivism (Level 5) would list these role functions in pairs as sources of contradiction inherent in the student teaching situation.

Table 5: Contingency table showing relationship between student teacher role level and specific role functions.

<table>
<thead>
<tr>
<th>ROLE FUNC</th>
<th>STLVL</th>
<th>MEDIUM</th>
<th>HIGH</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOW</td>
<td>39</td>
<td>16</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>76.5%</td>
<td>32.0%</td>
<td>52.6%</td>
</tr>
<tr>
<td>MEDIUM</td>
<td>6</td>
<td>32</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>11.8%</td>
<td>64.0%</td>
<td>23.7%</td>
</tr>
<tr>
<td>HIGH</td>
<td>6</td>
<td>2</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>11.8%</td>
<td>4.0%</td>
<td>23.7%</td>
</tr>
<tr>
<td>COLUMN</td>
<td>51</td>
<td>50</td>
<td>38</td>
</tr>
<tr>
<td>TOTAL</td>
<td>36.7%</td>
<td>36.0%</td>
<td>27.3%</td>
</tr>
</tbody>
</table>

| ROW TOTAL | 75 | 47 | 17 | 139 |
|           | 54.0% | 33.8% | 12.2% | 100.0% |
The most frequently mentioned role function over all was that of subordinate or guest (27 instances), closely followed by learner or apprentice (23 instances). Between 10 and 20 percent of respondents at each level mentioned these two role functions. Two functions (teacher; manager) were not assigned to any definition level. The teacher role function was mentioned most often at the Naive Empiricist level, and the manager role function was evenly distributed across the three lowest levels. In general, role functions clustered strongly at one level with smaller numbers at adjacent levels.

Question 3

3a. Is level of pedagogical conception consistent across definitions of teaching, learning and the student teacher role?

Overall, 29% of respondents defined both teaching and learning at the same level. Those who did not, were evenly split between higher level learning definitions and higher level teaching definitions. Approximately 31% defined teaching and the student teacher role at the same level and 20% defined learning and the student
teacher role at the same level. In about two thirds of the cases where definition levels did not match, the definition of the student teacher role was at a lower level.

If one considers all three definitions (learning, teaching, and the student teacher role) only 13% of participants were consistent as to definition level, 55% were split between 2 levels and 33% had all three definitions at different levels. For each definition, responses at the Naive Empiricist level (Level 1) predominate (see Figures 1-3). There is no apparent pattern to the level changes across all three definitions. When all three are considered simultaneously no particular definition is at a higher level and there is often more than one level between definitions. When mean pedagogical level is calculated across all three definitions (see Figure 4) most respondents receive a mean level score of 2 (Behaviorist level).
3b. Are level of pedagogical conception of teaching, learning, and the student teacher role, and/or adequacy of role definition related to success in the practicum as measured by supervisor ratings?

There was no correlation between the total level of pedagogical conception across all three definitions and supervisor rankings on the practicum (Kendall's Tau = 0.07; p > .05). Nor was there a significant correlation.
between the level of any one definition and supervisor rankings (See Table 6). The correlation between the adequacy of role definition (mean comment level) and the supervisor ranking were not significant (Kendall’s Tau=0.60; p>.05), nor was the correlation between number of comments made and supervisor ranking.

Table 6: Correlations among definition levels and supervisor ratings (Kendall’s Tau).

<table>
<thead>
<tr>
<th>Concept</th>
<th>Supervis. Def’n. of</th>
<th>Def’n. of Learni</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level</td>
<td>Score</td>
<td>ng Teaching</td>
</tr>
<tr>
<td>Def’n. of Learning</td>
<td>0.10</td>
<td></td>
</tr>
<tr>
<td>Def’n. of Teaching</td>
<td>0.15</td>
<td>0.14</td>
</tr>
<tr>
<td>Def’n. of Role</td>
<td>0.02</td>
<td>-0.11</td>
</tr>
</tbody>
</table>

Of the five respondents who had inconsistency scores of 0 (all definitions were at the same level), four were at Level 1 (Naive Empiricism) and one was at Level 4 (Differentiated Constructivism). The consistent Naive Empiricist level respondents did not receive either consistently high or consistently low rankings. The level 4 individual was rated third in a group of six advisees. It seems that even consistently high
definition levels had little to do with how individuals were ranked.

