DOCUMENT RESUME

ED 320 902 SP 032 468

AUTHOR Schmidt, William H.; Kennedy, Mary M.
TITLE Teachers' and Teacher Candidates' Beliefs about Subject Matter and about Teaching Responsibilities.
INSTITUTION National Center for Research on Teacher Education, East Lansing, MI.
SPONS AGENCY Office of Educational Research and Improvement (ED), Washington, DC.
PUB DATE Feb 90
NOTE 23p.
AVAILABLE FROM National Center for Research on Teacher Education, 116 Erickson Hall, College of Education, Michigan State University, East Lansing, MI 48824-1034 ($4.60).
PUB TYPE Reports - Research/Technical (143)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Beliefs; College Students; *Education Majors; Elementary Secondary Education; Higher Education; *Intellectual Disciplines; Mathematics Instruction; *Opinions; Preservice Teacher Education; Student Attitudes; *Teacher Attitudes; *Teacher Responsibility; Writing Instruction

ABSTRACT

Recent research has suggested that teachers' beliefs about subject matter influence what they choose to teach and how they choose to teach it. The findings suggest that educational reforms need to take teacher' beliefs into account. This study examines teachers' beliefs about two school subjects, mathematics and writing, and their beliefs about their own responsibilities toward diverse learners. Respondents included intending teachers (usually college juniors), first-year teachers, and experienced teachers. Although there are some differences in patterns of beliefs across these three groups, the most remarkable finding is the diversity of patterns found. The evidence suggests that teachers, as a group, hold no clear view on any of these issues. Six tables display the data on patterns of beliefs. (Author/JD)

Research Report 90-4

Teachers' and Teacher Candidates' Beliefs About Subject Matter and About Teaching Responsibilites

William H. Schmidt and Mary M. Kennedy

National
Center for Research
on Teacher Education

Sponsored by the United States Department of Education
Office of Educational Research and Improvement

Research Report 90-4

TEACHERS' AND TEACHER CANDIDATES' BELIEFS ABOUT SUBJECT MATTER AND ABOUT TEACHING RESPONSIBILITIES

William H. Schmidt and Mary M. Kennedy

Published by

The National Center for Research on Teacher Education
116 Erickson Hall
Michigan State University
East Lansing, Michigan 48824-1034

February 1990

This work is sponsored in part by the National Center for Research on Teacher Education, College of Education, Michigan State University. The National Center for Research on Teacher Education is funded primarily by the Office of Educational Research and Improvement, United States Department of Education. The opinions expressed in this paper do not necessarily represent the position, policy, or endorsement of the Office or the Department.

National Center for Research on Teacher Education

The National Center for Research on Teacher Education (NCRTE) was founded at Michigan State University in 1985 by the Office of Educational Research and Improvement, U.S. Department of Education.

The NCRTE is committed to improving teacher education through research on its purposes, its character and quality, and its role in teacher learning. NCRTE defines teacher education broadly and includes in its portfolio such diverse approaches as preservice, inservice, and induction programs and alternate routes to teaching.

To further its mission, the NCRTE publishes research reports, issue papers, technical series, conference proceedings, and a newsletter on contemporary issues in teacher education. For more information about the NCRTE or to be placed on its mailing list, please write to the Editor, National Center for Research on Teacher Education, 116 Erickson Hall, Michigan State University, East Lansing, Michigan 48824-1034.

Many papers published by the NCRTE are based on the Teacher Education and Learning to Teach Study, a single multisite longitudinal study. The researchers who have contributed to this study are listed below:

Marianne Amarel
Deborah Loewenberg Ball
Joyce Cain
Sandra Callis
Barbara Camilleri
Anne Chang
David K. Cohen
Ada Beth Cutler
Sharon Feiman-Nemser
Mary L. Gomez
Samgeun K. Kwon
Magdalene Lampert
Perry Lanier
Glenda Lappan
Sarah McCarthey
James Mead
Susan L. Melnick
Monica Mitchell
Harold Morgan
James Mosenthal
Gary Natriello
Barbara Neufeld
Lynn Paine
Michelle Parker
Richard Prawat
Pamela Schram
Trish Stoddart
M. Teresa Tatto
Sandra Wilcox
Suzanne Wilson
Lauren Young
Kenneth M. Zeichner
Karen K. Zumwalt

