

## PREPARING TEACHERS FOR UNCERTAINTY<sup>1</sup>

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Teaching is evidently and inevitably uncertain. No teacher can be sure how a lesson will go or what a student will learn. No one can be sure which teaching approach will be most successful with a particular group of students. Casual observation and systematic research both indicate the importance of uncertainty to the ways teachers think and feel about their work. Uncertainty is especially troubling for novice teachers. Researchers and teachers have described qualities and consequences of uncertainty. Drawing on interviews and observations, Lortie (1975) and Jackson (1968) stress the important and inevitable unpredictability of classroom life; Lampert (1985) and Berlak and Berlak (1981) detail the dilemmas that teachers must deal with routinely--dilemmas that defy resolution; Schön (1983) and Yinger (1983) characterize teaching as rich in uncertain practical problems.

Though the uncertainty of teaching is much discussed, surprisingly little has been published about the stance teacher education should take toward uncertainty. Writings about teacher education stress how much teachers can learn, rather than what to do about the uncertainties that remain. Numerous reviews describe the "knowledge base" that teachers can draw on. Essays advocate providing teachers with knowledge and skills that will help them provide effective instruction or enable them to see classrooms from a variety of perspectives. Prospective teachers themselves seem eager for solutions to practical problems of management and motivation. The residual uncertainty of teaching is an unpleasant, apparently unacknowledged problem for teacher education.

Perhaps preparation for uncertainty is implicit in teacher education practices or is discussed in internal institutional documents; published explications are, however, rare. Hence, preparation for uncertainty remains incidental to national discussions about teacher education curriculum.<sup>3</sup> This paper is

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<sup>3</sup>Scholarship--analytic, empirical, or some combination--on teacher education curriculum is comparatively scarce. Teacher educators, like other practitioners, put their energies more into doing than into talking and writing. Widespread understanding of the whats and whys of teacher education curriculum is further hampered by educators' notorious reliance on the latest fashionable jargon. Perhaps this paper is an argument in support of prevalent teacher education practice, rather than a call for change. Practices going under the names of "inquiry" or "reflective" approaches may, for example, directly confront problems of uncertainty. The wide variation in cases falling under these rubrics (see Tom, 1985) makes it difficult to tell.

Teacher education thus has its own hidden curriculum, content that is intended but not explicated. This curriculum might be uncovered, understood, and improved if more teacher educators wrote analytically about what they do and why. Zeuli and Buchmann (in press) provide one model; perhaps this paper is another.

intended to introduce the issue into those discussions, exploring what it would mean for teacher education to face the uncertainties of teaching head on. We hope that others will move the discussion farther, showing how our presentation should be extended, changed, or replaced, and indicating where preparation for uncertainty fits among the other issues to be weighed in designing teacher preparation programs, courses, and workshops.

We begin by examining the various ways in which teaching is uncertain, showing that the uncertainties of teaching are more variegated and extensive than previous authors have suggested. Teachers are (or perhaps should be) uncertain about what their students know, what effects teaching has had and will have, what content they should be trying to teach, what instructional authority they have, and how they can improve their teaching. We then consider what it would mean to be prepared for these uncertainties--what teachers should know and do.

### **Uncertainty in Teaching**

In his chapter "The Uncertainties of Teaching" Jackson (1986) discusses teachers' discomfort with uncertainty about their influence on pupils. The chapter is encompassingly entitled, yet mentions no other uncertainties. Significantly, few readers probably notice that the chapter tells only part of the story. Much of the scholarly literature (e.g., Jackson, 1968; Lortie, 1975; Schön, 1983) takes a similar partial perspective. Therefore, in discussing how teacher education should approach uncertainty, it will be helpful to draw some distinctions that will sketch the broad boundaries of uncertainty in teaching.

Uncertainty about influence arises because teachers can never be sure how student understanding is changing, let alone about whether what they do will have its desired effects on students. But uncertainty goes beyond doubts about influence. Teachers also face uncertainties about instructional content, ranging from difficult choices about what to teach, to imperfect understandings of difficult concepts, to the fragile foundations of the academic disciplines themselves. Together, these aspects of uncertainty undermine teacher authority, creating situations in which they must always weigh the uncertainty of teaching against the responsibility for guidance built into the relationship between teacher and student. They may also wonder about how they can improve their practice, including how they deal with uncertainty. These aspects of uncertainty in teaching deserve elaboration. We will begin by making some important distinctions.

Our first distinction is between uncertainty of knowledge and uncertainty about how to act.<sup>4</sup>

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<sup>4</sup>Rather than distinguishing knowing and doing, one might distinguish propositional from procedural knowledge. This would, however, obscure the difference between lacking a skill and being unclear or undecided about what goal is desired, between uncertainty about how to do what is wanted and uncertainty about what is wanted. The knowing-doing distinction should also not be confused with the fact-value distinction (if one can be made). We allow for the possibility of moral facts (e.g., that hitting students is bad).

The former is uncertainty about how to answer the question, "What is true?" It would include, for example, uncertainty about who discovered America, whether Tommy understands addition, and whether Susan will stop talking if the teacher moves closer to her. The latter encompasses uncertainty about how to answer the question, "What should I do?" It includes uncertainty about whether to give a test next week, whether to end the class discussion, and whether to move closer to Susan.