4. To what extent can the student teachers’ problem representations be characterized as productive (Getzels, 1979)?

While Getzels description does not take into account the importance of recursion and successive approximations in the solving of complex problems, it does offer another useful qualitative viewpoint for examining student teachers’ problem formulation. Productive questions should share certain characteristics in addition to the quality of the outcome they produce. Considering each characteristic in turn:

1. There is a body of knowledge (concepts, data, techniques) within which the problem of becoming a teacher may be placed. At this point, student teachers have been exposed to a variety of teaching techniques for a minimum of 16 years (as a student), they have received specific education in pedagogy for the better part of a year and have been exposed to theory,
methodology and content courses.

2. Is the problem well-conceived in the sense that its background and presuppositions... are neither false nor undecided? In this sense, student teachers' problem formulations may be open to question. Their presuppositions about the nature of teaching and learning may well be false, the best ways students learn and the best ways to teach may well be undecided.

3. The problem is somewhat circumscribed; the question "What is my role as a student teacher?" seems quite specific, but the students must decide on the limitations and delimitations of the problem for themselves as they are not given a description of what their role is to be, but must decide that for themselves or in cooperation with their sponsor teacher.

4. Conditions necessary to solving the problem (at least once) are available. The practicum offers the opportunity to obtain the needed observations and perform the pertinent analyses. In this case the needed
observations are the results of one’s attempts to teach, and the analyses are the reflection on action and feedback provided by students, sponsor teachers, and practicum advisors.

5. Consideration should be given before settling on the problem to the possible kinds and forms of solutions that might be forthcoming." It is unlikely that most students, formulating the problem of their role as a student teacher, are aware that there are different understandings of what that role might be, or are aware that the way in which they see their role will affect their attempts to solve the problem. Only students whose definitions were at Integrated Constructivist level, indicated any awareness of a point of view other than their own.

The results of the study have several implications. They shed some light on the problem that student teachers intend to solve on the practicum as opposed to the one that the university thinks they are intending to solve. This has practical implications for teacher education. The results also have implications for the wider use of Ammon & Levin’s model of levels of
pedagogical awareness and suggest lines of research to be followed if its applicability in a wider variety of settings is to be adequately tested. These issues will be discussed in the next chapter.
CHAPTER V
DISCUSSION

It was the stated intent of this study to combine developmental and problem solving orientations in looking at the ways in which prepracticum education students represent the problem of learning to teach. This discussion will use these two filters to examine the results of the data analysis.

The answers to each research question will be considered in turn, followed by an examination of the relationship between them. The usefulness of both developmental and problem solving approaches in dealing with the problem as a whole will be discussed. Recommendations for further research and for possible changes in teacher education will be made.

Ammon & Levin (1991), working with students in a postgraduate, developmental teacher education program at University of California, Berkeley developed "Levels of Pedagogical Understanding" which they felt described the development in understanding that their students went through, in the process of becoming a teacher. They found most of their students to be at Levels 2 and
3 and were able to document a progression during the two year program. They confirmed their results using students from a similar program.

It is not unreasonable to suggest that many students attending a developmental teacher education program would have chosen that program because of pre-existing interest and/or belief in developmental principles. In addition, the program is a small one with only 15 students admitted each year. Under such conditions it is probable that all students take courses from the same professors, and participate in the same seminars. Given such a developmental/constructivist orientation, combined with a two year program which consistently reinforced such beliefs and developed congruent theoretical and practical knowledge, it is not surprising that participants would show growth along those lines. Ammon & Levin (1990) also note that most of the change in levels occurs in the second year of the program.

The participants in the present study, however, were students in a much larger, much shorter program leading to a B. Ed. rather than an M.A. They had not been exposed to any such theoretically coherent
program, but in their courses had been exposed to behaviorist, information processing and developmental approaches as well as general constructivism. In this population, coming to the experience with a wide range of pre-existing belief systems, and being exposed to a variety of theoretical and practical orientations (although with the overall, currently popular, flavor of constructivism), the path of development is not as clear.