Abstract

Recent research has suggested that teachers' beliefs about subject matter influence what they choose to teach and how they choose to teach it. The findings suggest that educational reforms need to take teacher beliefs into account. This study examines teacher beliefs about two school subjects, mathematics and writing, and their beliefs about their own responsibilities toward diverse learners. Respondents included intending teachers (usually college juniors), first-year teachers, and experienced teachers. Though there are some differences in patterns of beliefs across these three groups, the most remarkable finding is the diversity of patterns found, the evidence suggests that teachers, as a group, hold no clear view on any of these issues.

TEACHERS' AND TEACHER CANDIDATES' BELIEFS ABOUT SUBJECT MATTER AND ABOUT TEACHING RESPONSIBILITIES

William H. Schmidt and Mary M. Kennedy[1]

The history of education in the United States is a history of efforts to reform it, with different reforms characterized both by their purposes and by their strategies. The 1960s reforms aimed at upgrading the intellectual content of the curriculum with a strategy of teacher-proof curricula. The 1970s reforms were more oriented toward basic skills, and used a variety of regulatory and other accountability strategies. The 1980s reform actually consist of two separate reforms: one seeking further control of teaching through detailed performance appraisals and by introducing consequences for performance; the other wanting to give teachers more autonomy than they have had for some time, in the hope that they might do a better job than policy makers have done of improving education. Throughout this history of reform has always been, of course, a variety of preservice and inservice teacher education programs, many of which complemented the reforms of their day.

Educational observers and commentators have tended to portray the shifting purposes of these reforms in terms of a fundamental tension between teaching specific facts, on one side, and fostering independent thought on the other. The two sides of this dichotomy have been labeled "traditional" versus "progressive" by O'Laughlin and Campbell (1988), "mimetic" versus "transformational" by Jackson, (1986), basic skills versus higher order thinking by many contemporary reformers, and as content versus process by other contemporary reformers. Depending on which side of this dichotomy a reformer sits, he or she construes the reform problem as one of getting teachers to spend less time on basic skills and more on higher order thinking, or of getting teachers to spend more time on content and less on process.

With respect to strategy, most reforms attend either to what teachers should teach--that is, the content of their instruction--or to how they should teach it--their pedagogy. Rarely do reformers consider what teachers themselves think about either content or pedagogy. Yet evidence is accumulating to suggest that teachers' beliefs can have a substantial impact on their practices (Clark and Peterson, 1986; Clark and Yinger, 1987). Trumball (1987) has shown, for instance, how teachers' beliefs constrain their ability to generate solutions to educational problems they face. As an example, he describes "Alice," who believes that learning is strictly hard work and that students are either successful or not successful in doing it. Alice could not envision learning that was *both* hard work *and* interesting or rewarding, nor could she imagine that her students might be motivated in

---

[1]William H. Schmidt, professor of counseling, educational psychology, and special education at Michigan State University, is a senior researcher with the National Center for Research on Teacher Education. Mary Kennedy, professor of teacher education at MSU, is director of the NCRTE.

different ways. Her beliefs presented her with a dilemma, for she did not know whether she would be more effective if she adopted the role of taskmaster or the role of friend to her students. Given her perception of teaching and learning, no other options were available to her.

Even more compelling evidence of the importance of teacher beliefs comes from Peterson, Fennema, Carpenter, and Loef (1989), who found that teachers' beliefs about teaching and learning mathematics were associated not only with their pedagogical practices but also with what their students learned. Teachers who held a more cognitively-based view of learning mathematics had students who performed better on problem solving tasks.