The two are linked, because uncertainty about what is true increases uncertainty about what to do. If a teacher were more certain about the consequences of approaching Susan, he or she would have a clearer idea about whether to make that move. Noticing uncertainty about action can raise awareness of uncertainty about knowledge, and vice versa. When a teacher raises questions about how much a student understands, "the answers he gives to them have an important bearing not only on what his next pedagogical move will be but also on how well he thinks he has performed his work" (Jackson, 1986, p. 57).

Our second distinction is between the uncertainty teachers themselves perceive and the uncertainty seen by outside observers (e.g., researchers, pupils). A teacher might, for example, think that the proper content of mathematics instruction is a given (i.e., nothing to be uncertain about), whereas a university professor might consider this a central problem of mathematics education (i.e., highly uncertain). In considering influence on pupils, a researcher might see even more uncertainty than the teacher does. This distinction raises obvious questions for teacher educators, for example, "Should teacher education attempt to raise teachers' sense of uncertainty, or to lower it?"

Our third distinction is one of source: From where does the uncertainty arise? Some uncertainty comes because a teacher lacks knowledge or skills that other teachers possess; such uncertainty may vanish with additional education and experience. Uncertainty about how to maintain a minimal level of classroom control is an example. Other uncertainties are common to experienced teachers, but will ultimately be eliminated as educational knowledge grows. For example, uncertainty about how children's subject-matter understandings typically develop fits this category.

Still other uncertainties are inevitable; these will always be present, for individual teachers and for the occupation as a whole. Uncertainties of knowledge are inevitable because teaching involves humans, beings who are ultimately unpredictable and unknowable. Uncertainties of action are inevitable because teaching involves essential tensions--striving for one end requires giving up on others (at least for the moment)--so that no choice of action will be clearly preferable. (See Berlak and Berlak, 1981; Elbow, 1983; Lampert, 1985.) Jackson holds that uncertainty about influence is largely inevitable, though teachers could reduce it somewhat (e.g., by asking more questions during class discussions). Classroom testing might also reduce this aspect of uncertainty, but some uncertainty about influence is unavoidable.

Each source of uncertainty suggests a different course of action for the teacher. Uncertainties

due to individual lack of knowledge call for study and practice. Uncertainties amenable to research call for attention to (and perhaps support for) current scholarship. Inevitable uncertainties call for tolerance. Teachers, particularly beginning teachers, may have difficulty distinguishing among these sources, hence may respond inappropriately--vainly struggling to banish an inevitable uncertainty or resigning themselves to uncertainties that could be eliminated. One role of teacher education may be helping teachers to recognize the sources of uncertainty. To do so requires a fuller understanding of each of the ways uncertainty enters teaching--from uncertainty about learning, teaching, and subject matter through uncertainty about how to improve one's own teaching.

### **Uncertain Assessments of Student Understanding**

Academic learning is a primary goal of teaching (Buchmann, 1984; Shulman, 1987). Hence, as Jackson (1986) points out, it is especially troubling that teachers are seldom sure what their students know and what they are learning. That skeptical claim rests on an appreciation of the limits of educational measurement and on the surprising power of children's own conceptions about subject matter.

No test is perfectly reliable and valid. Hence any nontrivial inference a teacher (or anyone else) draws from a child's test performance is open to the possibility of error. A mistake may indicate carelessness or fatigue, rather than lack of knowledge. A correct answer may be no more than a lucky guess or a fortunate misunderstanding of the question.

The difficulties of determining what students know are compounded by the powerful human capacity for making sense of situations. Cognitive psychologists suggest that the meaning in a situation is not a given to be understood in the same way by every moderately intelligent individual. Instead, individuals construct meaning, drawing on their personal, sometimes idiosyncratic, prior beliefs. The meanings different individuals construct are compatible enough to provide smooth social interactions; but the chance of significant variations makes teachers unsure that students understand an explanation in the same way the teacher does.

Studies of students' subject matter conceptions provide dramatic examples of the misassessments of student knowledge that stem from these difficulties. One especially striking case is a study of a student named Benny (Erlwanger, 1973). Benny's test results appeared to show above-average mastery of mathematics; but he had constructed a bizarre system of mathematical computation. Benny's ideas about how to compute with fractions illustrate his nonstandard interpretation of mathematics. Benny understood 1.5 to be the same as  $1/5$ . When he or the teacher's aide checked his unit tests against the answer book, Benny reconciled differences between his own understandings and the book's solutions by an expanded idea of which numbers are equivalent. Just as  $1/2$  is equivalent to  $2/4$ , he reasoned, his answer (1.5) was probably the same as that given in the answer book ( $1/5$ ). In this case,

the difference between teacher and student understanding remained invisible to both student and teacher, despite the fact that Benny was regularly tested.

Benny is an example of what is possible. Teachers are not likely to have such extreme cases among their pupils, but it is even less likely that they have a perfect picture of what their pupils know. Classroom tests provide generally reliable means of ranking students and assigning course grades. But these tests provide at best uncertain indicators of student understanding. Clinical interviews--themselves imperfect indicators of student knowledge--can show the limits of the knowledge students seemed to demonstrate on a multiple choice exam or can show that poor test performance resulted from the test format, for example, rather than from student misconceptions. Even answers given in class discussions can suggest degrees of understanding different from those displayed in an essay assignment or on a multiple-choice exam.

