The development of children’s beliefs about intelligence

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Abstract

We review research in the development of children’s beliefs about intelligence and propose that this development represents simultaneous processes of concept acquisition and theory building. Research in beliefs about the nature of intelligence has focused on children’s definitions of intelligence, beliefs about the component structure of intelligence, and the criteria children use to evaluate ability. Children’s beliefs about the stability of intelligence have been examined in terms of constancy, controllability, capacity, the origins of intelligence, and mechanisms of change. Researchers have also examined the relationships among beliefs about intelligence and the relationship between those beliefs and achievement behaviors. We summarize prior theoretical frameworks used to explain the development of children’s beliefs and propose a new integrative model to understand children’s conceptions.

Introduction

Children’s beliefs about intelligence are of interest to psychologists because of their implications for both basic and applied issues. In the realm of basic science, children’s conceptions of intelligence are part of children’s
theory of mind (e.g., Yuill, 1992, 1997) as well as an aspect of general concept development (e.g., Ruble & Dweck, 1995). A comprehensive understanding of children’s beliefs about intelligence and of the development of these beliefs will permit integration of this area of knowledge with other aspects of cognitive and social development. For example, children’s developing understanding of traits, often including smartness, has received focused attention in recent years (e.g., Alvarez, Ruble, & Bolger, 2001; Heyman & Gelman, 1999; see Ruble & Dweck, 1995, for a review).

On the applied science side, researchers are interested in linking children’s thinking about intelligence and ability to their evaluations of themselves and others and to the processes governing achievement striving (e.g., Heyman & Dweck, 1998; Pomerantz & Saxon, 2001). For example, the way in which children define intelligence affects their choice of criteria for judging whether they or their peers are intelligent; judgments of ability may then influence achievement striving (Dweck & Leggett, 1988; Nicholls, 1984). Moreover, when certain beliefs or patterns of beliefs are more adaptive than others, then interventions aimed at fostering more adaptive beliefs in children are indicated (e.g., Bempechat, 1998; Dweck, 1999; Kurtz & Borkowski, 1984).

Interest in children’s conceptions of intelligence originally grew out of disparate research areas. The bulk of this review is based on work from three of these areas. First, some investigators have shown interest in what specific skills and skill groupings comprise the structure of intelligence according to children (e.g., Chen, Holman, Francis-Jones, & Burmester, 1988). Second, researchers interested in self- and other-evaluation processes have argued that understanding the development of beliefs about ability can inform theory regarding how children come to evaluate themselves and others in a variety of domains (e.g., Rholes & Ruble, 1984; Stipek, 1981). Finally, researchers in achievement motivation have posited that beliefs about ability influence achievement goals and thereby achievement behaviors (e.g., Dweck, 1986; Nicholls, 1989).

In an attempt to integrate the extant literature on children’s conceptions of intelligence, we propose here that the development of children’s beliefs about ability represents simultaneous processes of concept acquisition and theory building. That is, at the same time that children develop a concept of ability, they are also piecing together information on its relationship to other traits and behaviors (e.g., its role in self-evaluation and achievement motivation as mentioned above). This theory-based view of concept development is drawing increasing attention in a variety of domains (Carey, 1985; Keil, 1994; Murphy, 1993). Precedents for consideration of children’s understanding of intelligence as a theory come from both cognitive development and social psychology traditions.

Children’s beliefs about ability possess many of the attributes ascribed to children’s “naïve theories” in other domains of cognitive development.
(e.g., theory of mind, Gopnik & Wellman, 1994; theory of biology, Springer, 1999). Gopnik and her colleagues (Gopnik & Meltzoff, 1997; Gopnik & Wellman, 1994) have argued that children’s “theories” share key characteristics—coherence and abstractness—with scientific theories. Children’s theories are coherent to the extent that they represent closely interrelated concepts that are organized according to causal, explanatory beliefs. Abstractness in children’s theories arises from their use of unobservable causal mechanisms, in the form of entities, events, or forces, to explain observed phenomena. In addition to this explanatory utility, the coherence and abstractness of children’s theories allow for prediction and guide interpretation of events. Consistent with other “theory theory” applications, we argue that children’s developing “intelligence theory” serves as an organizational framework for children’s knowledge about intellectual ability and guides children’s interpretations and explanations of ability-related information and their predictions in ability-related contexts.