**Question 1**

1a. At what level of pedagogical conception (Ammon & Levin, 1991) do prepracticum education students define learning and teaching?

The highest proportion of the participants defined teaching and learning at Naive Empiricist level but only 29% overall, defined both teaching and learning at the same level.

An important principle of development is the role played by appropriate experience. In general, this means direct relevant experience which challenges the learner's current understandings and which offers the
opportunity to create more complete, more accurate understandings over time. As mentioned before, the program in which these students were involved was one in the process of change, but one which at that time consisted primarily of coursework, with brief, limited experiences of actual classroom teaching. In fact these students were supposed to have had no experience with whole classroom teaching, although a similar group at the same university reported teaching 2 - 20 whole class lessons during the introductory small group practicum (B. Housego, personal communication, July, 14, 1993). Given this limited and variable experience, it is not surprising, that for many of them, their understandings of teaching and learning are at relatively undeveloped and inconsistent levels as the results of data analysis show.

1b. Are the strategies (ways to learn, teaching methods) that prepracticum students choose consistent with their views of teaching and learning?

Previous research (Getzels & Csikzentmihalyi, 1976; Schoenfeld, 1983; Sinnott, 1989) suggests that the way
a problem is represented is likely to affect strategy choice and so may create differences in the way the problem is solved. The results of the present study offer further support for the connection between problem representation and strategy choice. There is a significant relationship between definition levels and descriptions of best ways to learn/best ways to teach. For students who have virtually no experience in classrooms, the fact that a relationship exists suggests that their initial problem representation is at least adequate to suggest strategies that are congruent with the problem representation and that may lead to a solution.

Chi Square analysis only confirms what would be expected, but the actual patterns of response are more revealing. For both best ways to learn and best ways to teach, respondents whose definitions were at a low level suggested an unexpectedly high number of ways that were at Global Constructivist level. This result can be explained by considering what a Naive Empiricist level (Level 1) definition of learning or teaching implies. At this level, a person believes that knowledge or information is passed from the teacher to
the student who absorbs it unchanged.

Since the provincial program of studies for schools and current educational talk reflect a basically constructivist orientation, it is not surprising that students at this level would have learned that these are the "right" answers. Further evidence comes from the fact that a number of these general constructivist strategies appear in almost equal numbers across all definition levels, as one might expect if they were part of current jargon rather than a reflection of a particular understanding of the nature of teaching and learning.

Almost all of the the behaviorist level ways were suggested by students whose definitions were at Behaviorist level (Level 2). Since behaviorist strategies are currently out of favour, it seems likely that this is a relationship that reflects an actual congruence between understanding of teaching or learning and the strategies one would use, and provides further evidence that the strategies one chooses are dependent on one's problem representation. These students would have been exposed to the same constructivist methods as the Naive Empiricist level
students, but did not choose to list them as best ways one might teach or learn.

Respondents whose definitions were at the Global Constructivist level chose strategies mainly from that level, but the few respondents at the levels of differentiated and integrated constructivism were more eclectic in their strategy choice. Since these levels represent a more personalized, contextualized view of teaching and learning, it makes sense that these individuals would choose a variety of strategies from all levels. This is also consistent with a more expert understanding of teaching and learning (Berliner, 1986; Lampert, 1986).

Question 2

2a. At what level do prepracticum education students define their role as a student teacher?

Almost 70% of student teachers define their role on the practicum at the two lowest levels. This may be due to any one or a combination of factors. As teaching is a relatively new domain for these students, one would expect that initial problem formulations might be at a
lower level. The structure of the practicum itself, where evaluation depends heavily on how well one meets the goals of others may discourage more personal and individualistic formulations. Direct teaching to prepare students for the practicum may emphasize the subordinate role and evaluative aspects of the experience. Whatever the reasons, these students define their role as student teachers in ways that seem unlikely to lead to personalized strategy selection and problem solution.

2b. Are the specific student teacher role functions that prepracticum students list consistent with their overall view of their role as a student teacher?