The importance of these findings is further amplified by the fact that analogous findings are appearing in other contexts as well. Schon (1987), for instance, has found that professionals in a variety of fields hold tacit theories of their work and of their work environments, and that these theories influence the ways in which they go about their work. And O'Laughlin and Campbell (1988) have cited research in learning and cognitive development indicating that prior beliefs in a variety of contexts can influence how new information is interpreted.

Teachers' beliefs can influence not only pedagogical choices but their content choices as well. Ball (in press) and McDiarmid, Ball, and Anderson (1989) argue that teachers' curricular decisions are closely related to their perception of the subject matter they are teaching. For some, subject matter means a particular set of skills; for others it means a set of ideas or concepts; for still others it may mean a way of reasoning about certain kinds of problems. Teachers' perceptions of the subjects they teach can influence day-to-day decisions about what to teach, what to skip, how much class time to devote to a unit, and so forth.

That teacher beliefs can influence curriculum decisions is a particularly important issue in the United States, for unlike many other countries, the United States has no national curriculum. And even though most districts provide curriculum guidance for their teachers through their purchase of textbooks, their development of curriculum outlines, and/or their selection and use of tests, individual teachers still have considerable freedom to interpret these policies, or to compromise them (Schwille et. al, 1983).

These findings suggests that, if reformers want to improve the content and pedagogy of teaching, they need to confront teachers' prior beliefs Providing new curricula, new incentives, or new regulations is not likely to significantly alter teaching practices if teachers either do not understand or do not agree with the goals and strategies implicit in these new devices.

Yet, though we are learning more and more about teaching practices, we still know very little about the beliefs that contribute to these practices. Studies of teaching practices,

such as those by Goodlad (1983) and Sizer (1985), suggest that classroom activities are generally monotonous, low-level and intellectually wanting. Similarly, Porter (1989) found the content provided in many elementary mathematics classrooms to be scattered and superficial, with most topics being covered for exposure only rather than for understanding. Doyle (1986), too, found academic tasks in the classrooms he observed to be routine and to have predictable outcomes.

These findings about teaching practices have led O'Laughlin and Campbell (1988) to hypothesize that teacher beliefs fall mainly on one side of the fundamental educational dichotomy. That is, teachers must believe that the point of education is to give specific knowledge and skills to students rather than to foster their intellectual development. Yet Stodolsky (1988) has found that teaching practices can vary considerably from one subject to another, suggesting that teacher beliefs might not be placed quit so tidily on one end of this dichotomy or the other.

For the past four years, researchers at the National Center for Research on Teacher Education have been engaged in a longitudinal study of Teacher Education and Learning to Teach (TELT) which examines, among other things, teachers' and teacher candidates' beliefs about teaching, learning, and subject matter (McDiarmid and Ball, in press; National Center for Research on Teacher Education, 1985). These teachers and teacher candidates are participating in ten programs of teacher education. Though they cannot be taken to represent teachers at large, they still offer an opportunity to examine teacher beliefs at different stages of their careers, for the study includes undergraduate candidates, first year teachers, and experienced teachers. The study examines beliefs in two subjects--mathematics and writing--and beliefs about teachers' responsibilities with respect to the subjects and to diverse learners.

In this paper, we present an analysis of these beliefs. The data presented here are drawn from responses to a questionnaire administered at the beginning of the study, before respondents had participated in their programs. Each of our three areas of interest--mathematics, writing, and teacher's responsibilities--was represented in a particular set of questions on our questionnaire. To learn teacher beliefs about the nature of each subject, we asked respondents what it means to be good at the subject, and offered them a series of options that represented a range of views about the nature of that subject. In writing, for instance, the questionnaire said,

To be good at writing, you need to . . .

- Present ideas logically
- Produce polished prose with ease
- Consider the particular audience for whom you are writing

- Write more than one draft
- Be able to write in a variety of genres or forms (eg., letters, reports, poems)
- Discuss ideas with others while work is in progress and seek feedback on drafts
- Read widely
- Know the parts of speech and the terms people use to describe writing conventions
- Pay attention to the quality and appearance of the final product

These items reflect not only the fundamental educational dichotomy between content and process, but also beliefs about the relationship between reading and writing, the relationship between author and audience, and the role of natural ability in writing. Respondents could agree or disagree with any item or combination of items on the list.

