

Effects of Beliefs About the Nature of Knowledge on Comprehension

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Two questions were addressed: "What are students' beliefs about the nature of knowledge", and "How do these beliefs affect comprehension?" In Experiment 1, an epistemological questionnaire was administered to undergraduates. Factor analysis of the questionnaire resulted in 4 factors reflecting degrees of belief in innate ability, simple knowledge, quick learning, and certain knowledge. In Experiment 2, students read a passage about either the social sciences or the physical sciences in which the concluding paragraph was removed. Then they rated their confidence in understanding the passage, wrote a conclusion, and completed a mastery test. Belief in quick learning predicted oversimplified conclusions, poor performance on the mastery test, and overconfidence in test performance. Belief in certain knowledge predicted inappropriately absolute conclusions.

This research addresses the question "What effects do students' beliefs about the nature of knowledge have on comprehension?" Recently there has been a growing interest in identifying what students believe about the nature of knowledge and learning, or personal epistemology (e.g., Feltovich, Spiro, & Coulson, 1989; Schoenfeld, 1983, 1985; Steinbach, Scardamalia, Burtis, & Bereiter, 1987). The motivation for these studies is the assumption that epistemological beliefs affect comprehension in important ways.

Earlier attempts to investigate students' epistemological beliefs focused on developmental issues. On the basis of research involving a questionnaire and some in-depth interviews with Harvard undergraduates, Perry (1968) suggested that students go through stages of development of epistemological beliefs. In the early stages, students see knowledge as either right or wrong and believe that authority figures know the answers. When students reach the late stages of development, they realize that there are multiple possibilities for knowledge and there are times when one must make a strong, yet tentative commitment to some ideas.

Research based on Perry's (1968) work has produced mixed results. Ryan (1984) investigated some of the educational implications of epistemological beliefs. Using items from Perry's questionnaire, Ryan categorized students as either highly 'dualist' or highly 'relativist.' When asked what their criteria were for determining whether they had comprehended a textbook chapter, dualists reported using fact-oriented standards, such as recall of facts, whereas relativists reported using context-oriented standards, such as paraphrasing and application. In contrast, Glenberg and Epstein (1987), using Ryan's dualism scale to predict comprehension monitoring, found that it "accounted for little of the variance and, thus, tended to waste degrees of freedom" (p. 87).

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Such an inconsistency in results can perhaps be accounted for in terms of shortcomings in the current conception of epistemological beliefs. Perry (1968) and most of those following him (e.g., Kniefelkamp & Slepitzka, 1976; Rvan, 1984; Touchton, Wertheimer, Cornfeld, & Harrison, 1977) have assumed that personal epistemology is unidimensional and develops in a fixed progression of stages.

A more plausible conception is that personal epistemology is a belief system that is composed of several more or less independent dimensions. Beliefs about the nature of knowledge are far too complex to be captured in a single dimension. I propose that there are at least five dimensions: the structure, certainty, and source of knowledge, and the control and speed of knowledge acquisition.

These proposed beliefs are based on research that suggests that there may be more than one facet to epistemological beliefs. The notions of structure, certainty, and source can be derived from Perry's (1968) work in that he found that many students enter college with the beliefs that knowledge is simple, certain, and handed down by authority. The belief about the control of the knowledge acquisition can be derived from Dweck's research (see Dweck & Leggett, 1988) on beliefs about the nature of intelligence. She has found that some students have a predominant belief that intelligence is a fixed entity, whereas others believe it is incremental—that is, it can be improved. The belief about the speed of knowledge acquisition, as well as the nature of intelligence, can be derived from Schoenfeld's (1983, 1985) study of high school students' geometry proofs. Like Dweck, Schoenfeld found that students seem to believe that only the gifted can derive theorems or be creative in mathematics. In addition, he suggested that some students seem to believe in quick, all-or-none learning. They spend 10-12 min working on a problem. If they do not get it by then, they assume they never will get it.

In line with this rationale, a preliminary study (Schommer, 1988) was conducted. Students' epistemological beliefs were assessed with a questionnaire. Next, they read a passage with one of two types of underlying resolution to conflicting information: multiple theories that need to be integrated or multiple theories whose complexity of interrelations makes an

absolute conclusion inappropriate. Then students wrote a concluding paragraph for the passage.