Ammon and Levin did not develop a description of the student teacher role for their levels of pedagogical understanding. The descriptors used in the present study are the creation of the author, using information from their descriptions of perceptions of learning, teaching and behaviour at each level. These more global descriptors seem to hold up well in describing students' understanding of their role as a
student teacher.

One might expect that definitions and descriptions of student teacher roles would be isomorphic, and this might well be the case for experienced or expert teachers whose definitions of their role are the result of extensive, (hopefully) reflective practice in the complex, real world of the classroom. For students who have virtually no actual classroom teaching experience and no clear, consistent list of expectations for their role, but who have been exposed to a variety of teaching/learning situations as students, the relationship between their definitions and the specific role functions is at least reassuring. It suggests that they have come to some understanding of the problem of their role as practicum students and have selected strategies that are consistent with this understanding.

There are obvious differences in the ways that respondents at different levels of pedagogical understanding describe their various roles as student teachers. Some role functions are clearly derived from what they have been told by their practicum advisors. "I am a guest in another teacher's classroom" is one clear example of such a comment. This comment was found
more frequently at the lowest pedagogical level, with a few instances at higher levels. At Integrated Constructivist level it was used as one source of contradiction "I am a guest in someone else's classroom but must treat the class as my own...". Other comments were clearly original. "...a performer at someone else's party" is one such comment. In fact, such original comments may be the best representation of students' understanding because they have not been not "told" the answers.

In all cases it appears that being asked to describe what is a real immediate situation that they will be asked to "solve" in some real sense, may bring out the participant's best and most coherent understanding of that situation or problem.

**Question 3**

3a. Is level of pedagogical conception consistent across definitions of teaching, learning and the student teacher role?

Understandings of learning, teaching and the student teacher role should be very closely linked, since learning and teaching are two sides of the same
transaction and the student teacher's goal, in its most basic form is to learn to teach. The lack of relationship among the three definitions is disturbing. If one considers definition of the student teacher role as well as definitions of teaching and learning, only 13% of participants were consistent as to definition level, 55% were split between 2 levels and 33% had all three definitions at different levels. One might consider the possibility of decalage were it not for the fact that there is no apparent pattern to the level changes between the three definitions. No particular definition is at a higher level and there is often more than one level between definitions. This suggests that these three definitions are not expressions of an overall level of pedagogical understanding, but that some or all may reflect some combination of what has been taught, what has been experienced as a learner in schools, and personal belief systems.

This would seem to cast doubt on the validity of Ammon & Levin's developmental model of pedagogical understanding. If there is no consistent relationship among kind or level of understanding of such closely
related concepts, in the absence of a specific type of educational program, then perhaps the progression through levels of understanding that they see in their students and in those enrolled in a similar program, are a result of the specific orientation of the program. In order to determine whether their levels represent a developmental progression (if not a domain specific stage theory) one would need to study, over time, the development of pedagogical understanding in students enrolled in Masters level programs which offer programs that are similarly coherent but differing in focus.

3b. Are level of pedagogical conception of teaching, learning, and the student teacher role, and/or adequacy of role definition related to success in the practicum as measured by supervisor ratings?

While the the answer to this question can be seen as a succinct "No, they are not", the problem is more complex than that. Supervisor ratings of practicum students are subjective, as are understandings of what constitutes good teaching. To someone trained in a traditional "teacher as sage" or behaviorist paradigm,
a student working in a constructivist model may seem less adequate than one whose understanding matches the supervisor's. The same would be true for a constructivist supervisor watching a student whose goal is to "follow my sponsor teacher around like a sponge". It seems probable that, given the subjectivity of supervisor ratings, the degree of agreement between the supervisor and student's level of pedagogical understanding would be a better predictor of the student's success on the practicum than the student's level of pedagogical understanding per se.

In addition, supervisor ratings are based on student performance and not on the amount of learning that has taken place over the practicum. As a matter of fact "He/she has learned a lot over the past weeks" is often considered a somewhat damning comment on evaluations. Since learning is messy and involves a certain amount of unsuccessful attempts and theory testing, evaluation which is based on one's routinely successful performance may be devaluing much of the learning that could be taking place, given a situation that valued rather than penalized learning and risk taking.
This problem has been recognized by the university in question. The students participating in this study were the last for whom actual marks were given on the practicum. Since that time the practicum has been graded pass/fail only.