Uncertainty is compounded when teachers have responsibility for teaching many things to many students. An in-depth clinical interview might give a strong basis for statements about one child's understanding of photosynthesis, but no teacher has the luxury of spending an hour interviewing every student on every major concept. Moreover, some areas of knowledge are easier to assess than others (Frederiksen, 1984). While recall of important events may be readily assessed by a traditional objective examination, the ability to respond adequately to complex, changing situations (like the ones teachers themselves face) probably requires elaborate individual assessment.

Limitations of time, energy, and measurement expertise mean that teachers must get by on general indicators of student understanding. They must work with reasonable guesses about how much students understand of the topics at hand. Even the topics easiest to assess (e.g., ability to recall facts or demonstrate simple skills) can never be assessed with certainty. A correct answer may be a lucky guess or the right answer for the wrong reason; an incorrect response may stem from temporary emotional disturbance or carelessness, rather than lack of knowledge. Many important areas (e.g., ability to solve complex practical problems) may not be assessed at all.

The uncertainty in testing and grading can surprise and trouble beginning teachers. Their own teachers appeared firm and confident (even inflexible) about the grades they assigned. But when these beginners give tests or read essays, they see that the common means of assessing student understanding provide no easy path to certainty. The importance, impersonality, and finality of grading make beginners feel especially uncomfortable about this source of uncertainty.

### **Uncertain Effects of Teaching**

Even if teachers had a good idea of how much students knew, they would remain uncertain about the links between their teaching and pupils' learning and about what to do to enhance learning. Pupils' responses, both behavioral and cognitive, are affected by the range of contexts in which they live,

of which classroom instruction is only one part (albeit an important one). The lesson that has always excited students, for example, can flop with this year's class. The child whose creative writing suddenly improves may have been inspired by a parent's comment, not by the teacher's language arts unit. The student who has never completed her homework can turn in a carefully completed essay. Although teachers have some ability at guessing how students will react to a lesson or to see which things a student is learning in school, uncertainty remains. Common sense suggests that if the teacher provides clear explanations and engages students in tasks closely tied to the content to be learned, students will grasp the focal concepts. This hope is, unfortunately, often disappointed.

Systematic research on teaching can contribute to teachers' understandings of the connections between teaching activities and student learning, but it cannot provide a means to engineer classroom success. Research provides concepts that illuminate puzzling events and descriptions of the relative overall merits of different teaching approaches. But research has not permitted, and probably never will permit, accurate prediction of what *this* child will learn from *this* lesson taught in *this* way by this teacher in *this* school. Nor can it ever remove all doubts about what to do to when a pupil raises an interesting, but unexpected, point in class discussion.

Certainty decreases even further when one shifts perspective from the instruction in a single class, or on a single topic, to the education of an individual over 10 to 20 years. Rather than enhancing certainty, research has shown that the long-term effects of education are variable and unpredictable. This is driven home to teachers whenever a former student returns to testify to the tremendous importance of a lesson or comment that seemed insignificant to the teacher at the time.

### **Uncertainties About Instructional Content**

Instructional content--what teachers hope their students will learn about mathematics, history, or literature--holds several uncertainties. Take the choice of what content to cover--an uncertainty about what to do. Some bounds may (or may not) be set by explicit guidelines, available instructional materials, and agreements with other teachers. The individual teacher, however, inevitably faces important, difficult decisions about coverage and emphasis (Schwille et al., 1983). These range from, at one extreme, global choices between an orientation towards facts and rules or one toward relationships among concepts and broad understanding to, at the other extreme, whether or not to spend time on a specific topic. They run from uncertainty about what to cover today to uncertainty about how to structure an instructional unit or what units to include in a school year. Because plausible objections can be made to any curriculum choice, teachers always face uncertainty about their decisions.

Action uncertainties about what content to cover are added to knowledge uncertainties springing from teachers' own imperfect subject-matter understandings. It is no scandal that the typical high school teacher knows less than the Nobel laureate, or that the typical elementary school teacher

knows less about ecosystems than the typical high school biology teacher. Differences in content area knowledge are understandable, but they still leave teachers uncertain about the concepts they must teach, especially for topics that seemed elusive when studied in college. The range of content in the school curriculum, coupled with the relatively short time *that* content is studied by college undergraduates, implies that teachers can expect to teach some things about which their own understanding falls short of the best scholarship in the field.

Further study will not bring certainty about instructional content. The farther one goes in studying a subject, the more opportunity one has to see ongoing disputes, disputes that often run near the heart of an area, and that have little chance of resolution (Buchmann, 1984). Some scholars (e.g., Feyerabend, 1975) influenced by Thomas Kuhn (1970) would go so far as to say that the disputes will be settled by politics or charisma, rather than by appeals to reason. Scholars impose meaning on the world in a process similar to that by which children make sense of their experience. Like children, their interpretations can be influenced by personal history and local circumstance, as well as by logical argument. Scholars can take advantage of concepts and observations that have survived serious scrutiny, but they have no certainty that their interpretations will always be the most appropriate. Hence, some uncertainty about subject matter will survive, no matter how well the teaching force is educated.