The role of the individual as a “naïve scientist” is also longstanding in social psychological research. Both Kelly (1955) and Heider (1958) proposed that people’s naïve understandings of the social environment play a role in their processing of social information and in their reactions in social situations. Accordingly, what have been variously called “common-sense,” “lay,” “implicit,” “intuitive,” and “naïve” theories have enjoyed constant examination in social psychology. And, in fact, one line of research examining beliefs about intelligence has specifically adopted the “theory” terminology (i.e., entity versus incremental theories of intelligence, Dweck & Leggett, 1988).

Multiple aspects of children’s beliefs about intelligence have been explored. Much of this work can be categorized as responses to two basic questions that have been central in theoretical discussions of intelligence for decades: “What is intelligence?” and “How stable is intelligence?” On the surface, each of these questions seems essentially conceptual in that the focus is on the defining features or characteristics of ability. However, providing a “neat” definition of intelligence has eluded psychologists for decades, and recent views highlight its multifaceted nature. Consequently, it seems appropriate to acknowledge that the layperson’s (developing child’s) naïve theory of intelligence also consists of a network of features and their interrelationships. In the following review, we first summarize the literature on children’s conceptions of the nature and stability of intelligence, highlighting concurrent conceptual and theory development. Following these sections, we discuss relations among conceptions of intelligence and their links to achievement. Finally, we provide a critique of prior theoretical frameworks for research in children’s conceptions of intelligence, and we propose a more holistic approach.
Children’s beliefs about the nature of intelligence

Researchers have employed a variety of methods to understand how children define intelligence: Children have defined terms such as “intelligent” and “smart,” have rated the relevance of test items to intelligence measurement, and have explained their ratings of their own and peers’ smartness. In like fashion, the following sections will address children’s definitions of intelligence, their beliefs about its component structure, and their criteria for identifying it.

Children’s definitions of intelligence

In a few studies, researchers have taken the direct approach of asking children to define words such as “smart” and “intelligent.” This work has shown that children—particularly those in the late elementary grades—associate “smartness” with a rich knowledge base and academic success. For example, in Yussen and Kane’s (1985) interviews of first, third, and sixth graders, children at all grade levels tended to include amount of knowledge in their general definitions (38, 30, and 28%, respectively), and academic skill was increasingly identified as a central aspect of smartness across grades (13, 26, and 46%, respectively). Using a similar procedure with fourth through eighth grade children, Henderlong and Lepper (1999) found that younger children tended to define intelligence in terms of having knowledge, whereas older children included the ability to use knowledge or process information in their definitions. Although the intelligence definitions of older children may be more elaborated than those of younger children (Henderlong & Lepper, 1999), the responses of older children are also more homogeneous, linking intelligence more exclusively to cognitive, intellectual traits. Younger children, in contrast, are more likely to include social skills in their definitions (Yussen & Kane, 1985). Definitions that included knowledge and academic ability and developmental differences consistent with those described above were also found in a comparative study of German and US children in kindergarten, second, fifth, and eighth grades (Kurtz-Costes, McCall, Kinlaw, Wiesen, & Joyner, 2003).

References to academic skills also appeared in a study in which children were asked about intelligence in a more contextualized manner. Cain and Dweck (1995) asked first-, third-, and fifth-grade children what it meant to be “smart, in [their] schoolwork.” Children’s free responses were coded into categories. The most frequent response across grades referred to ability (e.g., “you’re good at stuff like math and art”) and was followed in frequency by explanations touting outcomes (e.g., “he gets mostly A’s and B’s”). Although there were no grade differences in children’s responses, first graders had more difficulty overall in providing an answer to the question.
Summary/critique

Direct inquiries to children about the definition of “smart” or “smart in school” have shown consistently that children recognize that smartness is linked primarily to knowledge or other cognitive/intellectual abilities. Age differences in definitions, with older children focusing more exclusively on academic skills, emerged in some studies but not in others. These inconsistencies might be partially explained by the fact that disparate methodologies were used. First, alternate categorization schemes were used across studies to group children’s responses, and variations in these schemes may have contributed to the appearance of age differences in some instances while obscuring them in others. Second, the use of a more contextualized prompt (i.e., what does it mean to be smart “in school”?) by Cain and Dweck (1995) provided a more uniform frame of reference for children. Consequently, the lack of age differences in this study might not seem so surprising.