In retrospect, using supervisor ratings as a measure of adequacy of problem formulation and solution is less than satisfactory. The difficulty is the same one encountered by Sinnott (1989). She found that participants who operated in larger problem spaces were often less successful in solving presented problems, than those who operated in more restricted ones, but in her evaluation of success or failure, she failed to consider that the problem that these participants were solving may have been different than the one she presented. In this study, students who conceived of their task as one of resolving multiple contradictions (Integrated Constructivist level) or developing a personal teaching style (Differentiated Constructivist level), may have been more or less successful in that task than those who conceived of their task as copying their sponsor teacher (Naive Empiricist level), but the degree to which they were able to plan and carry out
lessons, and manage students, is unlikely to shed much light on their success in solving the problem as they had represented it. A more adequate measure might ask students at the end of the practicum to evaluate how successful they had been in learning what they had set out to learn.

**Relationship among the research questions.**

Questions 1 and 2 look at the same general questions: "How do students represent the problem of learning to teach?" and "Does this representation enable them to choose appropriate strategies for solving the problem?" The third question asks whether more advanced (according to Ammon & Hutcheson, 1989; Ammon & Levin, 1990) understandings of the problem lead to greater success on the practicum. The fourth question asks whether student teachers’ problem formulations meet the criteria for productive problem representations.

From the lack of consistency among students’ definitions of teaching, learning and the student teacher role, one may infer that they see these as three separate problems (how to learn, how to teach,
how to become a teacher) rather than different facets of the same problem. That they have selected strategies for each problem that are consistent with their problem formulation as revealed in their definitions, leads one to hope that they may arrive at adequate problem solutions. That there does not seem to be an adequate understanding that teaching, learning and the student teacher role are interconnected, makes one doubt the adequacy of these formulations for use in the real, complex world of classrooms.

A basic principle of development (and indeed of all learning) is that development or learning does not take place without appropriate experience. The fact that so many students, almost at the end of their professional education, do not have a consistent, coherent understanding of the teaching/learning transaction, suggests that they may not have had appropriate experience to enable them to do so. While it might be unreasonable to expect that their view would be totally coherent one would hope to see more consistency than is apparent here.

There is a lack of relationship between
supervisor ratings of practicum success, and student understanding of teaching, learning and the students teacher role considered either singly or in combination. This may be due to the fact that supervisor ratings measure a different sort of success. On the other hand it may be that the lack of coherence among the subproblems of teaching, learning and the student teacher role, interferes with the student’s ability to make effective use of the practicum as a problem solving, learning opportunity.

Some of the basic tenets of constructivism are to connect new experiences to the learner’s prior experience, to make use of current understandings, and to challenge current structures through thought-provoking authentic experiences. Getzels’ characteristics or productive problems suggests areas for change that might improve teacher education. A teacher education program that examined and made use of students’ current understandings, in the authentic setting of the classroom, and that revealed contradictions between these understandings and classroom practice, might enable students to make better use of the practicum in representing, solving
and rerepresenting the problem of becoming a teacher.

The student teacher role: a developmental perspective

There are clear qualitative differences in understanding of the student teaching role by participants at different levels of the Ammon & Levin model. These differences lie in the perceived roles of the teacher, the information, and the student. At Naive Empiricist level, an active teacher passes inert information to a passive student who absorbs it. At the behaviorist level, the passive student receives the stimulus (active information) either from the teacher or the environment, responds, and receives feedback from the teacher. At Global Constructivist level the student acts on the information/experience provided by the teacher who has structured the environment. At Differentiated Constructivist level, the student interacts with the information in a problem solving context. The teacher reacts to the student’s need for information, providing guidance as necessary. At Integrated Constructivist level, the teacher structures the environment (information) and interacts with the student providing the scaffolding for the student to
become her/his own teacher (see Table 7 for a more concise description)