To learn respondents' beliefs about the nature of mathematics, we presented an item that said,

To be good at mathematics, you need to . . .

- Remember formulas, principles and procedures
- Think in a logical step-by-step manner
- Have basic understandings of concepts and strategies
- Be able to think flexibly
- Have confidence you can do it
- Have a kind of "mathematical mind"
- Be interested in mathematics

Finally, to learn teachers' beliefs about their responsibilities to students, we presented the following items, with which respondents could agree or disagree:

- Teachers should avoid grouping students by ability or level of performance
- Teachers should make independent decisions about what to teach
- When working with slow learners, teachers should focus nearly all their instruction on "minimum competency" objectives
- Required high school classes should have separate classes for low-achieving and high-achieving students
- The main job of the teacher is to transmit the values of the mainstream American culture

- The main job of the teacher is to encourage students to think and question the world around them
- The main job of the teacher is to teach the subject matter

Again, the set of items was designed to accommodate a wide range of views about teachers' responsibilities, some having to do with whether teachers should teach students in homogeneous or heterogeneous groups, others having to do with teachers' substantive responsibilities.

Respondents were asked to indicate their agreement or disagreement with each of these statements on a seven-point scale, ranging from strongly agree to strongly disagree. We dichotomized their responses into two categories (agree and disagree), and examined the pattern of agreement and disagreement across the items. Respondents who agree that being good at mathematics requires one to think logically, for instance, hold a different perception of the nature of mathematics than those who believe you need to think flexibly. Each pattern of agreements and disagreements with a set of items represents a pattern of beliefs about the nature of writing, the nature of mathematics, and about teachers' responsibilities for helping students learn subject matter.

For purposes of analysis, we grouped items on each of these three topics into subgroups of items that were conceptually related. For instance, in the area of writing, we combined items calling for multiple drafts and seeking help from others, since both of these items address the iterative process of writing and represent one end of the fundamental education dichotomy. We also grouped items asking for knowledge of parts of speech and attention to appearance of the final product on the assumption that these two items represent the formal conventions of writing more than its process and thus represent the other pole of the dichotomy. We also combined items calling for attention to audience and genre into a single scale, on the assumption that both of these items define the parameters of a writing task.

The response options we defined for each subset of items reflected the most common response patterns we found. For instance, for the subset of items asking about audience and genre, we defined three main response options: (a) both audience and genre are important; (b) only audience is important, not genre; and (c) audience is not important, and genre may or may not be important. Notice that this third response category contains both people who believe genre is important and those who believe genre is not important.

Tables 1 through 3 summarize the patterns of beliefs that we identified in each content area. It is particularly important to keep in mind patterns that include something called, "not topic a," or "at least topic a," for these patterns do not indicate the respondent's beliefs about topics other than "topic a."

Table 1

To be good at writing, you need to . . .

– Read widely	1 = yes 2 = no
– Consider the particular audience for whom you are writing – Be able to write in a variety of genres or forms (e.g., letters, reports, poems)	1 = both 2 = audience only 3 = not audience
– Produce polished prose with ease	1 = yes 2 = no
– Write more than one draft – Discuss ideas with others while work is in progress and seek feedback on drafts	1 = at least drafts 2 = feedback only 3 = neither
– Know the parts of speech and the terms people use to describe writing conventions – Pay attention to the quality and appearance of the final product	1 = at least grammar 2 = appearance only 3 = neither

Table 2

To be good at mathematics, you need to . . .

