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AUTHOR White, Bonita C.
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ABSTRACT

This paper examines the problem that the beliefs with which preservice teachers leave colleges of education are virtually the same as when they entered. This issue is addressed by establishing that preservice teachers' belief formation regarding teaching, learning, students, and content should be a rational rather than nonrational or irrational process. The premise of the paper is that helping preservice teachers move toward developing rational beliefs about teaching, learning, students, and content involves a three-pronged approach that addresses epistemology, informal reasoning/argumentation, and metacognition. The paper shows that each level of belief formation is related to and dependent on epistemology. Epistemology, in turn, is related to informal reasoning or argumentation and to metacognition. To improve the process of belief formation or adaptation, it is necessary to address all three arenas. The three major aspects of each arena are outlined. (Contains 61 references.) (SM)

Preservice Teachers' Beliefs: Nonrational to Irrational to Rational

Bonita C. White

University of Memphis

bcwhite1@memphis.edu

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Note 2. This paper is not a finished product. I do, however, want to submit it to some journal for possible publication after it is finished. I would very much appreciate any feedback or ideas you are willing to share with me. For example, I am interested in knowing whether there are whole sections I can omit or summarize, how you react to the central premise of the paper, whether I need to review other sets of literature, or any other reaction you have. Thank you. Bonita

Introduction

Long realizing the importance of beliefs in practice, researchers have studied preservice teachers beliefs. Often finding them generally incongruent with the canons of best practice, teacher educators have variously 'treated' preservice teachers in course experiences in an effort to alter their beliefs. Overall, results have been disappointing. Some, though reporting an overall change in students' conceptions of teaching and learning as a result of course experiences (Feiman-Nemser, McDiarmid, Melnick, & Parker, 1989; Richardson & Kile, 1992) have indicated a lack of confidence in the durability or the depth of the belief change. Most report little or no change (McDiarmid, 1990; Goodman, 1988; Hollingsworth, 1989; Zeichner & Gore,1990). Some, in fact, report that existing beliefs seem to become more firmly entrenched (Feiman-Nemser & Buchmann, 1989; Zeichner, Tabachnick, & Densmore, 1987).

Largely unanimously, teacher educators have recommended facilitating preservice teachers becoming consciously aware of what they believe (Connelly & Clandinin, 1986; Munby, 1982; Russell, 1980; Shipman, 1967). Being more reflective about beliefs, they believe, will help the change process (Connelly & Clandinin, 1988; Russell, 1980). One has recommended that preservice teachers need to discover the complex system of beliefs, practice, and theory that make up the frames through which they view classroom phenomena (Barnes, 1992). Though in agreement with all these, I posit that one additional step is necessary to bring about the needed change.

The Needed Belief State

Preservice teachers should be, " . . . in control of the fundamental logical structures—the assumptions, values, and beliefs that guide actions," (Paul, 1984, p. 12) and they should be able to rationally justify them. One implication of having conscious control is that the preservice teachers monitor belief formation with regard to both external and internal influences. Likely external influences on beliefs are parents, peers, cultural mores, policy-makers, etc. Likely internal influences are bias, protection of self-interest, etc. Monitoring and controlling external and internal influences does not imply that these should be supplanted but that they should be recognized for what they are and, if chosen, chosen freely and rationally. Another implication is that the preservice teachers are free to choose what to believe. Freedom, however, is not to be taken as synonymous with license, e.g., exercise of unexamined opinion, but as synonymous with the absence of intellectual, emotional, or social repression and the presence of rationality. Paul (1984) provides the desired description of freedom,

> The ultimate court of appeal of a free and open mind is, and must be, the principles of comprehensive reason and evidence, not external authority, ego-identification, or technical expertise, the willingness to listen to and empathize with all contending perspectives on an issue without presupposing any connection between the truth and any preselected line of reasoning" (p.12).

Gaining conscious control over beliefs, indeed, was John Dewey's (1933) aim in creating the construct of reflective thinking. Dewey (1933) wrote, "Active, persistent, and careful consideration of any belief or supposed form of knowledge in the light of the grounds that support it and the further conclusions to which it tends constitutes reflective thought," (p. 9). Implicit in this description is rationality and freedom as Paul (1984).

Associated with engagement in such a thinking process is a sophisticated level of epistemology variously referred to as reflective (King & Kitchener, 1994), evaluative (Kuhn, 1992), contextual (Baxter-Magolda, 1992), and constructed (Belenky, Clinchy, Goldberger, & Tarule, 1986). Intrinsic to this level of epistemology—referred to in this paper as reflective epistemology—are a sophisticated level of metacognition and the ability to reason informally (Kitchener, 1983; Kuhn, 1998; Perkins, Farady, Bushey, 1991).

Some have written that epistemology influences the beliefs preservice teachers hold about teaching and learning (Britzman, 1986; Greeno, Collins, & Resnick, 1996; Mayer, 1985), and, indeed, it is intuitively apparent that this association is valid. The association between epistemology and beliefs about teaching, learning, students, and content has not, however, been established empirically. It is my intention to make a case for that link in this paper, i.e., it is the thesis of this paper that epistemology provides the primary explanatory framework for preservice teachers' beliefs. Further, because an empirical case has been established for a relationship among epistemology, informal

reasoning, and metacognition (King & Kitchener, 1994; Kuhn, 1998) and between informal reasoning and metacognition (Olson & Astington, 1993; Perkins, Farady, & Bushey, 1991), attaining conscious control of beliefs and doing so in a rational way implicates not only epistemology but also informal reasoning and metacognition.

To explicate the theoretical and empirical basis for the proposal that epistemology provides the explanatory fromework for beliefs, I present an overview of the research findings regarding preservice teachers' beliefs about teaching, learning, students, and content. Problem solving is described and is identified as the framework used to situate the beliefs of interest. Following that is an overview of epistemology followed by the research on college students of informal reasoning. Next are sections that include descriptions of informal reasoning and metacognition followed by the research on college students of each. Then I interpret the beliefs' preservice teachers' beliefs within an epistemological framework. Finally, I recommend ways teacher educators might work toward bringing about the needed change in belief state.

Preservice Teachers' Beliefs about Teaching, Learning, Students, and Content

Content beliefs typical of preservice teachers are that the curriculum is predetermined (Goodman, 1988), and pupils can move through it at a prespecified pace. A small number, however, challenged standardized curriculum and wanted to do their own teaching units (Goodman, 1988).

Content generally consists of propositions that can be practiced (Ball, 1989) and memorized (Black & Ammon, 1992; McDiarmid, 1990) or that can be processed in algorithmic fashion to get an answer that is definitely right or definitely wrong (Erickson & Mackennon, 1991). Teaching this content happens via didactic methods (Comeaux, 1992) of handing knowledge to students or of dispensing from a 'bag of tricks' (Rodrigues, 1993) ways to help students either to learn the propositions (Black & Ammon, 1992); McDiarmid, 1990) or to develop strategies that will function to produce right answers (Erickson & MacKennon, 1991). A few preservice teachers, however, are critical of a drill-skill routine (Goodman, 1988). Hollingsworth (1989) reported that five of 14 preservice teachers she studied modified or adapted their beliefs about teaching to make them consistent with a constructivist view. These same students gained the understanding that what pupils learn is dependent on the task in which they engage (Hollingsworth, 1989), i.e., they equated successful teaching with successful learning rather than believing as do many that successful teaching is equivalent to an improvement in grades (Goodman, 1988).