### **The Teacher's Uncertain Authority**

The three aspects of uncertainty discussed above lead to a fourth aspect, an overarching uncertainty about the teachers' role as an intellectual and social authority in the classroom. Recognizing their weak intellectual footing, teachers may feel that they have little reason to contradict pupils who assert their own view of what they should be studying. Teachers are unsure about how much students already know, about what will happen if students go along with the planned lesson, and about whether the claims in the text are really the last word on the subject at hand. Who is the teacher to say what students should do or learn? The teacher has no unshakable basis for having the final say on choice of content, selection of academic tasks, or evaluation of student performance.

The intellectual authority relationship between teacher and student is further constrained by teachers' moral obligation to respect the personal autonomy of students (Strike, 1982). Because students are human, they have the right to hold opinions about matters of personal choice. Indeed, teachers often strive to foster student autonomy. Yet the teacher has a potentially conflicting obligation to help shape students' logical and aesthetic standards for judgment (Elbow, 1983). This tension between preserving autonomy and exercising authority cannot be neatly resolved (though a few superhuman teachers--Christ, Socrates--seem to be able to transcend these tensions, see Elbow, 1983); teachers remain uncertain about the course they should pursue and the appropriateness of their actions.

For beginners, uncertainty about managerial authority is more salient than uncertainty about intellectual authority. They want to be liked by their students, and may even feel more affinity with their students than with their colleagues. Yet they cannot avoid responsibilities that distance them from their students, responsibilities such as maintaining classroom discipline and assigning grades to student performance. Moreover, they often doubt their capacity to control student behavior (Veenman, 1984). The common advice of not smiling until Christmas provides a simple solution that reduces uncertainty about proper modes of action, but such simple escapes from uncertainty may not be the most appropriate ways of coping.

### **Uncertainty About Learning to Teach**

Teachers can learn as well as teach. Just as they are unsure of what their students know and can learn, teachers are uncertain about their own capacities. Students entering teacher education cannot be sure of their ability to manage a class or explain a concept. Nor can they know how much they will be able to improve during teacher preparation or the first years of teaching.

As adult learners, teachers have a large say in their curriculum (probably more than they realize). In college courses, they can choose where to put their energies, where to go beyond the course requirements, how much to seek help from faculty and peers. In their first years of teaching, they can decide whether and what to continue to study, and how and when to seek help with current classroom activities. In either case, they play a primary role in assessing their progress: What are they learning? What good will it do them as teachers or as people? How much more can they expect to learn? What can they do about their own uncertainties?

Thus teachers face both action and knowledge uncertainties about their own progress as teachers. They will be unsure of how much they know (especially in comparison to the experienced teachers they encounter), about what they are learning from their educational experiences, perhaps even about their own commitment to a teaching career. Their relative autonomy means that they face uncertain choices about what to study, whom to consult, and whether to admit their own uncertainties.

### **On Being Prepared for Uncertainty**

What should teacher educators do to prepare their students for the uncertainties of teaching? One deceptively attractive answer is that teacher educators should warn teachers of the myriad uncertainties and give them the wherewithal to reduce those uncertainties to a minimum. This "know (and smite) thy enemy" approach has advantages but is incomplete and (somewhat) misguided. Some reduction in uncertainty is desirable, so teachers should know how to reduce it by using routines and by acquiring additional knowledge and skill. The capacity for reducing uncertainty, however, needs to be supplemented with ways to cope with residual uncertainties and tempered with a critical view of the



single-minded pursuit of certainty.

### **Would More Certainty Be Better?**

Certainty has its advantages. If you can accurately predict the results of your instruction, you can choose teaching strategies that will lead more efficiently to your desired outcomes. If you understand just how you share authority with your students, you can avoid unpleasant confrontations or heavy-handed actions that inhibit children's mature acceptance of responsibility. If teachers could be more certain about the effects of different teaching approaches, they might choose instructional strategies on the basis of impact on student learning, rather than on their lack of obvious problems and their fit with current practice (Cohen, 1987).

Single-minded pursuit of certainty, however, can lead to a limited conception of education. A teacher in quest of certainty will be drawn toward factual content that can be taught by rote memorization and tested by requests for recall. Since the present is more certain than the future, a desire for certainty pulls towards a focus on immediate, obvious, specific difficulties, away from global, long-term plans and goals. Thus striving for certainty can lead to limiting teaching and education to those parts where certainty is easiest to obtain. (See Murphy, 1973, for a discussion of this phenomenon on the organizational level.)

The costs of means used to reduce uncertainty must also be considered. Teachers can reduce uncertainty about student understanding, for example, by asking more questions. The benefits in added certainty derived from questioning, however, "must be weighed not only against its potential discomfort to individual students but also against the strain it puts on the social relationships within the classroom as a whole" (Jackson, 1986, p. 69). The benefits from increasing certainty must be weighed against whatever disadvantages arise from the way the increase is obtained. Moreover, an increase in certainty need not always be a benefit. Uncertainty has virtues that are obscured by the negative connotations of the word. Suppose that instead of "uncertainty," we spoke of "openness," "awareness of possibilities," or "fluidity."