– Remember formulas, principles and procedures	1 = both
– Have basic understanding of concepts and strategies	2 = concepts only 3 = not concepts
– Think in a logical step-by-step manner	1 = both
– Be able to think flexibly	2 = logical only 3 = not logical
– Have a kind of "mathematical mind"	1 = at least ability & work
– Work hard at it	2 = at least ability 3 = work and interest only
– Be interested in mathematics	4 = work only 5 = interest only 6 = none of the three

Table 3

Teaching and Learning in General

– Teachers should make independent decisions about what to teach	1 = Yes 2 = No
– The main job of the teacher is to transmit values of the mainstream American culture – The main job of the teacher is to encourage students to think and the world around them – The main job of the teacher is to teach subject matter	1 = Values/thinking/ subject matter 2 = Values/thinking 3 = Thinking/subject matter 4 = Thinking only 5 = Subject matter only 6 = None
– Teachers should avoid grouping students by ability or level of performance – Required high school courses should have separate classes for low-achieving and high achieving students – When working with slow learners, teachers should focus nearly all their instruction on "minimum competency" objectives	1 = Tracked/grouped with minimum competency (MC) 2 = Tracked/grouped not MC 3 = Grouped with MC/ not tracked 4 = Grouped no MC/ not tracked 5 = Tracked/not grouped 6 = No tracking or grouping

The complete pattern of beliefs held by a particular respondent is represented below with a *string* of codes, with one code for each subset of items. Thus, a respondent who received a code of "one" on each of the five subsets in writing is assigned the string, 11111. Respondents holding belief pattern 11111 agree that you need to read widely (the first 1 in the string), that you need to consider both audience and genre (the second 1 in the string), that you need to be able to produce polished prose with ease (the third 1), that you need to write more than one draft, but may or may not need to discuss ideas with others (the fourth 1 in the string), and that you need at least to know the parts of speech, whether or not you pay attention to quality and appearance (the fifth 1 in the string).

In the following three sections, we present the belief patterns of teachers and teacher candidates who are about to enter a variety of preservice and inservice teacher education programs.

Patterns of Beliefs About Writing

Table 4 lists the most commonly held patterns of belief about the nature of writing along with the percent of all respondents and the percent of each group of respondents who held each belief pattern. Included in Table 4 are only those beliefs which were held by at least 10 respondents. This restriction reduces the presentation to only 15 of the 108 possible patterns of belief.

Even though we have reduced the number of belief patterns from 108 to 15, the most remarkable feature of Table 4 is still the variety of belief patterns held by these teachers and teacher candidates. These 15 patterns account for only 74 percent of all respondents, and the remaining 26 percent held the remaining 93 belief patterns. Of the possible 108 patterns of beliefs, only two are held by more than 6 percent of our respondents. The data contradict the assumption of education reformers that uniformity of educational practices reflects a uniformity of beliefs, at least in the area of writing.

Moreover, the two most prevalent belief patterns do not place teachers at either of the two presumed poles of the education dilemma. The 11111 pattern is an all-inclusive belief that, to be good at writing, you need to know or be able to do virtually everything on our list. The second pattern, 11211, is similarly expansive. It includes everything in the first pattern except the ability to produce polished prose with ease. That is, respondents holding the second pattern believed it was possible to be good at writing, even if writing does not come easily. If we are to draw any conclusion from these data, it cannot be that teachers believe that education should provide specific facts, nor that they believe it should foster independent thought. These teachers and teacher candidates believe being good at writing requires everything from factual knowledge about the parts of speech to the use of an iterative writing process.

Table 4

Patterns of Beliefs About Writing

Pattern Value	Overall Frequency (N = 720)	Overall Percent	Percent of Undergrads (N = 476)	Percent of First-Year Teachers (N = 184)	Percent of Experienced Teachers (N = 60)
11111	161	22	25	20	12
11211	132	18	19	19	13
12211	44	6	6	7	8
11212	43	6	5	8	10
12212	22	3	2	5	7
11112	21	3	3	3	3
21211	16	2	3	2	2
11221	16	2	2	2	2
12111	15	2	2	2	2
12221	13	2	2	2	2
11121	11	2	2	1	0
11213	11	2	1	2	5
12231	11	2	2	2	2
11231	10	1	2	1	2
13211	10	1	2	1	0

It is possible that these all-encompassing beliefs represent a naive view of the nature of writing. Whereas 44 percent of college students hold these first two patterns, only 25 percent of experienced teachers hold them. Perhaps, then, as teachers gain more teacher education and more experience teaching, their beliefs become more refined. Still, even among experienced teachers, we find no evidence of a homogeneous view of writing, nor evidence that teachers tend to fall on one end of the educational dichotomy, whether content or process, more than on the other.