The majority of the preservice teachers in Goodmans' (1988) study viewed teachers as rule makers and authority figures invested with the power of the institution. A few, however, viewed the children as members of a community that should create its own rules and as the grantors of power. These preservice teachers wanted the children to confer authority on them (Goodman, 1988). Five of 14 preservice teachers were able to achieve integrated classroom management in which instruction and management were integrated with and complemented one another.

Preservice teachers sometimes become aware that they lack adequate content knowledge but tend to believe they will be able to adequately augment their knowledge with that in teacher's manuals (Feiman-Nemser, McDiarmid, Melnick, Parker, 1989), or they will learn enough in their methods courses (McDiarmid, 1990).

Preservice teachers typically believe that methods courses are not helpful in learning to teach (Mayer, 1985); experience, on the other hand, is critical (Book, Byers, & Freemen, 1983; Richardson & Koehler, 1988; Rodrigues, 1993). It is important for teachers to be warm and friendly (Goodman, 1988), caring and inventive (Mahlos & Maxson, 1995); they believe that pupils' self-concept is linked to teachers being 'nice' to them. Others, on the other hand, believe that self-concept is tied to curriculum. They believe that traditional curriculum ignores what students already know and implies that they are not capable of learning (Goodman, 1988). Preservice teachers typically believe information about pupils' personality (National Center for Research on Teaching, 1991) and ability (Brousseau & Freeman, 1988) are important for them to have. Pupils are viewed as submissive, compliant, and happy (Mahlos & Maxson, 1995) likely because of they view students as being like they were as students (Kagan, 1991). Unimportant are ethnicity, gender, and class (National Center for Research on Teacher Education, 1991). Failure of students to accomplish learning goals is attributed to the student or to the home (Hollingsworth, 1989).

In a study of the relationship between knowledge and beliefs, Alexander and Dochy (1994), described and compared the beliefs of college students (n=18) who were honors students in their first educational psychology course. They found that common to 50% of the students is that though beliefs can be influenced by knowledge, long-cherished beliefs cannot be swayed by knowledge. Also common was the belief that beliefs exist for which the students may or may not have knowledge (Alexander & Dochy, 1994). Similarly, beliefs can exist that have no rational support and others can exist for which the person can specify pros and cons (Voss, 1991). Explanations of the role of personal experience in the knowledge-belief relationship in the Alexander and Dochy study included both that experience could signal a drastic shift in beliefs and that experience could mediate so that knowledge did not affect beliefs. Examples of beliefs that the students held intact despite disconfirming knowledge were creationism/evolution, depletion of rain forests, homosexuality, abortion, use of steroids, and multicultural education. A sizable proportion (29%) indicated that religious beliefs were responsible for this knowledge-belief schism. Though 98% indicated that beliefs are changeable, 21% attributed change to acquired information or education while (38%) attributed change to personality traits. Interestingly, many undergraduates considered tenacity of beliefs to be a positive character trait.

Overall, the researchers (Alexander & Dochy, 1994) indicated both great disappointment and grave concern at the high level of certainty and confidence with which the students held their beliefs, at the simplicity of the explanations they offered, and at the insularity of their beliefs. The onus of this concern is for the large proportion of students who displayed these characteristics. The researchers also indicated, however, that there was as much diversity in the beliefs of undergraduates as among the graduate/faculty and the experts (both of whom were also participants in the study). This diversity and the diversity reported in the studies of preservice teachers' beliefs is one part of the basis for the thesis that epistemology provides the explanatory framework for preservice teachers' beliefs. The use of ethnographic methodology in a few studies allowed the reports of the beliefs of the minority as well as of the majority of the preservice teachers. The other part of the basis for epistemology as an explanatory framework is that the proportions of preservice teachers exhibiting desirable beliefs or accomplishing desirable change approximately parallel the different levels of epistemology--as will be described later in the paper.

Problem Structure

Our interest is in those beliefs preservice teachers hold about actions to take in problematic classroom situations, regardless of whether the arena of decision-making is instruction, students, curriculum, or management. The prescriptive view preservice teachers take about decisions relative to these actions (Black and Ammon, 1992; McDiarmid, 1990; Erickson & Mackennon, 1991), indicate that they see the situations as simple (White & Mostert, 1995; White, 2000) and answers to them right or wrong (White,2000), i.e., they view them as structured problems.

To clarify, structured problems are like those most often encountered in mathematics classrooms that can be worked using some algorithm or those found in textbooks requiring factual answers that can be obtained by reference to the printed text and can usually be copied verbatim. Structured problems have a right or wrong answer that can be ascertained by checking, and incomplete, and the consequences of actions can be far-reaching and long-lasting (Dewey, 1933). Different viewpoints exist on the same situation, and each can be based on different assumptions. The available information/evidence may be interpreted differently depending on the viewpoint, and different viable (rather than definitely right or wrong) solutions will be possible. Problematic situations in classrooms typically are ill-structured and are complex.

Ill-Structured Problems as the Context for Judgment-Making

Making decisions about ill-structured problems in classrooms requires making a judgement, a rational process, not forming an opinion, an irrational process. Shulman (1998) explains why judgment-making is one of the six commonplaces of teaching as a professional activity:

> "Life, as it plays itself out in our everyday activities, doesn't correspond to our generalizations about how the world is in general . . . if the world were regular and predictable, if either theory alone or practice alone or theory and practice in some algorithmic combination were sufficient to dictate good practice or best practice, you wouldn't need professionals. You'd need robots or folks with a little guidebook, (p. 14)
>
> He goes on to elaborate on judgment-making, "When we prepare professionals, although we teach and have them learn theory, and we teach and have them learn practice, the bottom line is, what they have to learn is judgment." (p. 14). That's not like flipping a coin" (pp.15). . . . Judgment is essentially that set of processes of reasoning, of intuiting, of deciding, of discerning, that one undertakes, in the presence of novel combinations of uncertain elements, where one must make a best estimate or decision about what to do next, (p. 14). .
>
> Paul (1984) provides an excellent description of both ill-structured situations and of the reasoning involved with making judgments about them:
>
> > Once into the ebb and flow of mundane life [as exists in the classroom], into its messy criss-crossing of categories, values, and points of view, its inevitable blending of the intellectual, the affective, and the moral, its embodying of irrationality in social practices and beliefs, there is little room for the neat and abstract procedures of technical reason [those applicable to structured problems]. What is called for is dialogic; point-counterpoint, argument for and argument against, scrutiny of individual event against the background of this or that global 'totalizing' of it into one's life (pp. 14, 15).

To reiterate, the rational way to decide what to do in response to an ill-structured problematic classroom situation is called judgment-making. Informal reasoning is the medium through which judgments are made. Because of the back

and forth weighing of relative values and likely consequences of alternative perspectives possible on ill-structured problems, the specific type of informal reasoning employed is called dialogical reasoning. Informal reasoning can also occur if the person does not consider alternative possibilities, presenting an argument for one particular view instead. Reasoning within one perspective is called monological. Both are informal because the logic in them is buried in everyday language rather than in formal propositions that follow a prescribed format (Nickerson, 1991).

Metacognition

Metacognition is often described as monitoring and adjusting 'on line' thinking. To monitor thinking implies attending to what one is thinking (the content of thought). Examples of the content of thinking are the meaning of the term prime (as in a prime number) or understanding of the theory of relativity or knowledge of the steps in reciprocal teaching. Monitoring also implies awareness of how one is thinking, (the process of thinking). Examples of the process of thinking are as general as randomly, free-association, or logically or as specific as using the IDEAL five-step method of solving problems (Bransford & Steen, 1984) or Palincsar's (1987) reciprocal teaching.