Writing about the teachers' experiences, McDonald (1986) characterizes uncertainty as the tension that lies at the heart of all teaching. This tension is an essential, driving force in teaching, which cannot and should not be removed. Uncertainty may be a vital part of all practice in all professions (Schoön, 1983). In measured doses, it may provide the tension that keeps adrenaline flowing and energizes the enthusiastic teacher. Too little certainty may be disabling, but too much certainty can lead to boredom and stagnation or to the sense that teaching is mechanical.

Teaching is in part an art, whose impact comes through interweaving the expected and the surprising. An artistic work of depth continues to reveal new facets each time one experiences it. Likewise a teaching lesson has depth if, while going on the whole as expected, it repeatedly provides

unexpected opportunities for learning. These tempering thoughts about certainty's virtues are part of what teachers should know, so that they can strike some moderate stance, rather than rooting out uncertainty wherever they find it. Achieving a good balance is difficult. Understanding the various aspects of uncertainty should help in finding the balance, as well as in reducing uncertainty.

Below we elaborate on understanding as part of preparation for uncertainty. We will then turn to ideas about how teachers can be prepared to reduce uncertainty through having routines and through knowing how (and when) to acquire additional knowledge or skill. In both cases, teachers must consider whether the benefits of the strategy (including other benefits besides added certainty) are worth the costs. Uncertainty will always remain. It may add interest and excitement to instruction, but it may also put strains on teachers and students alike. In the last part of this section, we will discuss approaches for coping with these strains. The strain on students may be reduced by maintaining an aura of certainty. The strain on teachers may be reduced by discussing uncertainties with other teachers. Both strategies themselves contain tensions that make them embody uncertainty as well as helping teachers live with it.

### **Understanding Uncertainty**

It goes almost without saying that being prepared for uncertainty includes understanding it. Apart from its intrinsic educational value, understanding is important for maintaining an appropriate stance toward uncertainty, for maintaining flexibility, and for deciding when uncertainties might be reduced through study and effort.

How much should beginning teachers understand about the uncertainties they face? Appreciating the extent of uncertainty can, after all, be unsettling. The danger of despair complicates plans for teacher preparation. Teacher educators must provide knowledge about uncertainty without suggesting that uncertainty eliminates all bases for reasoned choice. Unexamined relativism or the cynical positions that "anything goes as long as you can come up with a reason" or "nothing works, so why bother" confuse uncertainty with anarchy.

Teachers will become aware of many uncertainties on their own, especially uncertainties about student learning, about the effects of teaching, and about authority. Uncertainty about managerial authority is especially salient for beginning teachers (Veenman, 1984). Other aspects of uncertainty are less likely to be salient. Constructivist views of student and expert knowledge, for example, are at odds with the commonly held conception that children will understand anything that is clearly explained, and that the curriculum has the untroublesome character of received truth, scientifically and permanently proven. Some awareness of uncertainty seems to diminish over time. Teachers become satisfied with their ways of testing student knowledge and forget about possible (even probable) mistaken inferences about student understanding.

Should teacher educators feel satisfied that teachers are likely to recognize some uncertainties, or should they try to bring the full range to teachers' attention? Should teacher educators try to keep awareness of uncertainty from slipping completely away? Just as teachers should be moderate in their pursuit of certainty, teacher educators should probably be moderate in their efforts to raise teachers awareness of uncertainty.

Relativism should be avoided. It would be excessive and inaccurate to tell teachers that they have no basis for any aspect of instruction. Such scare tactics could lead to unnecessary discouragement and despair. Compared with a typical elementary or secondary school student, teachers know more about instructional content, including the content's worth. Teachers may not be sure of what to teach or why, but they have better grounds for assessing choices than do students. Uncertainty militates against dogmatism, but it is no excuse for anarchy. Teachers retain responsibility for pushing students toward worthwhile accomplishments, even though teachers may not be sure which accomplishments are worth most.

It is, however, desirable to let teachers see a greater range of uncertainties than they would easily discover themselves, even though this entails raising their felt level of uncertainty. Everyday classroom experience is unlikely to bring to the surface some uncertainties (e.g., about instructional content) because they do not interfere with the immediate goal of running a smoothly functioning classroom. Raising awareness of these uncertainties can draw teachers' attention to the more distant, yet still important, goals such as long-term learning that are faithful to current states of disciplinary knowledge.<sup>5</sup>

One possible teacher education compromise would be to limit attention in preservice programs to those uncertainties that would be most salient to beginning teachers. It is for these beginners that the danger of being overwhelmed by multiple uncertainties is the greatest. The existence of other uncertainties could then be introduced in inservice education.