Students' written conclusions were related to their epistemological beliefs. For the Integrated Resolution passage, the more students believed in quick, all-or-none learning, the less likely they were to conclude that a resolution could be found by integrating theories. For the No Resolution passage, the more students acknowledged uncertainty in the world, the more likely they were to describe the conclusion as unresolvable. These results provided some initial evidence that conceptualizing epistemological beliefs as a set of more or less independent dimensions is useful in that their effects appear to be different.

My two experiments were extensions of this preliminary study. Experiment 1 served to test the conceptualization that epistemological beliefs are a system of more or less independent beliefs and to explore factors that might predispose students to have certain epistemological persuasions. In order to improve the questionnaire used in the preliminary study, the size of the sampling was increased and the composition of the sampling was diversified. In order to explore what factors might predispose students to have certain epistemological persuasions, a survey of students' education and home background was prepared. Epistemological dimensions were derived from the questionnaire with factor analysis, and then the relation between these factors and students' responses to the survey was examined.

Experiment 2 served to link epistemological beliefs to aspects of students' comprehension, including interpretation of information, which was measured with the conclusion task; learning typical of the classroom, which was measured with a passage mastery test; and monitoring their understanding, which was measured with students' confidence ratings in their understanding of the passage. Links between epistemological beliefs and comprehension were tested by regressions of epistemological dimensions derived from Experiment 1 on comprehension measures obtained in Experiment 2 after the effects of verbal ability, prior knowledge, and gender were removed.

Experiment 1

Method

Subjects

This study was carried out in a midwestern city; 117 junior college students and 149 university students participated as subjects. The junior College students were enrolled in an introductory psychology class. The university students were enrolled in either an introductory educational psychology class or an introductory physics class. More than 95% of the students were either freshman or sophomores. There were approximately equal numbers of men (120) and women (143). Three students did not report their gender.

Materials

Overview of *materials*. Four booklets were prepared for group administration of the following instruments: (a) a wide-range vocab

ulary test (French, Ekstrom, & Price, 1963), (b) an epistemological questionnaire, (c) a student characteristics survey, and (d) a filler task. The general purpose of the first three tasks is self-evident. The filler task as included in order to keep students who finished early occupied.

Epistemological questionnaire. The questionnaire used in the preliminary study was modified with the same five hypothesized epistemological beliefs in mind. Stated from a naive epistemological persuasion, these beliefs, and shorthand terminology in parentheses, are the following: (a) "Knowledge is simple rather than complex" (Simple Knowledge), (b) "Knowledge is handed down by authority rather than derived from reason" (Omniscient Authority), (c) "Knowledge is certain rather than tentative" (Certain Knowledge), (d) "The ability to learn is innate rather than acquired" (Innate Ability), and (e) "Learning is quick or not at all" (Quick Learning).

Two or more subsets of items were prepared in order to assess each epistemological dimension. For example, there are at least two ways in which learners can oversimplify complex information: They could focus on one aspect of the information, or they could compartmentalize pieces of information. These two notions were tested by items that tapped either a preference for single answers or a preference for discrete facts (avoidance of integration of information). Table 1 shows the epistemological dimensions, the subsets, and an example of an item in each subset for this 63-item test. From a naive epistemological view, there were 28 items with a negative valence and 35 items with a positive valence. Students were asked to rate their degree of agreement for each item on a scale from 1 (*strongly disagree*) to 5 (*strongly agree*).

Survey of student characteristics. In order to examine the relation between epistemological beliefs and characteristics of the learner, a survey of students' personal characteristics and home background was prepared. Basic information, such as age, gender, year in school, parents' occupation, and parents' education were requested. In addition, items to assess students' upbringing were included. These items covered three categories: (a) characteristics of family structure (e.g., single parent), (b) adherence to rules (e.g., enforcement of strict rules), and (c) encouragement toward independence (e.g., making decision for oneself). Students rated these upbringing items on a scale from 1 (*seldom*) to 5 (*always*).

Procedure

Group administration was possible for both the junior college and the University educational psychology students. For these students, the experimenter introduced the vocabulary test. After 5 min, students were told to begin the second booklet. All tasks were self-paced except for the vocabulary test. When all the students had completed the first three booklets, the session was ended.

Physics students were available only on an individual basis. The class professor informed these students that booklets were available to be picked up when they left class. They were instructed to fill them out independently and return them to the next class.