Being able to adjust 'on line' thinking implies awareness that the enterprise of thinking might occur differently, i.e., that there are alternative paths by which thinking might progress, and it implies an ability to evaluate the success of the process being used. Metacognition being done well implies knowledge of the specific purposes particular strategies serve and do not serve. Strategies can be preexisting or can be created to satisfy particular thinking needs (Tishman, Perkins, and Jay, 1995).

Though different typologies exist for metacognition, the clarity of Kuhn's (1998) makes it preferable to me. To describe what's typically referred to as metacognition, Kuhn (1998) uses the term meta-knowing. To differentiate the content from the process of thought, Kuhn uses the terms metacognitive and metastrategic respectively. What the thinker knows, whether knowing that or knowing what a particular strategy is called, what the steps are, and how to perform them are all content knowledge. Selecting a particular strategy to use and monitoring and evaluating how well it is working is metastrategic knowledge. For example, a person who is reading a passage in a book might not be understanding what he/she is reading but be unaware of the lack of understanding (no metaknowing here.) or the person may hit a snag in reading comprehension and stop to consider what to do (metacognition—awareness of not understanding). To deal with the snag, the person might stop and think about what to do next. Multiple options exist (metacognition-awareness of different strategies that can be used). The person may consider rereading the troublesome passage, doing a concept of the section of text to see if he/she can figure out what logically might have been said in the text, asking another person to interpret the passage, looking all the unfamiliar words in the passage (if any) up in the dictionary to try to determine what they might mean in this particular context, etc. The person decides to reread the section of text and see if that helps alleviate the problem (metastrategic knowledge—strategy selection). Upon rereading the section of text, the person pays especial attention to the meanings he/she is taking from the text and to the troublesome spot in particular (metastrategic—evaluation of how the strategy is working). [Note. An implicit implication is that knowledge that is metastrategic at one point in time might become declarative knowledge at some point, e.g., when something is learned to automaticity, such as—problem's wrong so automatic reaction is to check and see if it is copied down correctly. This type knowledge often becomes intuitive in experts.]

The research on the metacognitive ability of college students that will be reported here is relative to college students thinking about ill-structured problems. Kuhn (1992) reported that about 80% [averaged across two topics] of the students in her sample (n = 20 college students from two private colleges) lack the ability to think about their own thinking in terms of separating what they (inside their own head) believe to be the case about the problem from external evidence related to the ill-structured problem. Only those students who had attained what she called reflective epistemology were able to generate genuine evidence for their beliefs regarding ill-structured problems.

Educational psychologists who have investigated the relationship of metacognition to epistemology have utilized a questionnaire created by Schommer (1990) in their studies. The questionnaire consistently reveals a four-factor structure. Scores reflect some point along a continuum of epistemological dimensions. Titled from the naïve (tending toward absolutist) perspective the factors are: (a) Fixed Ability (from ability to learn is fixed at birth to the ability to learn can be improved), (b) Simple Knowledge (from knowledge is organized as isolated bits and pieces to knowledge is organized as highly interrelated concepts), (c) Certain Knowledge (from knowledge is unchanging to knowledge is evolving), and (d) Quick Learning (from learning is quick or not-at-all to learning is gradual). The knowledge utilized in the various studies is knowledge that is, in fact, inconclusive (that informs an ill-structured problem.

The more naïve college students are epistemologically, the more passive they are as learners and the more negative affect they display toward learning (Schommer, 1990; Schommer, Crouse, & Rhodes, 1992). These same students reveal a lack of cognitive flexibility and do not enjoy cognitively challenging tasks (Kardash & Scholes, 1995; Schommer, 1990; Schommer, Crouse, & Rhodes, 1992). They ignore inconclusiveness in text that would require tentative conclusions, often engaging instead in biased assimiliation, i.e., they become even more firmly entrenched in their own beliefs, digging in so to speak (McHoskey, Miller, & Dowd, 199_; Kardash & Scholes, 1995). The more students are naïve epistemologically, the more they use ineffective text processing strategies (Schommer, 1990; Schommer, Crouse, & Rhodes, 1992), failing to utilize strategies for developing awareness of textual meanings (Kardash & Scholes, 1995). They use different and more effective strategies for text that matches their beliefs than for text contrary to their beliefs, where they use ineffective strategies (Kardash & Scholes, 1995; Kuhn, Garcia-Mila, Zohar, & Andersen, 1995). These tendencies combine to affect how much and what is remembered about text and to result in more distortions of textual meanings when reporting what they have read (Kardash & Scholes, 1995).

The more epistemologically sophisticated students reverse all these tendencies, i.e., they are active learners who are flexible thinkers (Schommer, 1990; 1992) and enjoy cognitive challenge (Kardash & Scholes, 1995). They use better text processing strategies including those for developing awareness of textual meanings. They grapple with the meanings that can be obtained from inconclusive text and correctly posit tentative interpretations (Schommer, 1990;1992). Interestingly Kardash and Scholes (1995) also report that these students display more misinterpretations of text.

Informal Reasoning/Argumentation

Informal reasoning is not the type reasoning that occurs in math and symbolic logic, i.e. the individual's task is to " . . . draw logically necessary conclusions from given premises," (Johnson & Blair, 1991, p. 134), as in the example

below. It does not occur within a prescribed format that renders conclusions necessarily true; nor does it utilize a particular language and symbolic system. The following example is formal reasoning:

Every student is a learner.

Every learner experiences intellectual growth.

Therefore, every student experiences intellectual growth.

Informal reasoning is used in everyday, ill-structured situations to make an argument for a position or a point of view. It is couched in everyday language used in everyday ways. Johnson and Blair (1991) provide an excellent description of informal reasoning. "In informal reasoning the individual's task is to use his or her knowledge to identify premises relevant to a particular proposition and build plausible lines of argumentation" (p. 134) . . . It involves reasoning about causes and consequences and about the advantages and disadvantages or pros and cons of particular propositions or decision alternatives," (p. 133). Informal reasoning for argumentation purposes requires mustering all existing information (both pro and con the view to be argued for) on the issue under consideration. It involves making judgements about the relevance and credibility of each bit of information, the plausibility value it would contribute to the argument and the weigh of its overall worth to the argument.

Informal reasoning is used to build a case for a particular point of view or to evaluate evidence related to a particular point of view. Doing the reasoning required in the belief state I have specified as needed in this paper, i.e., preservice teachers are in conscious control and are able to justify their beliefs, preservice teachers need to be able to evaluate evidence. Reasoning of this ilk is not typical of adults. Rather, reasoning tends to suffer from bias and incompleteness. Bias is revealed in a tendency toward what Baron (1988) calls irrational belief persistence, i.e., the person views only one side—the favored one—of an ill-structured situation, ignoring alternate possibilities regardless of the evidence in their favor. Incompleteness is the tendency to present only part of an argument that, well done, would exhaust the possibilities for inclusion (Perkins, Farady, Bushey, 1991; Voss, 1991).

Research on the reasoning of college students regarding ill-structured problems is scanty. Perkins (1985) attributes this scantiness to the difficulty of evaluating informal reasoning He undertook the investigation of informal reasoning of first and fourth year high school, college, and doctoral students. His findings are reported here regarding our population of interest—college students. Perkins (1985) determined that six scales measured quality of reasoning without overlap: number of sentences in the reasoned episode, number of lines of argument [different ways of arguing for the point of view], number of objections [indications of what might count against the viewpoint being argued for], prompts [number of times the interviewer had to prompt the subject to return to the question being responded to], explanation [clarification of the logic by which the line of argument supported the point of view], and rating [an holistic rating by the judges of the argument taken as a whole]. He obtained disappointing results. The college students gain in informal reasoning from the first to the fourth year was borderline significant only in explanation. Interestingly, The change in lines of argument was 0.3 (about one-tenth of a line of argument for each of three intervening years) and in objections was 0.1 (not even a tenth of an objection to the favored point of view for three years of college!).