This staged approach has two dangers. First, because the content of inservice education is often largely at the discretion of the individual teacher, many teachers might not choose to learn about uncertainty. Instruction on additional uncertainties would then be avoided, rather than postponed. Second, teachers may establish convictions of certainty that will be difficult to shake. The belief that instructional content is certain, for example, is often supported by preservice teachers' experiences of their own school instruction. If some suggestion of hidden uncertainties are not planted in preservice

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<sup>5</sup>It may be instructive to compare the case of teaching with that of public management. Public managers also face greater uncertainties than they are typically aware of. From their own perspective, these managers have little incentive to increase awareness of uncertainty. They can function well with a false sense of certainty because their success is judged by whether they can make a decision that others can be made to agree to, not by whether the decisions have close to optimal long-term consequences. From the point of view of the general public, however, it would probably be desirable for these managers to have a clearer sense of how policies might go wrong, leading them to guard against long-term evils or unlikely (but still possible) short-term disasters (e.g., nuclear accidents).

programs, they may never be able to take root.

The danger that introducing preservice teachers to additional uncertainties will lead to despair may not be, after all, that great. Formal teacher education is only one influence on teachers' learning, and perhaps a relatively weak influence. Teaching teachers about the full range of uncertainties seems a reasonable part of preparation for uncertainty.

### **Strategies for Reducing Uncertainty**

Understanding could lead to despair if teachers had no hope of reducing uncertainty to manageable levels. Fortunately, uncertainty can be reduced, though not eliminated. Much of what goes on in teacher education helps. Knowledge may increase awareness of the possible extent of uncertainty, but it also raises the absolute level of certainty. Increasing pedagogical knowledge and skill give teachers better abilities to make reasonable, rapid choices of action, to anticipate classroom events, to assess student understanding, and to find acceptable postures of instructional authority. Increasing subject matter knowledge increases certainty about instructional content.

In addition to the increase of such instructionally valuable knowledge and skill, teacher education can provide teachers with knowledge and skill especially focused on reducing uncertainty. By learning teaching routines (and learning how to generate new routines), teachers become prepared to impose certainty on classroom events and to free more attention to deal with the unexpected. By learning how and when to seek greater certainty, teachers become prepared to make long-term gains in certainty.

**Routines increase certainty.** Experienced teachers use a variety of routines in their teaching (Clark and Peterson, 1986). Drawing on ideas from information-processing psychology and organizational behavior, researchers portray such routines as adaptive responses to classroom complexities. Habitualized patterns of thought and action remove doubts about what to do next, reduce perceived complexity, and may increase the predictability of classroom events. Routines are tools for increasing certainty.

To examine how routines reduce uncertainty, we must distinguish classroom routines, which involve habitual student actions, from teacher routines, which include patterns for interacting with students and for working alone. A standard method for passing in homework would be a classroom routine; a regular procedure for planning the next day's lesson would be a teacher routine. Classroom routines reduce both felt and actual uncertainty by increasing the predictability of student responses. Once the class learns the routine, unforeseen behavior will be the exception, rather than the rule. One reason such routines are important for classroom management (Doyle, 1986) is that they increase teachers' certainty that students will do what the teacher expects.

Teacher routines can reduce felt uncertainty by simplifying options for action. When

constructing a social studies quiz, for example, the teacher might routinely write one question for each section in the textbook. The choice about what content to test is then partially determined; uncertainty is cut down to more manageable amounts. Other routines might cut it down further. In addition to reducing felt uncertainty, routines free time and attention for dealing with unusual events or individual students. They represent one way of coping with the limits of human mental capacity. If the time and attention are used to think about what students know or what they should be taught, using teacher routines could reduce actual, as well as felt, uncertainty.

Routines are not equally effective for the whole range of uncertainties. Classroom routines primarily reduce uncertainty about student responses. Teacher routines can reduce felt uncertainties across the full range of uncertainties, but actual reductions in uncertainty depend on how the freed time and attention are used. At best, a routine leads to a satisfactory outcome most of the time, with relatively little investment. A routine does not guarantee the best possible action; actions tailored to the specific situation could probably improve results. Choosing the best possible action, however, requires time and attention, both of which are in short supply. A routine can be a reasonable compromise for a wide range of situations. Routines replace optimizing with satisficing.

Though having routines reduces uncertainty, routinization is not always desirable. Routines can reduce uncertainty and complexity to manageable proportions, but having more routines does not necessarily mean being better prepared for uncertainty. Some routines may have questionable instructional results. Imagine, for example, mathematics instruction entirely composed of routines for handing out and collecting ditto sheets.

In other cases, an increase in uncertainty might seem preferable to reliance on routine; being prepared for uncertainty might mean less reliance on routine, more awareness of uncertainty. Consider, for example, the disdain sometimes expressed for teachers who reduce content selection to routinely turning the textbook page. Routines can also become so firmly entrenched that teachers continue to use them even when they are not giving satisfactory results (Clark and Peterson, 1986). To maintain responsiveness to changing classroom situations, flexibility is a desirable complement to routinization. Being prepared for uncertainty includes being flexible enough to break out of a routine when appropriate and being able to do something reasonable after abandoning the comparative safety of standard routines (Bromme and Brophy, 1986).