Patterns of Beliefs about Mathematics

Table 5 indicates the proportion of our respondents who held the 12 most common patterns of belief about the nature of mathematics. Like Table 4, Table 5 suggests a considerable variety of belief patterns. Still, even though our respondents held numerous patterns of beliefs about mathematics, they were more homogeneous in their beliefs about the nature of mathematics than they were in their beliefs about writing. The 12 patterns shown in Table 5 account for 90 percent of all respondents, with only 10 percent holding the remaining 42 belief patterns. More homogeneity of beliefs about mathematics is also evident in the two most common belief patterns, in that a larger proportion of respondents are captured with the first two patterns than was the case with writing. The first two patterns account for 54 percent of our respondents' beliefs about mathematics, whereas they accounted for only 40 percent of their beliefs about writing.

As was the case in writing, the first belief pattern is all-inclusive. In this case, being good at mathematics requires remembering formulas, principles, and procedures; having basic understandings of concepts and strategies; thinking logically as well as thinking flexibly; ability (a "mathematical mind") and work; and perhaps an interest in mathematics as well. Those holding the second pattern, 113, hold a similarly-inclusive view, except that they specifically exclude the need to have a "mathematical mind."

Also, as was the case with writing, experienced teachers differed from novices in their belief patterns. However, they did not differ as much from novices in their beliefs about mathematics as they did in their beliefs about writing. Whereas the first two patterns account for only a quarter of experienced teachers' beliefs about writing, they account for over half of experienced teachers' beliefs about mathematics.

Patterns of Belief About Teachers' Responsibilities

Teachers decisions about what, how, and when to teach are influenced not only by their beliefs about the nature of the subject, but also by their beliefs about their own responsibilities with respect to teaching subjects to diverse students. Table 3 shows the three primary dimensions of beliefs we examined with respect to teachers' responsibilities.

Table 5

Patterns of Beliefs About Math

Pattern Value	Overall Frequency (N = 739)	Overall Percent	Percent of Undergrads (N = 481)	Percent of First-Year Teachers (N = 200)	Percent of Experienced Teachers (N = 58)
111	230	31	33	29	24
113	173	23	25	20	28
114	62	8	9	10	0
121	46	6	8	3	0
213	40	5	4	9	9
123	26	4	3	4	5
115	18	2	2	2	7
124	17	2	2	4	0
211	17	2	3	2	3
214	16	2	2	4	2
116	11	2	2	3	2
112	10	1	1	1	7

The first subset of items asks whether teachers should make their own decisions about what to teach. The second subset poses a set of ideas about the teacher's main job--whether it is to transmit values of the mainstream culture, encourage students to think and question the world around them, or to teach subject matter.

The third subset of items includes beliefs about the importance of tracking and grouping students for instruction. The coding for this third subset reflects the variety of possible belief patterns teachers may hold with respect to grouping, tracking, and emphasis on minimum competencies. Respondents in category 1, for instance, believe that students should be both tracked and grouped, and that the slow learners should receive instruction that focuses on minimum competencies. Respondents in category 6, on the other hand, did not agree that grouping or tracking was necessary, nor that slow learners needed minimum-competency instruction. Presumably, respondents who fall in this category believe they can teach the same content in the same way to all students, and do not need to sort students for purposes of teaching them.

Table 6 summarizes our respondents' beliefs about their responsibilities. These beliefs are far more varied than are beliefs about the mathematics and writing. Table 6 indicates that 25 of the 72 possible belief patterns are held by at least 10 respondents, and that these still account for only 75 percent of all respondents. The remaining 25 percent of our respondents held the remaining 47 belief patterns. Relative to beliefs about the nature of the two subject areas we examined, then, beliefs about teachers' responsibilities are far more heterogeneous.