Baron also addressed the issue of objections, though he referred to them differently. What Perkins (1985) called objections, Baron (1991) called two-sided. Relative to one and two-sided arguments, Baron (1991) found through

a series of studies that college students believe two-sided reasoning to be no better than one-sided as long as the examples of reasoning they are judging are equally long, i.e., as long as one-sided are not shorter than two-sided (Baron, 1991). He (Baron, 1991) indicated that though quality of reasoning is correlated with intelligence, belief in two-sidedness is indicative of no more intelligence than belief in one-sidedness. He concluded that students may even be using their intelligence to better bolster their one-sided view. Some tangential evidence for this view was presented in the research on the metacognition of college students, i.e., that the more epistemologically sophisticated students were more likely to misinterpret text than those who were naïve (Kardash & Scholes, 1995). Other tangential evidence is that freshmen and sophomores (n = 784) consistently reported a disinclination toward truth-seeking (Facione, Sanchez, & Facione, 1994). Truth seeking was defined as, " . . . being honest and objective about pursuing inquiry even if the findings do not support one's self-interests or one's preconceived opinions" (p. 7).

White (1998) also reported on arguments in terms of one and two-sidedness/objections, though she used the words pro and con to indicate whether the parts of the argument were for or against the chosen stance or one of the three remaining possible stances not chosen. She indicated that 59% of the preservice teachers argued only for their chosen stance, 9% argued for their chosen stance and gave one reason why the other three possible stances were not 'best,' 18% argued for their chosen stance but also included its negative aspects (objections or other side), and 14 % argued for a chosen stance by presenting evidence for and against all four possible stances. White (1998) speculated that the students who argued for their chosen stance and gave one reason why the remaining three possibilities were not 'best' were, in essence, proving their case—in the sense of proving as it is used in mathematics. They were using an informal form of the Law of the Excluded Middle from formal logic which holds that if there are four possibilities (a, b, c, d) and if possibilities a, b, and c can be eliminated, then d must be the answer. In like manner, a second (of four) categories of students presented their chosen stance but also included its negative aspects. These students used monological reasoning so that, in essence, they constructed a proof that established their view as the best, even though it was somewhat flawed. These students, she surmised, had no need to tell why the other possibilities were less good than their chosen stance because they had 'proved' their stance best. The students in the third category argued pro and con each possibility. They utilized dialogical reasoning to establish their point of view as best and did so very well indeed. Those in the fourth category argued for their own view only. These students simply described the stance they favored.

Investigating correlates of the quality of informal reasoning, Perkins (1985) found that the largest contributor to informal reasoning is intelligence and a borderline contributor is education. Using results of a series of related studies, Perkins, Faraday, and Bushey (1991) reported that informal reasoning is related to training in metacognitive skills and to training in reasoning skills. Perkins (1985) indicated that college students perform better on informal reasoning tasks if scaffolding is present to guide their thinking. Questions eliciting objections or other side points are more likely to occur if asked for and additional lines of argument are more likely to be given if students are asked if there are any other reasons they would like to give.

Both Kuhn (1992) and White (in review) provided the needed scaffolding. Kuhn interviewed students and probed for complete answers. White (in review) included in the assigned task investigation of pros and cons all four

possible stances with respect to a set of class-generated criteria. Both report on the evidence students use in their arguments but do so in somewhat different typologies. Kuhn judged genuine evidence as being a type of covariation. She reported reported that 60% of the college students in her sample [including current juniors and seniors, masters level and some PH. D. level participants] were able to generate genuine evidence [some form of covariation] on the problem, i.e., they were able to justify why they believe what they do. These adults had the metacognitive ability to separate their beliefs about the ill-structured problem from evidence bearing on the problem while the remaining 40% did not have that ability. Kuhn (1992) reported that reasoning is related to epistemology.

White (in review) judged evidence productions students used in arguing for a chosen stance on an ill-structured problem in terms of the type of informal reasoning used. She reported that 10.5% of the preservice teachers used dialogical reasoning and 36% used monological reasoning as described above (for a total of 46.5% using genuine evidence), 19% used evidence by illustration or example [equivalent to Kuhn's (1992) pseudoevidence], and 33% used nonevidence, i.e., they justified their chosen stance only by citing information and substantiating it with statements of personal belief.

Helping students learn the skills of reasoning for the purpose of problematizing and evaluating their own beliefs and being able to justify why they believe what they do also would require that they agree that the desired standards for evaluating reasoning are appropriate and best. It cannot be assumed that preservice teachers will adopt the standards propounded by teacher educators. People set their own standards for reasoning (Baron, 1991). For example, one person may believe that thinking often leads to better results while another may believe that quick decision-making is a sign of wisdom or expertise; one may believe that there is nothing wrong with being undecided or uncertain for a period of time while another may believe that being open to alternatives leads to confusion or despair or causes one to betray some belief; one may believe that difficulties can be overcome by thinking while another may think that truth is determined by an expert and that we have no influence on the happenings of life (Baron, 1991. Because people have personal standards for thinking changing thinking may require changing the standards of thinking.

The standards that would be requisite for bringing about the belief state specified in this paper are disposition-oriented. Dispositions, or enduring tendencies or habits of thinking, needed are:

- the disposition to problematize the accepted and to do so with "wholeheartedness" Dewey (1933) that are likely to lead the thinker to an understanding that different value and belief systems tend toward ends that either are in conflict with one another or that subjugate the interests of one group to the interests of another (White, in review).
- the disposition to actively seek engagement with controversies between competing value and belief systems (Paul, 1984).
- the disposition to "mindfulness" in thinking, i.e., an open state paired with a tendency to view phenomena from different perspectives thus drawing novel distinctions (Langer, 1993),
- the disposition toward fair-mindedness and objectivity that will enable the thinker to separate self interest or bias from the idea being considered, (Perkins, Faraday, and Bushey, 1991),

- the disposition to reason clearly and carefully that will enable the thinker to be thorough and precise, and to remain alert to possible error (Tishman, Perkins, & Jay, 1995).

Below I present epistemology-related information. Researchers have learned about the epistemology of different groups of people: children, adolescents, adults and have learned about epistemology of teachers in different subject areas, e.g., social studies, mathematics, literacy. The epistemology of interest and reported here is that of preservice teachers. We include no subject areas except reading for preservice teachers. Reading and interpretation of text, particularly inconclusive text, is of great importance in the education of preservice teachers because they are expected to acquire knowledge and form judgments from reading such text.

Epistemology

Researchers have investigated epistemology by looking at beliefs people hold about ill-structured problems such as whether the ancient Egyptians had the technological knowledge to build the pyramids (King & Kitchener, 1994) or why children fail in school (Kuhn, 1992). Both report that the beliefs adults hold about the certainty of knowledge and the process of knowing lie on a continuum.

At one end is the belief that knowledge is certain and comes from authorities. The world is unambiguous. Problems are viewed a simple and as having one right answer. People at this end of the continuum, frequently called absolutists, tend to accept without question those everyday precepts prevalent in the culture in which they live. Knowledge, for absolutists, is free of context, i.e., what counts as knowledge holds true across situations and across people.