Unexpected opportunity, as well as unexpected difficulty, may be good reason to break with standard procedure. Absence of flexibility may lead to forgone "teachable moments" (Shroyer, 1982) or to failure to adjust to apparent improvements in student performance. It is possible

that teachers are often temporarily confused by unexpected success (simply because it is unexpected) . . . [or] that unexpected events are somehow troubling even when desirable

(because we tend to become well adjusted to and eventually to prefer what we have come to expect). (Brophy, 1983)

Some routines may be more compatible with flexibility than others. Some lesson planning routines, for example, may yield plans that depend on specific student responses for the lesson to continue or that may not allow any part of the lesson to be omitted. Such routines militate against flexibility. Once the lesson starts, the teacher has little choice but to push through to the end. Other routines may yield plans that are more "robust." They may, for example, have the lesson divided into segments, some of which might be dropped if time ran short. Teachers whose planning routines yield robust plans will have an easier time being flexible.

The other components of being prepared for uncertainty--knowledge, seeking new information, peer support, and confidence--may help the teacher react to the unexpected with an appropriate change in routine, rather than attributing the problem to self-deficiency or student problems.

**Seeking greater certainty where appropriate.** In some cases, teachers may be able to reduce uncertainty by strengthening their own knowledge or skill. This may sometimes be impossible, too costly, or too time-consuming. But, in other cases, seeking additional information from colleagues, books, or even from students can reduce uncertainty and thus permit better teaching choices. Preparation for uncertainty includes both knowing how to reduce uncertainty and knowing when to try.

One aspect of this preparedness is being alert to information that would contradict assumptions. Teachers may assume, for example, that strong performance on the textbook's chapter test indicates student understanding. Part of being prepared for uncertainty is noticing student responses (to test items, in homework or recitation, and informally) that suggest persisting student misunderstandings, and thinking through whether and how to probe student understanding further.

Another aspect of preparedness is having a sense of when it is worth the cost to work for greater mastery of an instructional topic. Teachers lack time to do that for every topic, and the best rule need not be to study the things you feel least certain about. But being prepared means entertaining the option of further study on some topics and knowing how to pursue that study. Further study might include consultation with teaching colleagues, talking with college faculty, enrolling in a special course, making a trip to the library, or calling on a knowledgeable parent.

### **Strategies for Coping With Residual Uncertainty**

Even with the help of routines and continuing teacher learning, teaching remains uncertain. A reasonable measure of uncertainty adds interest and excitement to teaching. But stress is a psychological side effect of living with uncertainty. Doubts about one's knowledge and effectiveness can add to the psychic and emotional costs of an already demanding job. Students, as well, may suffer

from feeling that their teachers are uncertain. Part of being prepared for uncertainty is having ways for reducing the stress caused by residual uncertainties. Two such strategies are discussing uncertainty with other teachers and maintaining an aura of certainty.

**Raising teachers' voices.** Authors of educational reform proposals often advocate increasing the prevalence of teachers' professional conversations. Such teacher talk may have many benefits, among them helping teachers reduce the stress of residual uncertainties. Talking to other teachers can ease the strain in three ways. First, being able to talk about one's worries and fears with a sympathetic comrade is in itself relieving. Second, talking can remind teachers that uncertainty is an essential, important part of teaching, not merely a worry and a trouble. Moreover, recognizing that uncertainties are endemic to teaching may reduce inappropriate feelings of individual failure. Third, if teachers can articulate uncertainty in conversations among themselves, they may also be able to communicate it to others, thus reducing the outside pressure for certainty.

Unfortunately, the current organization of American public schools works against this suggestion. School structure and the facts of classroom life inhibit teacher talk. Moreover, social norms discourage admission of uncertainty, treating it as a unacceptable fault. Educational scholars often reinforce this view.

Most theory about teaching--and in consequence much policy too--supposes that teaching is at best simply the rational application of means to given ends. In this light, all the ambiguity, irrationality, and conflict which teachers are used to feeling in their bones, if not used to talking about, are simply evidence of failure. (McDonald, 1986, p. 377)

Individual teachers may find it difficult to use talking as a strategy to cope with uncertainty because its success depends not only on their own willingness to talk but also on other teachers' willingness to join the conversation. The challenge for teacher education is to provide teachers with skills that will enable them to talk about their work with an initially unsympathetic audience.

Professional discussions may be discouraged by current school structures, but success stories show that the organizational barriers can be surmounted or circumvented. McDonald (1986) eloquently describes the struggles and joys of talking about teaching. In monthly meetings over beer and pizza, he and other teachers described and discussed specific incidents in their work lives. These meetings led not only to their own greater appreciation of limits to certainty, but also to essays about educational scholarship and policy through which the group broadened public awareness. This group exemplifies what increasing teacher talk might accomplish, how talking might help teachers cope with their worries in a society where intellectual tradition puts a high value on certainty (Cohen, 1986).

Discovering uncertainty when certainty is the measure of knowledge can only produce

demoralization, and perhaps paralysis of action as well. . . . But what if teachers, recognizing the uncertainty in their work, raised their voices instead of growing silent? And what if theorists recognized that intimate knowledge of this uncertainty was exactly what was missing from both their theories and the policies these theories provoke? (McDonald, 1986, p. 362)

**Maintaining a comforting aura of certainty.** The residual uncertainties of teaching can also create stresses for students. If teachers appear unsure about what to do and why, students might worry about the wisdom of letting teachers direct their efforts. Time spent agonizing about each thing the teacher does could stop all academic engagement. To maintain student confidence in instruction, teaching requires decisive action, not hesitation or paralysis.