Moreover, respondents are spread far more evenly among these various belief patterns than they are among the belief patterns in writing and mathematics. For the first time, we do not see one or two patterns that are clearly more prevalent than the others. The most prominent belief pattern in this list is held by only 6 percent of all respondents.

Differences between experienced teachers and novices are still apparent, however. Although the first five patterns characterize 27 percent of undergraduates and 31 percent of first-year teachers, they encompass only four percent of experienced teachers. This is not to say, however, that experienced teachers are more homogeneous that novices, however. Although the five most prominent belief patterns held by experienced teachers differ from those held by novices, these five patterns still account for about a quarter of all experience respondents.

Discussion

Probably the most remarkable finding from this study is the wide diversity of beliefs held by teachers and teacher candidates in all three of these important areas. Even within particular subgroups of teachers, such as first-year teachers or experienced teachers, and

Table 6

Patterns of Beliefs About Teachers' Responsibilities

Pattern Value	Overall Frequency (N = 769)	Overall Percent	Percent of Undergrads (N = 471)	Percent of First-Year Teachers (N = 243)	Percent of Experienced Teachers (N = 55)
236	47	6	6	8	4
136	41	5	6	6	0
146	39	5	4	9	0
232	35	5	5	5	0
132	34	4	6	3	0
246	33	4	3	8	2
134	31	4	5	3	2
144	30	4	4	4	2
244	28	4	3	5	7
234	27	4	4	3	4
115	25	3	5	1	0
214	24	3	4	0	6
135	24	3	3	5	0
116	23	3	3	3	4
235	21	3	2	4	0
114	19	3	3	3	0
142	18	2	3	1	2
216	17	2	2	3	0
242	16	2	2	3	6
215	13	2	2	1	4
145	12	2	2	1	2
231	12	2	2	2	0
212	11	1	2	0	4
126	11	1	2	0	2
112	10	1	2	0	0

even in their most agreed-upon subject, mathematics, we found a remarkable diversity of beliefs. Furthermore, although experienced teachers hold different patterns of beliefs than do teaching candidates, they are not noticeably more homogeneous in their beliefs.

The second important finding from this study is that, to the extent that any belief pattern stands out, it is an all-encompassing belief pattern, one that includes both poles of the education dichotomy. Teachers believe writing requires both content and process, that mathematics requires both basic skills and higher order thinking. And they believe these subjects incorporate a variety of other substantive aspects as well. There is no evidence of polarity in these beliefs, nor much evidence that teachers distinguish among the numerous ways of defining either of these subjects.

These findings present a dilemma for education reformers, for several reasons. First, these differences are not trivial. A teacher who believes that natural ability contributes to subject matter expertise may be less inclined to work hard to teach it to students. A teacher who believes students should be both tracked and grouped, and who believes that slow learners should receive minimum competency instruction, defines his task in radically different ways than a teacher who believes none of these things.

Second, these beliefs are not the product of armchair reasoning, but instead come from a vast array of personal experiences. Unlike candidates in other professions, teacher candidates have extensive experience observing members of their chosen profession. Lortie (1975) has referred to these experiences as forming an "apprenticeship of observation," and O'Laughlin and Campbell (1988) have argued that beliefs formed from personal experiences are far more intractable than other beliefs. The presence of beliefs formed through personal experiences is likely to hinder the efforts of reformers and teacher educators, in that these prior beliefs are likely to be used to interpret new information. Thus, messages from reformers and teacher educators may be misinterpreted by teacher candidates or experienced teachers who already hold views of their own. The task of reforming education, then, is not one of forming beliefs, but rather one of altering already formed beliefs.