At the other end of the continuum are reflective people who believe that knowledge related to ill-structured problems is uncertain, tentative, and subject to change. The world is viewed as ambiguous, problems occurring in naturalistic settings are conceived as ill-structured. Multiple possible solutions exist for such problems that can be judged in terms of worth relative to a desired outcome. Judgment is based on reasoning with the available information using criteria such as weight of the evidence, fit with the data, or utility of the solution. The reflecting individual knows that such judgments are subject to change with the advent of additional information. "They see the weighing of alternative claims in a process of reasoned debate as the path to informed opinion, and they understand that arguments can be evaluated and compared based on their merit (Kuhn, 1992)."

In between these extremes are relativists. Having come to be aware that different experts have different positions about the same issues, they conclude that a single right or wrong answer does not exist. They reasonably decide that experts who obviously don't know for sure must be operating on opinion. That being the case, the opinion of any person is as good as that of a 'so called' expert. Relativists believe knowledge is very uncertain, i.e., what counts as knowledge varies from situation to situation and from person to person.

Research that informs teacher education is scanty and is reported using different scales and different labels for the gradations of the scales. In addition, those researchers reporting on obtaining epistemology from a series of ill-structured problems (King & Kitchener, 1994; Kuhn, 1992; Ross, 1989) indicate that college students reason primarily but not exclusively at one stage/level. King and Kitchener (1994) have linked reflection to cognitive development and

have reported reflection of college students in terms of a seven-stage model with college students appearing on a small portion of that scale. Stages 1-3 are pre-reflective; stages 4 and 5 are quasi-reflective; stages 6 and 7 are reflective. Freshmen are typically at stage 3.6 while seniors are typically at stage 4. Stage 3 students believe knowledge is absolute or only temporarily uncertain. They judge the worthwhileness of information/evidence about ill-structured problems (for which knowledge is temporarily uncertain) based on whether they agree with it or believe it, indicating that if they hear something that they like, they will take it as fact. By the same token, they are forced to acknowledge that others do the same thus hold equally credible beliefs about the ill-structured problem. Stage 3 students are not able to separate (metacognitively) their own beliefs and external evidence relative to an ill-structured problem. Stage 4 students see knowing and justification as person and unassailable. They cheerfully acknowledge differences among people's beliefs and feel perfectly justified in selectively choosing from existing information/evidence whatever will advance their own cause. Stage 4 students are beginning to be able to differentiate their own beliefs from evidence bearing on their beliefs, but they do so sporadically, falling short of evaluating evidence and adjusting their own beliefs whenever appropriate (King & Kitchener, 1994).

Judgments of the quality of the justifications students gave for their beliefs were implicit in the descriptions King and Kitchener gave of justification for knowing. Among the standards they used to judge judgment are some that are obvious, e.g., tendency to remain open to uncertainty, objective use of evidence, tendency to view ill-structured situations from multiple perspectives, ability to weigh pro and con evidence. Implicit in their stage theory is that higher levels of epistemology are accompanied by increasingly better informal reasoning.

Reporting on the epistemology of college students who were juniors and seniors, Kuhn (1992) indicated epistemology in terms of three major demarcations: absolutist (n = 33%), relative (n = 34%), and reflective (n = 22%) (these are averages across the three topics Kuhn used in her study). She further reported that college students were somewhat more likely to show reinforcement and assimilation of evidence [these are roughly equivalent to King & Kitchener's stages 4 and 3 respectively] than the absence of epistemological reflection.

Ross (1989) devised a three-level scale tailored for the preservice teachers whom she studied. The study was conceptually based on King and Kitchener, though she also took into account the one descriptive of females described by Belenky, Clinchy, goldberger & Tarule, (1986). Ross indicated that the highest level of reflectivity she attained (Level 3 in her typology) was roughly equivalent to King and Kitchener's level 4. Ross did not report her findings in terms of levels for individual students [probably because students scored on multiple levels of the five papers Ross analyzed]. Ross did report that four students were predominantly low (absolutist) and none were predominantly high. Instead of reporting on individual students, Ross reported on percentages of papers analyzed that fell into each of the three levels. Forty-four percent of the papers were Level 1 (roughly equivalent to absolutist), 34.4% were Level 2 (roughly early relative), and 22% were Level 3 (roughly later relative). Ross did not report on the use students made of evidence.

White, (2000) devised a five-level scale tailored for the preservice teachers she studied. To validate findings, she triangulated instances of epistemology gathered from students reports on three different types of ill-structured problems. Again, the work was conceptually based on the work of King and Kitchener (1994). She reported on certainty

of knowledge, predictability of consequences, view of problematic situation, alternative of choice, source of knowledge informing choice of alternative, and justification for choice of alternative in terms of whether the preservice teachers would follow an alternative of their own devising, one recommended by an expert, or one recommended in a textbook. The preservice teachers responses fell into five categories: Departing Absolutist (n = 2), Intuitive Relative (n = 3), Selective Relative (n = 10), Informed Relative (n = 2), and Reflective Relative (n = 3). Departing Absolutist is roughly equivalent to King and Kitcheners' Level 3.5; Intuitive Relative and Selective Relative are roughly equivalent to Level 4 and Informed Relative is roughly equivalent to Level 5, and Reflective Relative is roughly equivalent to Level 6.

Sprinthall, Reiman, & Thies-Sprinthall (1996), indicating that epistemology is one component of cognitive development, have reported on preservice teachers in terms of an external orientation (roughly absolutist and an internal, autonomous orientation (roughly reflective). They report that concretely oriented preservice teachers are resistant to 'coaching' or 'guided reflection' that encourages them to link theory with practice. Abstractly oriented preservice teachers, on the other hand, are more autonomous and willing to engage in 'guided reflection' activities. My best estimate based on my own research and on the epistemological findings presented above is that approximately 10% of preservice teaches display characteristics of absolutism and reflective thinking, about 50% cluster in the middle, and the remainder are somewhere in between.

Epistemological Scenarios followed by Metacognition. Informal Reasoning, and Preservice Teacher Beliefs

The following is a description of how a preservice teacher at each of the three major levels of epistemology might think about an ill-structured problem that is a normal occurrence in the classroom. Using research findings about the epistemological levels preservice teachers display, the three scenarios I present will represent the thinking that is typical of preservice teachers (the approximate 50%) and the thinking that represents the extremes (approximately 10% absolutist and approximately 10% reflective). To enable comparison of the differences in reflective epistemology (the desired level and the one commensurate with rational beliefs) and the remaining levels, I will present the thinking of the upper extreme first (Reflective Relative), followed by the typical (Selective Relative), and, finally, the lower extreme (Departing Absolutist). Preservice teachers at the Reflective Relative level show some, but not all, of the characteristics of Reflective thinking described in the information on epistemology above. Selective Relative are far less uncertain than those who are completely relative, but, I believe, are typical of preservice teachers. Departing Absolutist, likewise, are just beginning to understand that there are not black/white or right/wrong answers for every situation, but they retain that belief for many situations. Often the thinking will be documented with preservice teachers' comments I have reported elsewhere.

In each scenario I present the views typical for the level of epistemology in terms of certainty of knowledge related to ill-structured problematic situations, beliefs about the knowledge of 'experts' like teacher educators or the knowledge contained in textbooks, and view of the problematic situation in terms of complexity or simplicity. Following each scenario I will briefly bring to bear on the scenario relevant research on metacognition, informal reasoning, and preservice teachers' beliefs about teaching, learning, students, and content.