Decisive action, however, may give the appearance of certainty. Indeed it is this appearance of certainty that deceives novice teachers into thinking that experienced teachers are sure of their students, their teaching, their subjects, their authority, and themselves. The illusion of certainty created by decisive action can help students cope with residual uncertainties. Students can throw themselves wholeheartedly into their studies if they believe in their teachers' academic and professional competence. Students' parents can likewise wholeheartedly support their children's studies. By appearing certain (or at least confident), the teacher takes responsibility for worrying about undesirable contingencies.

This aura of certainty does not mean that teachers should act as though their actions could never be questioned. Such an impression of complete assurance would be somewhat dishonest. Constant profession of doubt would, however, itself be dishonest. Teachers may not always make the best decisions, but they are right enough, often enough, to justify confidence in their decisions.

Understanding the limits of confidence means that teachers should be disposed to ask questions about what evidence stands behind the knowledge claims of experts, authorities, and curriculum materials in their fields. They should ask the same critical and analytic questions of their own knowledge and practice as teachers (e.g., What do I believe about teaching and learning? What evidence supports my beliefs? What kinds of evidence would lead me to change my beliefs and behavior?). But these questions need not be asked at every moment.

### **What About Inservice Education?**

The preceding analysis of uncertainty in teaching, and teacher education's role in preparing teachers for it, has focused on prospective teachers and preservice teacher education. Preservice is different from inservice education, in part because prospective teachers have a conception of the certainties and uncertainties in teaching that will change dramatically in their first years of experience. Preparation for uncertainty also has, however, an important place in inservice teacher education.

Experienced teachers have had many opportunities to appreciate and address uncertainty. For



teachers with habits of flexibility, collegial support, and alertness to new information, inservice education may only refine their understanding of uncertainty and suggest additional strategies for dealing with it. The habituation that comes with experience, however, tends to create a false sense of certainty. Even experienced teachers can confuse smooth performance with control, and decisive judgement with certain knowledge.

The central task for inservice preparation for uncertainty may be to remind teachers of the uncertainties they have managed to submerge under a patina of flawless classroom routines. Uncertainties about student understanding, teaching effects, and content knowledge remain. Teachers may gain managerial and psychic advantages from denying uncertainty, but they may develop inflexible habits or neglect opportunities to seek additional information, assistance, or moral support.

Experienced teachers are better acquainted with the uncertainties of teaching, yet they may still underestimate their extent or significance. The difficulty here is that experienced teachers come to overestimate the certainty of their own beliefs about learning, teaching, and academic content. Teachers may exaggerate their knowledge of what children are learning. Like-wise, teachers can be lulled into thinking that they know how students are reacting to their instruction or into thinking that they know the best way to deal with a particular child, when the situation is more complicated and diverse than they imagine. Similarly, teachers can slip into thinking that their content knowledge is more adequate than some outside observer might think. Thus, though their initial appreciation of teaching uncertainties is different from that of prospective teachers, inservice teachers may also profit from instruction or field research in their own classrooms designed to help them see, understand, and deal with uncertainty.

### **Epilogue: Preparing for Uncertainty in Another Profession**

Teachers are not the only uncertain professionals. In a classic paper, Fox (1957) describes the role of uncertainty in one medical education program. Our analysis was in many ways inspired by her analysis, and many of her insights apply to teacher preparation. Three points are especially note-worthy. First, medical students are especially dismayed when they first realize that expert physicians retain large and important areas of uncertainty. Fox describes the disorienting impact of the first post mortem in which the attending physicians cannot agree on the cause of death. The parallel recognition--that experienced teachers have less certainty than their assured actions suggest--can likewise be disorienting for prospective teachers.

Second, medical students can cope better with their uncertainties when they learn to distinguish uncertainties due their own ignorance and inexperience from uncertainties due to the limits of medical knowledge. It is reassuring to know that some of your uncertainties are shared, not only by your fellow medical students, but by the profession as a whole. Uncertainty need not imply lack of whatever it takes to become a competent professional.

Third, the transition from classroom instruction to clinical practice abruptly changes the options available for dealing with uncertainty. Structure and supports are removed, while responsibility is simultaneously increased. Students must suddenly decide for themselves whether and how to seek additional information. They have less opportunity to discuss their uncertainties with colleagues. They must also cope with the reactions that patients (and perhaps peers) have to public displays of uncertainty.

Whereas there may be similarities between the roles that uncertainty plays in medical education and in teacher education, however, there are also important differences. Beginning medical students typically believe that they have a great deal to learn from medical school. In contrast, many beginning teacher education students believe that they already know everything that there is to know about teaching. Greater consensus exists about the goals of medicine than about the goals of schooling. Compared with teaching, a far larger clinical literature exists in medicine, which can be consulted for ideas about how to deal with special situations. As in other cases where it is tempting to model teaching practice on a higher status occupation, the parallels are suggestive rather than compelling. Teacher educators should welcome any source of promising ideas, but they must weigh the available options in terms of the teacher education context. Teacher education is, if anything, even more uncertain than teaching; as teacher educators we should press forward with an aura of assurance, after weighing the odds on our own turf.

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