The third reason these findings present a dilemma for reformers is that the beliefs themselves are so various. For, even if a reformer disagrees with candidates' beliefs, he or she can do a better job of changing them if they are homogeneous than if they are disparate. A reformer cannot approach his or her task by assuming that teachers, whether novice or experienced, enter their teacher education programs with a homogeneous set of beliefs. In the absence of a clear portrait of the "typical" teacher or teacher candidate, it is difficult to know where to begin one's reform effort.

The scattered pattern of beliefs among both novice and experienced teachers suggests that teachers probably form their beliefs in isolation. Whether they are observing teachers as students or practicing teaching as professionals, their experiences and their interpretations

of those experiences are highly idiosyncratic, and have not been challenged by others. The predominance of all-inclusive belief patterns could be the result of the same phenomenon. We all use contradictory folk wisdom--"absence makes heart grow fonder" and "out of sight, out of mind"--to explain different events, and rarely see the contradiction unless someone else points it out to us. Similarly, teachers may accept multiple and contradictory ideas about their responsibilities and about the nature of the subjects if they have never had these beliefs challenged.

One result of this open acceptance of all ideas might be the tendency to teach numerous topics and to teach none well. Schwille et. al, (1983) found that teachers were more willing to add new material to their curricula than to eliminate material, and Porter (1989) found that teachers teach most content for exposure rather than for understanding. Perhaps teacher educators and reformers, in their efforts to improve teaching by providing teachers with new knowledge or with new techniques, have inadvertently contributed to the current practice of teaching everything superficially and nothing in depth.

References

Ball, D. L. (in press). The subject matter preparation of prospective mathematics teachers: Challenging the myths. *Journal of Mathematics education.*

Clark, C. M., and Yinger, R. J. (1987). Teacher planning. In J. Calderhead (Ed.), *Exploring teacher thinking* (pp. 84-103). London: Cassel Educational Limited.

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

Doyle, W. (1986). Content representation in teachers' definitions of academic work. *Journal of Curriculum Studies, 18,* 365-379.

Goodlad, J. I. (1983). *A place called school: Prospects for the future.* New York: Macmillan.

Jackson, P. W. (1986). *The practice of teaching.* New York: Teachers College Press.

Lortie, D. (1975) *Schoolteacher.* Chicago: University of Chicago Press.

McDiarmid, G. W., and Ball, D. L. (in press). *The nexus of knowledge and learning: Tracking changes in teachers' understanding* (Technical Series 89-1). East Lansing: Michigan State University, National Center for Research on Teacher Education.

McDiarmid, G. W., Ball, D. L., and Anderson, C. W. (1989). Why staying one chapter ahead doesn't really work: Subject-specific pedagogy. In M. Reynolds (Ed.) *The Knowledge base for beginning teachers.* New York: Pergamon.

National Center for Research on Teacher Education (1985). *The National Center for Research on Teacher Education.* East Lansing, MI: Author.

O'Laughlin, M., and Campbell, M. B. (1988). Teacher preparation, teacher empowerment, and reflective inquiry: A critical perspective. *Teacher Education Quarterly, 15*(4), 25-53.

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

Porter, A. C. (1989). A curriculum out of balance: The case of elementary school mathematics. *Educational Researcher, 18*(5), 9-15.

Schwille J., Porter, A. C., Belli, G., Floden, R., Freeman, D., Knappen, L., Kuhs, T., and Schmidt, W. H. (1983). Teachers as policy brokers in the content of elementary school mathematics. In L. S. Shulman and G. Sykes (Eds.), *Handbook of teaching and policy* (pp. 370-391). New York: Longman.

Schon, D. (1987). *Educating the reflective practitioner.* San Francisco: Jossey Bass.

Sizer, T. R. (1985). *Horace's Compromise: The dilemma of the American High School.* Boston: Houghton-Mifflin.

Stodolsky, S. S. (1988). *The subject matters: Classroom activity in math and social studies.* Chicago: University of Chicago Press.

Trumball, D. J. (1987). On changing perspective: An examination of teachers' dilemmas. *Journal of Curriculum and Supervision*, *3*(1), 45-60.