Results and Discussion

Assessing Epistemological Beliefs

Factor analysis made it possible to determine how many and which factors could account for students' responses on the questionnaire. The 12 subsets of items were used as variables in this analysis. With orthogonal varimax rotation and an eigenvalue greater than one as a cutoff point for factors, a principal factoring extraction generated four factors

Table I
Overall Scheme of the Epistemological Questionnaire and Sample Items

Subset dimension	Sample item	No. of items
	Simple knowledge	
Seek single answers	"Most words have one clear meaning."	11
Avoid integration	"Self help books are not much help." 'The really smart students don't have to look for specific facts.'	8
	Certain knowledge	
Avoid Ambiguity	"I don't like movies that don't have an ending."	5
Knowledge is certain	"Scientists can ultimately get to the truth." Omniscient authority	6
Don't criticize authority	"People who challenge authority are over-confident."	6
Depend on authority	"How much a person gets out of school depends on the quality of the teacher."	6
	work hard to do well in school.' -An expert is someone who has a special gift in some area.'	5
Can't learn how to learn		4
Success is unrelated to hard work		4
Ability to learn is innate		4
	Quick learning	
Learning is quick	"Successful students learn things quickly." - Almost " the information you can learn from a textbook you will get during the first reading.'	5
Learn first time		3
Concentrated effort is a waste of time	'If a person tries too hard to understand a problem, they will most likely just end up being confused.'	2

that accounted for 55.2% of the variance. Factors were given descriptive titles on the basis of high-loading subsets of items (factor loading greater than .50: see Table 2). Factor 1 was 'Ability to learn is innate' (Innate Ability); Factor 2 was 'Knowledge is discrete and unambiguous' (Simple Knowledge); Factor 3 was Learning is quick or not at all' (Quick Learning); and Factor 4 was "Knowledge is certain' (Certain Knowledge).

Table 2
Four Orthogonal Factors With Subsets of Items as Variables

Subset dimension	Factor 1	Factor 2	Factor 3	Factor 4
	.62'	.01	.06'	-.05
	.56	.06	.10	-.03
	.55	.14	.09	.28
	.34	.23	.19	.04 -
	.14	.68	.06	.03'
	.07	.56	.01.	.13
	.04	.54	.14	.04
	.08	.33	.30	.26
	.25	.27	-.20	-.07
	.34	.13	-.72	.08
	.04	.11	.11	.53
	.28	.10	.12'	-.27

'Pattern of loadings that are not consistent with the hypothesized epistemological dimensions.

To determine whether these factors would better be described as correlated, plotted factor graphs were examined, and several oblique rotations were computed. Oblique rotations did not lead to clearer, more interpretable factors. Consequently, the orthogonal rotation was used because it was the simpler and more eloquent of the two. These results suggest that epistemological beliefs may be characterized as a set of more or less independent beliefs. A set of four factors, rather than a single factor, was generated. The extension of the conceptualization of epistemological beliefs provided a broader spectrum of what students' beliefs about the nature of knowledge and learning are.

Exploring Predictors of Epistemological Beliefs

In order to explore variables that predispose students to have certain epistemological beliefs, the relation between students' characteristics and each of the four epistemological factors was studied.

Student characteristic variables were categorized into five blocks: (a) social/personal (e.g., age and gender), (b) cognitive (e.g., year in school and verbal ability), (c) educational atmosphere and opportunity (e.g., parents' highest education

and parents' highest occupational prestige score; Treiman, 1977), (d) encouragement toward independence variables

(e.g., allowed to voice opinion and question parents' decisions), and (e) adherence to rules or to guidelines (e.g., family strictness to rules and to religion). Because there was a possibility of multicollinearity within blocks, each epistemological factor was regressed on each block of student characteristics in order to determine which variables in each block would best represent that block. Variables within each block competed for entry in forward selection (see Table 3). For example, the older the students were, the more likely they were to believe that the ability to learn is acquired. Throughout this article, an effect is not reported unless it is statistically significant at least at the .05 level.

Students' background variables predicted their epistemological beliefs. There seemed to be a particularly strong effect of their beliefs on Simple Knowledge and Quick Learning. The interesting finding is that none of the variables surveyed predicted belief in Certain Knowledge. One variable (recorded in Experiment 2) that was available for the junior college students, but not for the university students, was the number of classes that they had completed in higher education. When Certain Knowledge was regressed on this variable, the results were significant. $F(1, 65) = 6.23, MS_e = 0.32, b = -.25, SD$

0.09. The more classes the students had completed in higher education the more likely they were to believe knowledge is tentative. This suggests that exposing students to more advanced knowledge, which is generally more tentative in nature, facilitates a change in their belief systems with regard to the uncertainty of knowledge.