Table 7: Role of Teacher, Information, and Student at Different Levels of Pedagogical Understanding

<table>
<thead>
<tr>
<th>LEVEL</th>
<th>TEACHER</th>
<th>INFORMATION</th>
<th>STUDENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Naive Empiricist level</td>
<td>Active</td>
<td>Inert</td>
<td>Passive</td>
</tr>
<tr>
<td>Behaviorist level</td>
<td>Reactive</td>
<td>Active</td>
<td>Reactive</td>
</tr>
<tr>
<td>Global Constructivist level</td>
<td>Active</td>
<td>Inert</td>
<td>Active</td>
</tr>
<tr>
<td>Diff. Constructivist level</td>
<td>Reactive</td>
<td>Active</td>
<td>Interactive</td>
</tr>
<tr>
<td>Integrated Constructivist level</td>
<td>Interactive</td>
<td>Active</td>
<td>Interactive</td>
</tr>
</tbody>
</table>

In order to reconfirm whether Ammon and Levin’s levels of pedagogical conception indeed represent developmental differences and to determine whether passage through them is invariant, thus meeting two criteria for a stage theory, it would be necessary to monitor the development of a large number of student
teachers through a number of different teacher educations programs. For this reason, at this point in time, one can only say that that a constructivist/developmental approach holds promise and that there is evidence for qualitatively different understandings of the teaching/learning transaction, shown in the description, by education students, of their anticipated role as student teachers.

The student teacher role: A problem solving perspective

Examining the description of the student teacher role from a problem solving perspective also yields useful information, since in this way we may be able to better understand what might constitute an adequate problem representation at any level. In addition, there is strong evidence that problem solving, particularly recursive problem solving, is essential in the development of expertise. In order to understand how teachers develop expertise, it is important to look at how they begin, by formulating the problem of their role as a student teacher.

When prepracticum students describe their role as a student teacher, they are giving us information on
their current representation of the problem of becoming a teacher since, as one respondent commented "if there is such a disparity between the two [student teaching and professional teaching] then why have a practicum at all?". There are two concerns about this problem representation: is it productive? in other words is it likely to lead to a viable solution to the problem, and what, if anything, might enable the student to improve the quality of the problem representation?

Examining student teachers' problem representation in the light of Getzel's description of productive problem representations makes it clearer where the difficulties arise. The naive theories that student teachers hold, derived from their own experience as students, may be based on false presuppositions about the nature of teaching and learning. In order to develop more adequate understandings of the teaching/learning transaction, students need to experience, rather than hear about different approaches to the problem, both as teachers and as learners. This would also allow them to experience the outcomes resulting from these problem formulations, giving them
a better sense of the ways in which their varied formulations of their role as a student teacher may lead to different learning experiences (strategy choices) and so to different outcomes. If those who taught content and methodology courses made explicit their own theories about teaching and learning (as theories rather than as fact) and structured their classes to provide learning experiences which provided clear examples of different approaches, it might go some way toward meeting these needs.

**Conclusion**

The results of this study offer further evidence that student teachers construct their understanding of what it is to learn and to teach, and that they hold qualitatively different theories about their role(s) as a student teacher. As they begin their practicum they have defined role functions which are congruent with these theories and which they intend to use as strategies in solving the problem of learning to teach. They have formed an initial representation of the problem of learning to teach.

There appears to be no relationship between the
adequacy of this problem formulation and supervisor ratings of the student's performance on the practicum. This may be due, in part, to a lack of congruence between student and supervisor formulations of the problem, but it also suggests that students have difficulty making effective use of their problem formulation in the real world of the classroom.

There is no specific, focussed attempt, in most teacher education programs, to enable students to form more adequate problem representations or to make best use of the representation that they have. In fact, there is no recognition of the importance of problem representation in the solving of an essential problem in the complex and ill-defined domain of teaching. Given the importance of relevant problem solving experience in the development of expertise in other domains, much more work needs to be done to understand student teachers' problem representation, to understand how teacher education might be changed to provide more relevant problem solving experience and to make explicit the relationship between the way the problem of becoming a teacher is represented, and the way it is solved.
References