It's important to remember that gradations exist between the categories described here. Also important to remember that the epistemology of any one student will likely not exactly replicate what is presented as typical

Reflective Relative and Nearly Reflective Relative Epistemology

Preservice teachers who are Reflective Relative or nearly so in epistemology have come to grips with the uncertainty of knowledge related to ill-structured situations. They readily agree that, "There's always a possibility that the alternative won't turn out like you think it will because outside factors are possible to come in, but you can make an educated guess." (2 p. 10) These students also have a healthy respect for the knowledge of 'experts' (such as teacher educators) and textbooks. They likewise have a wholesome knowledge of the strengths and weakness of each. Speaking of experts one student says,

> "I would hope that an expert would have a good understanding of students at that age and their research as far as commonly how students will react to certain things—they would be able to do that. But, again, I can see justifying, well, they don't know my own classroom. They look at this environment differently. I would think that being an expert, they would take that into account, but without being there for the length of time that I had, they wouldn't understand the complexity of the classroom. That's the only reason I could see that maybe they wouldn't know." (1 p. 7)

Speaking of the credibility of textbooks, another responds, and, at the same time, compares textbooks to experts.

> "Maybe somewhat of an expert as far as research [in textbooks], but again an expert would be better because they've gone into the classroom and looked at it where this source [the textbook] has not. But, I still really think there's a lot as far as human behavior can be compared very easily in many instances, therefore, I think that studies . . . the information I would have gotten from them could be compared to my classroom.

Armed with the confidence that they are able to peruse a set of alternatives for action and make an educated guess at outcomes and having considerable confidence in the knowledge of experts and of textbooks, these students nevertheless seek information from other sources. Another student explains her quest for knowledge relative to the classroom,

> "You can use any type of anything you have learned: past experiences, input from other teachers, and I think you can come pretty close to hitting the nail on the head [being able to predict outcomes of alternatives for action], but I'm sure there's a time when you could miss. (11, p. 18)

The students in this category do indeed view the classroom as complex, as one indicated above. In response to how they might decide from among a set of five alternatives, they list a lengthy set of criteria they would use, and they prioritize the criteria. Their criteria reveal that they are able to view the ill-structured problem from multiple perspectives and in terms of differential effects of various alternatives. In addition, these students consider solving the problem without causing more problems and indicate that they are operating out of a definite belief system. This stance is what Perry (1968) called Committed Relativism and others have called Principled Rationality. Following is a listing of one students criteria for choosing an alternative,

- " . . . fairness among students. . . there isn't special treatment"
- "How I would see it [alternative] being able to work. Is this alternative going to work?"

- "My ability to implement the plan."
- "How many other people are involved, other than just students. So that takes in administration approval sometimes, or if it takes more than that, e.g., city council."
- "Is it feasible for the students where they're at—for their abilities (mental and emotional) and attitudes and for where the environment is at for change to take place?"
- "Long term or short term effects, or being able to put it into a classroom without altering major things or disrupting them."
- "... adverse effects of alleviating the problem like if I ... like a lot more problems I could have created by solving this one. I need to have a clear understanding of the problem so I can know if it [the alternative] worked." (1 pp.2-5)

These Reflective Relative preservice teachers have attained a sophisticated understanding of which things are certain and which are not. They view classroom phenomena as complex and correctly identify the weaknesses of textbook knowledge. They value knowledge and utilize multiple sources of knowledge to obtain information about the classroom. They have learned to grapple with tentativeness. They clearly have the metacognitive ability to not only to separate their beliefs from external evidence on them but are able to evaluate at least two of the sources of evidence (experts and textbooks). In addition, the students in this category typically have a sophisticated level of informal reasoning about problematic classroom situations. Some reason dialogically, considering all the pros and cons of their preferred as well as alternative possibilities and do so by utilizing all the information they have at their disposal. Others (probably those who are nearly relative) reason monologically. These latter students, however, typically argue only for their chosen stance so they may be using their intelligence to bolster their one-sided view (Baron, 1991). They clarify the criteria upon which they base their judgments and elucidate their value systems (White, 2000). Kuhn (1992) labeled this level of epistemology reflective epistemology because they are able to generate genuine evidence for their beliefs regarding ill-structured problems.

These preservice teachers are also described as abstractly oriented preservice teachers who are autonomous and are willing to engage in 'guided reflection' activities (Sprinthall, Rieman, &Thies-Sprinthall, 1996). Active learners and flexible thinkers (Schommer, 1990; 1992), they enjoy cognitive challenge (Kardash & Scholes, 1995). They use better text processing strategies including those for developing awareness of textual meanings. They grapple with the meanings that can be obtained from inconclusive text and correctly posit tentative interpretations (Schommer, 1990; 1992). Interestingly Kardash and Scholes (1995) also report that these students display more misinterpretations of text, and Baron (1991) indicates that they may use their intelligence to bolster their one-sided view of problematic situations.

In terms of beliefs these preservice teachers are the ones who modified or adapted their beliefs about teaching to make them consistent with a constructivist view (Hollingsworth, 1989), and challenged standardized curriculum, wanting to do their own teaching units (Goodman, 1988). They were critical of drill-skill (Goodman, 1988) and the ones who believe that self-concept is tied to curriculum. They believe that traditional curriculum ignores what students already know and implies that they are not capable of learning (Goodman, 1988).

These students epitomize, in my judgment, qualities desirable of teachers and they show promise of being able to attain the desired belief state, if, indeed they have not already attained it.

Selective Relative Epistemology

Preservice teachers who find themselves in a world filled with constant change tend to view ill-structured problems in fairly simple ways (Alexander & Dochy, 1995; White & Mostert, 1995; White, 2000). The criteria they use to choose an alternative for action to take are:

- fit with the situation,
- whether the teacher is comfortable with the alternative,
- whether the students will benefit from it, and, occasionally,
- whether it will have differential effects on students or whether it is logistically feasible (White, 2000). They believe that pupils are in a state of change, which causes difficulty, but is not insurmountable. A student explains the effects of change on pupils,

"Kids are changing all the time, constantly. That's why it's hard to say that there is one thing that is right . . . One semester you could have a kid who's [using] inductive reasoning and the next semester they'll be [using] deductive and you won't know how to plan for them or handle [them]." He continues, "There are new truths and new rights and wrongs for that kid so what are you going to do? I don't think you could say that the old stuff is right [just] because it worked before." (8 p. 25)

Faced with this degree of change in pupils, these preservice teachers are unable to predict the likely outcome(s) of different paths of action—which makes selection of an alternative for action somewhat problematic. Given a set of alternatives from which to select a course of action, they separate alternatives into 'more likely' and 'less likely.' To further narrow the list of 'more likely' alternatives, they combine what they call 'good' parts of alternatives. To assemble their plan, they speak of perusing the alternatives for clues that indicate it has previously been used. Unable to predict consequences and having eliminated negative possibilities, these students use experience to determine efficacy. If an alternative has been tried and has held up, it must be good. Holt-Reynolds (2000) echoes the tendency to eliminate the negative when she describes preservice teachers who are, " . . . far more articulate about what to avoid than they are specific about what they imagine instead" (p. 1).

Concomitant with their faith in experience as a criterion for weeding out negative alternatives, these students indicate a wariness of experts (such as teacher educators) or textbooks, though experts are regarded more highly than textbooks. They believe that experts do have something of value to offer but are lacking knowledge of the particular situation. That being the case, they indicate they would listen to an expert and would, probably combine it with what they thought best to do. Textbooks, however, fare less well. A student explains the sentiment of the group, and at the same time reveals the logic of her point of view. Note that she appears to believe that educational theories can be disproved by one counterexample.