Experiment 2

Method

The purpose of this experiment was to examine the relation between epistemological beliefs, assessed in Experiment 1, and aspects of comprehension. Specifically, in this experiment, I tested the effects of epistemological beliefs on conclusions drawn, performance on a mastery test and comprehension monitoring. In addition, it was important to determine whether these effects occur beyond the influence of factors known to affect comprehension, such as prior knowledge and verbal ability, and whether these effects are generalizable across passages in different domains.

Design

Students read a passage, either in the domain of social science (psychology) or in the domain of physical science (nutrition), and then completed several comprehension tasks.

Subjects

Of the 117 junior college students who participated in Experiment 1, 86 served as subjects in this experiment. The other subjects were not included either because they dropped the class or because they were absent on the day of the experiment. Forty-one students (22 men and 19 women) read the psychology passage, and 45 students (19 men, 25 women and 1 subject who did not specify gender) read the nutrition passage.

Materials

Passages. Excerpts of texts from two domains were used to assess the effects of the epistemological beliefs on comprehension. The psychology passage (Baron & Byrne, 1977) presented four plausible theories of aggression with the underlying theme that any tentative resolution would require a theory that integrates aspects of 0 four theories. The nutrition passage (Jacobsen, 1986) highlighted controversial issues of the daily recommended allowance of Vitamin B-6 and recent inconclusive findings that B-6 may help with sickle-cell anemia, bronchial asthma, and premenstrual syndrome. No concluding paragraph was included for either passage.

Written conclusion task. Students were asked to write a concluding paragraph for the passage. The instructions were as follows:

Imagine that you are the *author* of the textbook chapter that you read for this research project. You've got it all done except for the conclusion. Please complete the chapter by writing a good final paragraph that *draws a conclusion (or conclusions) based* on what is already written in the chapter. Be as clear as possible in your conclusions.

Master tests. A mastery test was prepared for each passage. They were composed of 10 multiple-choice items and represented what might typically be asked in a classroom. Items tested for the recognition and application of main ideas in the passages.

Prior knowledge. As an indicator of prior knowledge, students were asked to report the number of classes they had taken in psychology, sociology, biology, nutrition, and health sciences. Classes relevant to the passage read were totaled.

Table 3
Student Characteristics and Home Background Variables That Predict Epistemological Beliefs

Variable type	Innate Ability	Simple Knowledge	Quick Learning	Certain Knowledge
		Socio-Economic Index of Career Goal	Gender'	<i>ns</i>
	<i>ns</i>	Verbal Ability	Year in school	<i>ns</i>
	<i>ns</i>	Highest Parental Education	Father's Education	<i>ns</i>
	<i>ns</i>	Decisions	Discussion	<i>ns</i>
	<i>ns</i>	Strict Rules	<i>ns</i>	<i>ns</i>

'Women were more likely to believe in Gradual Learning.

Confidence ratings. A technique to assess comprehension monitoring was derived from two existing paradigms. Glenber & Wilkinson, and Epstein (1982) measured accuracy of comprehension monitoring with a confidence accuracy paradigm known as the *illusion of knowing*. The illusion of knowing is operationally defined as students' having high confidence in their comprehension and concurrently performing poorly on a comprehension measure. Maki and Berry (1984) assessed comprehension monitoring on the basis of how accurate students were in predicting their test performance.

In this study, students were asked to rate their confidence in understanding the passage. The rating scale, which has been used in previous research (Schommer & Surber, 1986), ranged from 1 (I understood very little of this chapter I could not answer questions on this material) to 4 (I understood this chapter very well. I could explain the main points of this material to another person). An even-numbered scale was used to avoid equivocation in students' responses. Instructions were written in such a way as to prevent subjects from being hesitant to choose a low confidence rating for fear that it would reflect an inadequacy in themselves.

This confidence rating was used to generate predicted test performance. Test scores were regressed on confidence ratings. From the intercept and *b* weight from this analysis, a predicted test score was calculated. In order to derive a continuous measure of the illusion of knowing, the actual test performance was subtracted from the predicted test performance. Students who had a positive score (1-10) had overestimated their comprehension.

Procedure

Passages were randomly distributed to students to be read at home. In the following class session, comprehension booklets were distributed. The materials in these booklets were presented in the following sequence: (a) confidence rating, (b) number of classes in each domain, (c) written conclusion, (d) mastery test, and (e) filler tasks. Students were asked to read the directions on each page and then complete the page. When all students were working on the filler task, the session was ended and students were debriefed.