As children acquire more and more information about a phenomenon, their concepts become both more precise and more detailed. Where age differences appear, older children (fifth through eighth graders) link intelligence more exclusively to cognitive abilities than do younger children, illustrating conceptual development that brings the definitions of older children closer to those of adults. Older children also reported that an intelligent person not only has knowledge but can also use it efficiently—an example of the sort of elaboration seen increasingly as the child develops a more complex theory of intelligence. These developmental progressions might be expected to appear also in children’s understanding of the different types of cognitive skills (e.g., verbal, analytical) that are attributes of intelligence. We turn to this discussion next.

Children’s beliefs about the component structure of intelligence

Children’s views of the component structure of intelligence have been examined by contrasting beliefs about verbal and abstract (or nonverbal) competence. Nicholls, Patashnick, and Mettetal (1986b) described a developmental progression in children’s beliefs about the contribution of verbal versus abstract skills to the construct of intelligence. Children (ages 6–18) and adults (ages 19–22) were shown verbal and nonverbal items from the Lorge-Thorndike Intelligence Test. The verbal item required participants to pick a word from one list that most nearly matched in meaning the words in another list. The nonverbal item involved a similar matching task but with abstract symbols. Once participants were familiarized with the tasks, they were told about hypothetical pairs of children, one good at the verbal task and the other good at the nonverbal task. Then, students answered a series of questions that tapped beliefs about the origin and relevance of these skills.
The interview transcripts suggested an agewise progression of three conceptions of verbal and abstract intelligence (Nicholls et al., 1986b). At Level 1 (mostly ages 6–9), intellectual skills are judged by their subjective difficulty to the participating child. That is, whatever skill (verbal or abstract) seems more difficult to the child is judged by the child as more indicative of intelligence. At Level 2 (mostly ages 10–15), intelligence consists of effortful learning or acquisition of information. Children progress through three sub-stages at Level 2. First, they view verbal intelligence as more difficult to acquire because it requires learning and retaining many specific word meanings. In the second sub-stage, children view verbal intelligence and abstract intelligence similarly because both require effort to learn new information. In the third sub-stage of Level 2, abstract abilities are seen as more important because verbal intelligence is believed to be easier to improve than abstract intelligence (there are many opportunities to learn words but fewer opportunities to learn abstract stimuli).

At Level 3 (ages 16 to adult), information acquisition and problem solving are distinguished. Verbal reasoning reflects memory for specific word meanings and can be improved through effort, whereas abstract reasoning reflects problem-solving ability, which requires common sense, creativity, or general experience. Thus, it is harder to improve abstract skills and these skills are viewed as more indicative of intellectual ability.

The finding that young adults are less likely than children to link verbal skills to intelligence was further substantiated by Chen et al. (1988). These researchers studied children’s conceptualization of the component structure of intelligence by having Australian primary school, high school, and college students (ages ranging from 11 to 18 years) rate various skills on their relevance to intelligence. Participants were tested with items chosen from four intelligence tests (Stanford-Binet, WAIS-R, WISC-R, and Raven’s Progressive Matrices) and afterwards rated the items on perceived difficulty and relevance to measuring the concept of intelligence.