> I'm sorry, no. If kids were as easy to read as textbooks, we would all just be, 'Okay, we've got this solved right here.' No way. There's always going to be some margins. They may have a great idea, and they

have more input because they have studied all this, but, you know that there's going to be that kid out there who just blows all that into the trash! There's no way. No. (14 p. 35)

Another student relates beliefs she shares with others about the truth value of textbooks and the idiosyncratic use she would make of them. This student appears to be displaying irrational belief persistence (Baron, 1988), i.e., she selectively decides from the available evidence what to take and what to leave behind if she does not agree with it.

I guess I don't always agree with textbooks so I . . . If I saw they had good ideas and they could add stuff, I would take that information, but I wouldn't necessarily do it by the book. I would definitely use information and the knowledge that I have learned from reading something and use it to my advantage, but I don't think that I would go step-by-step with it. (13 p. 31)

Once they choose an alternative to follow, these students are cognizant that adaptability and persistence on the part of the teacher is valuable, and possibly necessary to get the alternative to yield the desired results. The only way one alternative can ever be definitely determined better than another is to try all alternatives and compare the results. At the same time, it's important to realize that the students in this category not only feel free to choose what to believe, they also feel the responsibility of having to choose what's important and of trying to decide what actions to take to resolve an ill-structured problem.

In choosing what to keep and what to leave behind and insisting that trying the alternatives and comparing results, the students in this category appear to be developing the metacognitive ability to separate their beliefs from evidence on their beliefs. They are only partially successful as they are still unable to view beliefs and evidence as entirely separate entities (Kuhn, 1998) as illustrated by their proclivity toward irrational belief persistence (Baron, 1988). In terms of argumentation, they tend either to present an illustration or example to substantiate their viewpoint or they use informal reasoning but do so only with selected (rather than all available) information (White, in review).

Note. I have placed research findings related to epistemology (derived from Schommer's (1990) Epistemology Questionnaire under Departing Absolutist because they are expressed in terms of the more naïve students are-, the more concrete students are-, the more naïve epistemologically students are-, etc. Because the findings are correlational, they address extremes and are more descriptive of Departing Absolutists and the students who are close by them on the epistemology continuum than they are of the students in this category.

Findings about beliefs are expressed in terms of typicality—which makes them a direct match for this category of epistemology. In terms of beliefs about teaching, learning, students, and content, these preservice teachers believe curriculum is predetermined (Goodman, 1988), and pupils can move through it at a prespecified pace. They sometimes become aware that they lack adequate content knowledge but tend to believe they will be able to adequately augment their knowledge with that in teacher's manuals (Feiman-Nemser, McDiarmid, Melnick, Parker, 1989), or they will learn enough in their methods courses (McDiarmid, 1990). The majority viewed teachers as rule makers and authority figures invested with the power of the institution (Goodman, 1988).

The content students should learn consists of propositions that can be practiced (Ball, 1989) and memorized (Black & Ammon, 1992; McDiarmid, 1990) or that can be processed in algorithmic fashion to get an answer that is definitely right or definitely wrong (Erickson & Mackennon, 1991). Teaching this content happens via didactic methods (Comeaux, 1992) of handing knowledge to students or of dispensing from a 'bag of tricks' (Rodrigues, 1993) ways to help students either to learn the propositions (Black & Ammon, 1992); McDiarmid, 1990) or to develop strategies that will function to produce right answers (Erickson & MacKennon, 1991).

Preservice teachers typically believe information about pupils' personality (National Center for Research on Teaching, 1991) and ability (Brousseau & Freeman, 1988) are important for them to have but ethnicity, gender, and class are not (National Center for Research on Teacher Education, 1991). It is important for teachers to be warm and friendly (Goodman, 1988), caring and inventive (Mahlos & Maxson, 1995) because pupils' self-concept is linked to teachers being 'nice' to them (Goodman, 1988),

Preservice teachers typically believe that methods courses are not helpful in learning to teach (Mayer, 1985); experience, on the other hand, is critical (Book, Byers, & Freeman, 1983; Richardson & Koehler, 1988; Rodrigues, 1993). Successful teaching is equivalent to an improvement in grades (Goodman, 1988). Failure of students to accomplish learning goals is attributed to the student or to the home (Hollingsworth, 1989).

Departing Absolutist

Preservice teachers are rarely, if ever, completely absolutist in their epistemology. Rather they show absolutist tendencies in some arenas but not others. For the most part Departing Absolutist preservice teachers view knowledge as external, as given, as factual, and answers/solutions to be right or wrong. They tend to be mostly unaware of areas of ambiguity or 'grayness.' Delineating areas of certainty and areas of less certainty certainty, one student explains,

> If it's something really specific like some kind of teaching strategy, then I think a person could decide pretty easily which one was the best. [But] it could be another situation like a multicultural classroom and maybe one might not be the best or would work. (4 p. 20)

Departing absolutist preservice teachers have a starkly simple view of problematic classroom situations. In trying to decide on an alternative to pursue in a problematic situation these students search for something that will work. That's it. They tend to situate problems either in the students or in the teacher (Wade & Moje, 1997; White, 1995). The teacher, in their view, is the authority. "Asked if a high school student would be more likely than a college students to 'believe exactly what you say,' Amber responded, "Exactly, Because of the fact that I am the teacher" (Holt-Reynolds, 2000, p. 6). Concomitant with their level of certainty, departing absolutist preservice teachers feel pretty confident that they can predict the outcomes of different alternatives they use in the classroom, prior to implementing them. One student displays her confidence, "You can just tell listening to them, 'Well, is that going to really fit my classroom or not?' You can just listen. You don't have to do it." (20 p. 35) The students in this category tend to respect those in authority or who have attained the status of expert in their eyes; they both identify teachers as experts. They tend to have a source of authority on which they depend. For one it is the textbook; for the other it is other teachers. Neither indicate that they would 'go against' the recommendations of their chosen authority. Experience looms big in terms of credibility for the students in this category, thus, teacher who has five years

experience is a better source of knowledge [is more expert] than one that has three years, and all teachers are better than they.

The preservice teachers at this level of epistemology live in a top down/bottom up world. They subjugate themselves to those they consider authorities or experts and expect their students to be subjugated to them. They make the rules in their classroom and expect students to obey them without question because, "... I'm the teacher and I said so." They appear to be completely unable to separate their beliefs from external evidence on them. Asked to make an argument for a point of view, they cite portions of text or their notes and substantiate their stance by saying that they believe what they are saying. They appear to believe that citations of information paired with a statement of belief create an argument (White, in review)

Note. In reading the following, it is important to remember that the extremes of the descriptions apply more to Departing Absolutist preservice teachers and that most preservice teachers are considerably less resistant, naïve, passive, etc., i.e., are more like the Selective Relative preservice teachers described above. At the same time, there are a distinct group that likely are Departing Absolutist and that do indeed become entrenched regarding their beliefs.

These preservice teachers are described preservice teachers are more concretely oriented and are resistant to 'coaching' or 'guided reflection' that encourages them to link theory with practice (Sprinthall, Rieman, & Thies-Sprinthall, 1996). In terms of epistemology, the more naïve they are are, the more passive they are as learners and the more negative affect they display toward learning (Schommer, 1990; 1992). These same college students reveal a lack of cognitive flexibility and do not enjoy cognitively challenging tasks (Kardash & Scholes, 1995; Schommer, 1990; 1992). They ignore inconclusiveness in text that would require tentative conclusions, often engaging instead in biased assimiliation which leads them to become even more firmly entrenched in their own beliefs (Lord, Ross, Lepper, 19--; Miller, McHoskey, Bane, & Dowd, 1993; Kardash & Scholes, 1995). The more college students are naïve epistemologically, the more they use ineffective text processing strategies (Schommer, 1990; 1992), failing to utilize strategies for developing awareness of textual meanings (Kardash & Scholes, 1995). They use different and more effective strategies for text that matches their beliefs than for text contrary to their beliefs, where they use ineffective strategies (Kardash & Scholes, 1995; Kuhn, Garcia-Mila, Zohar, & Andersen, 1995). These tendencies combine to affect how much and what is remembered about text and to result in more distortions of textual meanings when reporting what they have read (Kardash & Scholes, 1995).