Conclusions for both passages were coded for both simplicity and certainly on a dichotomous scale. Interrater agreement for this scoring was 93%. If students oversimplified text information by describing a single point of view or avoided drawing a conclusion, their conclusions were scored as simple. If students elaborated on text information or showed integration of key points, their conclusions were scored as complex. If students' conclusions were that people have the answer or will have the answer in the future, their conclusions were rated as certain. If students suggested uncertainty now or in the future, their conclusions were scored as uncertain. (See Table 4.)

Results and Discussion

Hypotheses were tested in multiple regression analysis. For each test, background variables were entered in forward inclusion regression before the four epistemological factors competed for entry. These background variables included verbal ability, prior knowledge, and gender.

To determine the effects of epistemological beliefs on the interpretation of information and the generalizability of these effects across passages in different domains, the students' conclusions for the combined passages were analyzed. Passage domain was entered first as a replication variable and was followed by background variables, epistemological factors,

Table 4
Excerpts From Each Type of Conclusion
Nutrition Passage

<p><i>Simple conclusion:</i> 'As you now well know, vitamin B-6 is a very important part of you (sic) and your children's everyday diet. So make sure you get enough, and keep that engine of yours well oiled!'</p>	<p><i>Complex conclusion:</i> 'Vitamin B-6 has some advantages and possible disadvantages. When [one is] taking the correct dosage (a little over 1.3 milligrams), vitamin B-6 has no side effect. When the dosage is increased to 500 or even up to 2,000 [mg], people have experienced numbness, nervous gaits, and other side effects.'</p>
<p><i>Certain conclusion:</i> "If a person could find the exact dose of vitamin B-6 to take ... vitamin B-6 could serve as a cure for sickle cell [anemia]. PMS and asthma...."</p>	<p><i>Uncertain conclusion:</i> "It is not proven that B-6 vitamin is good or not for asma [sic], premenstrual [syndrome, sic], sickle [sic] cell [anemia]. Bronchi [sic] diseases.'</p>

Psychology Passage

<p><i>Simple conclusion:</i> "After telling you about aggression. I hope you understood it. There are very many problems with aggression and they are trying to solve them as soon as possible. The most problem that their [sic] is with the children that have this problem [sic]. The social learning of aggression is the best descriptive [sic] word this [sic]."</p>	<p><i>Complex conclusion:</i> "Aggression. There are many theories on behavior and the reason people are or become aggressive. I believe that the combination of several of these theories and not just one, comes close to the answer."</p>
<p><i>Certain conclusion:</i> ... it is now agreed upon that social conditioning & rewards greatly effect [sic] human aggressive behavior.'</p>	<p><i>Uncertain conclusion:</i> 'The theories presented in this text are in no way concrete. Just as there is no conclusive support to definitely assert that violence comes from somewhere deep inside every human, aggravated [sic] by outside forces, or merely learned</p>

and an Epistemological Factors x Passage Domain interaction term. Quick Learning predicted oversimplified conclusions, $F(1, 59) = 7.47$, $b = -.18$, $MS_e = 0.17$. The more the students believed in quick, all-or-none learning, the more likely they were to oversimplify conclusions. Certain Knowledge predicted certain conclusions, $F(1, 57) = 8.50$, $b = -.33$, $MS_e = 0.21$. The more the students believed in certain knowledge, the more likely they were to write absolute conclusions. Prior

Knowledge also predicted certain conclusions, $F(1,60) = 5.86$, $b = .22$ $MSe = 0.23$. The more courses the students had completed the more likely they were to write tentative conclusions.

These findings replicate the results of my previous research. In both analyses there was no main effect for passage domain, nor was there a significant interaction of Epistemological Factor x Passage Domain. This suggests that the effects of beliefs of Quick Learning and Certain Knowledge are generalizable across the domains of psychology and nutrition.

In order to test the effects of epistemological beliefs on tasks similar to the classroom, each mastery test was regressed on the epistemological factors after the effects of background variables were removed. Quick Learning predicted performance on the psychology mastery test. $F(1, 26) = 9.15$, $b = -1.16$, $MSe = 2.07$. The more the students believed in quick, all-or-none learning, the more likely, they were to perform poorly on the psychology mastery test. None of the epistemological factors predicted performance on the nutrition mastery test. A close examination of the nutrition test revealed that a substantial number of items had either a floor or a ceiling effect. The psychology test was psychometrically sound with regard to this measure. If the psychology passage mastery test is used as the dependent measure, it appears that epistemological beliefs may influence performance on tasks similar to those used in the classroom.