Note. In terms of teacher beliefs, in this group are those student who tend to become intractable about maintaining existing beliefs. It cannot be assumed, however that every preservice teacher in this category is inflexible about their beliefs. Some are here because of particular developmental patterns that place them 'behind' their peers.

Conclusion

The problem I intended to address in this paper is that the beliefs with which preservice teachers leave colleges of education are pretty much the same as when they entered. I wanted to address that issue by establishing that preservice teachers' belief-formation regarding teaching, learning, students, and content should be a rational rather than nonrational or irrational process. Departing Absolutist preservice teachers' beliefs are nonrational because they are accepted without question from the reigning authority or expert—most likely the principal or a fellow

teacher who has x number of years of experience. Selective Relative preservice teachers' beliefs are irrational because they decide what to believe based on purely idiosyncratic reasons. Reflective Relative preservice teachers' beliefs are rational. They can articulate and justify a philosophy guiding their choice and can justify beliefs relative to the goals inherent in the philosophy. They take into consideration all relevant sources of knowledge and all stakeholders.

I have attempted to show that each level of belief formation is related to and is dependent on epistemology. Epistemology, in turn, is related to informal reasoning or argumentation and to metacognition. To improve the process of belief-formation or adaptation, it is necessary to address all three arenas. I have outlined below major aspects of each that are important goals.

Recommendations

> Learning more about how prospective teachers have negotiated their position on questions of multiple right answers can help identify those young adults for whom this is still a dilemma. Until they can achieve a kind of peace amidst the ambiguity, we can expect them to do little more than reward students' current understanding. We cannot hope that they will learn to shape students as thinkers and knowers. We cannot hope they will actually teach (Holt-Reynolds, 1999, p. 24).

The premise of this paper is that helping preservice teachers move toward developing rational beliefs about teaching, learning, students, and content involves a three-pronged approach that addresses epistemology, informal reasoning/argumentation, and metacognition. To that end, I have identified goals for preservice teacher learning under each. Please note that what I've written below represents understandings I've gained over the past 4-6 years of reading and investigation. I do not present it as finished or as perfect. It is the best I have to offer to date. I offer it as a way to begin a conversation not as a formula for 'fixing' the beliefs of preservice teachers.

<u>Epistemology</u>

The students need to come to understand the nature of knowledge in terms of its certainty and simplicity and to understand the process of knowing in terms of the source of knowledge and the justification for knowing (Hofer & Pintrich, 1997). I offer the table below contains one way of thinking about knowledge and knowing. As adults and as teacher educators, we may have intuitive parsings for the knowledge we have abut teaching and learning. We know more or less automatically that the statement Nashville is the capital of TN is absolutely true but that children respond more favorably to positive reinforcement than to punishment is true *most of the time but not 100% of the time*. We also know intuitively that opinion-based decisions are appropriate if selection of a restaurant at which to eat dinner is the question but are inappropriate if selection of a textbook series is the question. Preservice teachers have neither the intuitive parsing nor the understanding of the difference between most and all of the time. In addition, most of them have become aware of change as a factor influencing people and situations, and many of them are overwhelmed with it.

The table below is the way I have devised to think about knowledge and knowing so that I can talk with preservice teachers about knowledge. I have not devised a way to help them with change. You will notice that there

are several empty cells. I have deliberately left them blank as a reminder that they are questions that need dealing with for preservice teachers.

Below the table I have included information about how to address simplicity of knowledge.

Arenas of Knowledge	Source of Knowledge	Certainty of Knowledge	Justification for Knowing
Public	Factual Scientific/Mathematical Typical/Average Social & Cultural		
Personal	Self-knowledge Opinion		

Simplicity of Knowledge (in terms of viewing problematic situations or issues):

To help preservice teachers broaden their view of the sorts of situations that beliefs will address, they will benefit from learning to view from multiple perspectives. Following are some ways of thinking about multiple perspectives:

- Person: the stakeholders in a decision related to a classroom situation, e.g., different students, parents, teacher
- Parts of a Whole: different views that can be taken on the situation, e.g., management, instruction, assessment
- Layers of a Whole: e.g., classroom, department, school, community/cultural, state, national
- Different wholes/theoretical level: Behaviorism, Information Processing, Piagetian Constructivism, Vygotskian Socioculturism

Metacognition

Three overall goals are important in metacognition: (a) that dispositions toward thinking that is rational be developed, (b) that understanding of self and the role self plays in all judgment-making is attained, and (d) that the separation of beliefs from evidence is accomplished. Preservice teachers need to develop their metacognition in two ways: work on dispositions or tendencies of thinking and in terms of monitoring the place of 'self' in thinking. Dispositions I recommend working on are the following:

- Questioning: The questioning person will problematize the accepted (Dewey, 1933) but will go beyond that to question all aspects of what's known, underlying assumptions, connections with other knowledge or ideas, implications, etc.
- Wholeheartedness (Dewey, 1933): The person who invests the self wholeheartedly in thinking will engage in it with all the mental faculties and will be completely absorbed in it rather than giving cursory or divided attention to it.
- Mindfulness (Langer, 1993): Being mindful is the tendency to view a situation from all possible perspectives and to view all aspects of it.
- Listening: Developing the tendency to listen (rather than wait turns for speaking) leads to open-mindedness.

- Active Search for relevant information: This disposition will function to encourage the thinker to gather all relevant information—as opposed to making a judgment on what is already known (which may be outdated, inadequate, or slanted toward one view (Baron, 1991; Perkins, Farady, & Bushey, 1991; Voss, 1991).
- Reasoning: The disposition to reason includes the ability to reason well, e.g., deductively, inductively, inference, etc., but it also includes the tendency to be thorough, clear, organized, and to remain alert to possible error (Tishman, Perkins, & Jay, 1995).
- Give thinking time (Tishman, Perkins, & Jay, 1995): Giving thinking time encourages the thinker to not only allow but plan space for thinking so that contemplation can occur and so that the person resists premature closure.
- Fairmindedness (Baron, Perkins, , Voss (1991): Fairmindedness is the tendency to give all sides of a situation or question fair consideration, as opposed to brushing aside alternate viewpoints without thinking about them (Baron, 1991; Perkins, Farady, & Bushey, 1991; Voss, 1991).
- Objectivity: Objectivity is the tendency to separate self, in terms of bias and interest, out of the judgment-making process (Baron, 1991; Perkins, Farady, & Bushey, 1991; Voss, 1991).

Informal Reasoning/Argumentation/Judgment-Making all as Way of Knowing

Following are specific judgment-making understandings that preservice teachers need to gain in order to make rational judgments about beliefs:

- The difference between well-structured and ill-structured problems
- The difference between making a case and deciding what to believe and how to do each
- That accurate and adequate information are essential to judgment-making
- Weighting evidence for relevance, accuracy, and importance with respect to clearly articulated goals.
- How to infer in ill-structured situations so that the judgment (conclusion) reached is indeed supported by the evidence that is given for it.
- Considering counterevidence.

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