As discussed earlier, students' ability to assess their understanding of the passage was tested by a comparison of their predicted test score with their actual test score. Because the nutrition test was not psychometrically sound, only the performance of students reading the psychology passage was analyzed. Quick Learning predicted students' overestimation of their understanding of the passage. $F(1, 25) = 12.62$, $b = .81$, $MS = 0.72$. The more the students believed in quick, all-or-none learning, the more likely they were to overestimate their understanding of the passage. Table 5 shows descriptive statistics of key variables involved in the analyses linking epistemological beliefs to comprehension measures.

General Discussion

Five conclusions are suggested by this study: (a) Personal epistemology can be characterized as a system of more or less independent beliefs-, (b) these beliefs have distinct effects on comprehension and learning; (c) epistemological beliefs are influenced by home and educational background; (d) these effects exist beyond the influence of variables found to influence comprehension and learning-, and (e) these effects are generalizable across two content domains.

The composition and structure of personal epistemology as a system of more or less independent beliefs was reflected in the results of two factor analyses, in my preliminary study (Schommer, 1988) and in the present study. This multiplicity of dimensions not only begins to reveal the composition of Personal epistemology but also has provided a means to test the different effects of each dimension on comprehension and learning.

An important finding is that epistemological beliefs seem to affect students' processing of information and monitoring

Table 5
Epistemological Factors That Predict Comprehension Measures After the Effect of Background Variables Has Been Removed

Measure	<i>r</i>	<i>M</i>	<i>SD</i>
Quick Learning Simple conclusions Mastery	-0.38	1.74	0.07
test Confidence test	-0.50	3.73	0.38
Certain Knowledge	-0.59	-0.80	0.23
Certain conclusions	-0.45	1.40	0.11

of their comprehension. When one encounters complex information, belief in quick, all-or-none learning appears to affect the degree to which students integrate knowledge. This same belief affects students' accuracy in assessing their own comprehension.

Epistemological beliefs appear to affect the critical interpretation of knowledge; that is, it was a question not of students' being able to recall prominent information in the passages but rather of what they concluded from the information. When one encounters content material that is tentative, strong beliefs in the certainty of knowledge leads to the distortion of information in order to be consistent with this belief.

The relation between personal epistemology and students' characteristics revealed intriguing results. These results suggest that the more education parents have and the more they expect their children to take responsibilities in the home and for their own thinking, the more likely children "I develop a sophisticated system of epistemological beliefs. That education influences students' epistemology is apparent in regression analyses showing the effect of years in school on beliefs of discrete, unambiguous knowledge and quick, all-or-none learning. The influence of education is particularly obvious in the finding that of all the variables examined in this study, only the number of college-level classes completed predicted belief in the uncertainty of knowledge.

The generalizability of these findings lends credence to the important influence of epistemological beliefs. These findings were consistent across a preliminary study and this study and across passages from two domains. In addition, these effects were found after measures of verbal ability and prior knowledge were removed.

Insight into epistemological beliefs may advance our understanding of human learning. Research in the past 20 years has emphasized the importance of schemata and metacognition on comprehension. However, schema theory cannot explain why, some students fail to integrate information. The concept of metacognition does not explain why some students fail to monitor their comprehension. Some reasonable answers may be found in the study of epistemological beliefs.

Family influence notwithstanding, education may be the key to the prevention and intervention of self-defeating epistemological beliefs. Teachers can inform children in grade school that knowledge is integrated, that prior knowledge should be accessed, and that many times there is more than one right answer. Indeed, anecdotal evidence suggests that many of the disabling epistemological beliefs that students

have by high school have come from the way in which they have been taught (Schoenfeld, 1983). Both high school and college students may benefit from activities that raise their consciousness about the underpinnings of knowledge and learning and how their own epistemological views influence their learning.

That the study of epistemological beliefs is important seems undeniable. The fact that both epistemological beliefs and the effects of these beliefs are subtle highlights the need for careful investigation. Studying these beliefs, finding their niche among factors that we have studied for years, and determining how they affect learning will enable us to better understand the mind. With this understanding, we can guide students to become thoughtful, persistent, and independent learners.

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