Low correlations between participants’ relevance ratings and both difficulty ratings and performance suggested that participants’ definitions of intelligence were unrelated to their own abilities. The primary and high school groups showed high agreement on the items they rated most relevant, including a mix of verbal and nonverbal items, whereas college students favored nonverbal items as most relevant. Factor analyses of the relevance ratings yielded similar three-factor solutions for each age group with the first factor comprised of nonverbal skills, the second of verbal skills, and the third involving information retrieval. Items chosen to be representative of each factor were assembled and average relevance ratings for those sets of items were compared across age groups. These analyses suggested that younger participants gave more relevance to verbal items, high school participants rated verbal and nonverbal items similarly, and college students gave the highest rankings to nonverbal items (Chen et al., 1988).
Both Chen et al. (1988) and Nicholls et al. (1986b) found that older (Level 3) students consider nonverbal material more difficult to learn than verbal material. In essence, both studies tout the development over childhood and adolescence of a view of abstract reasoning ability as more diagnostic of intellectual prowess than verbal reasoning ability. However, it might be argued that both studies, instead of mapping the development of beliefs about the component structure of intelligence, simply tracked the development of the adoption of the traditional view of intelligence as institutionalized in modern intelligence tests. In fact, exposure to standardized assessments as children progress through formal schooling probably contributes to children’s developing beliefs (cf. Rosenholtz & Simpson, 1984). Both projects essentially presented participants with only two possible components of intelligence—verbal and nonverbal—as operationalized in tasks taken from standard assessments. This progression may be seen as normative development of the concept of intelligence. Children first come to understand that both verbal and nonverbal skills are components of intelligence, and only later learn the cultural norm in which nonverbal skills are valued more highly than verbal abilities. Next, we discuss the criteria that children use to evaluate the intellectual abilities of themselves and others.

The criteria children use to evaluate intellectual ability

Researchers have also asked children to justify their ratings of their own or another’s “smartness” and to describe the “signs” of intelligence. Such inquiries begin to make clear the underlying network of concepts that constitute the child’s theory of intelligence. Results of these studies have shown that with age, children rely increasingly on performance on cognitive tasks rather than noncognitive attributes in ascribing intelligence to others. This result has been found across several studies with varying samples and procedures. For example, Yussen and Kane (1985) asked first-, third-, and sixth grade children how they knew someone was smart and whether smart children are different from average children in the way they look, talk, act, or on a variety of mental, academic, physical, and social qualities. The youngest children in this study more often indicated a belief that intelligence is “visible” (i.e., evident in speech, physical appearance, or behavior) and were more global in their assessments of what qualities are associated with intelligence, choosing qualities across the various domains. Older children, however, evidenced greater specificity in “signs” of intelligence, favoring overt behavior over visual appearance and choosing qualities of a mental or academic nature. Similar results were found with slightly different methodologies by Stipek and Daniels (1990) and Droege and Stipek (1993). Stipek and Daniels (1990) asked children in kindergarten, fourth grade, and eighth grade to nominate
classmates who were smart and not smart, nice and not nice; to rate the nominated children on smartness and niceness; and to predict each nominated child’s performance in four situations: reading, completing a spatial test, sharing, and jumping a hurdle. All children differentiated their predictions as a function of the trait labels to some degree (i.e., smartness was relevant to reading and spatial tasks, niceness was relevant to sharing), but eighth graders showed greater differentiation than younger children. Droege and Stipek (1993) asked kindergarten, third grade, and sixth grade students to pick team members (and non-members) for an academic competition, to explain their choices, and to rate their choices on smartness. Although children in all three grades were more likely to give academic than non-academic reasons for their teammate choices, kindergartners gave more irrelevant responses than did third and sixth grade children. Teammate choices were also significantly related to ratings of smartness.

Stipek and her colleagues have also documented that as young children’s theories about intelligence become more sophisticated, they are able to use their perceptions of ability to interpret performance differences among children, thus providing a causal explanation for outcomes. For example, Stipek (1981) and Stipek and Tannatt (1984) asked children to rate themselves and/or their classmates on their “smartness” and then explain their reasons for the ratings. Second and third graders’ most common justifications of their self-ratings of smartness focused on performance on specific tasks. Although preschool- and kindergarten-aged children frequently failed to give interpretable responses, many children from preschool through at least third grade cited work habits in explaining smartness ratings, especially for peers. In addition, preschool, kindergarten, and first grade children were more likely to cite sociability and less likely to cite social comparisons and task difficulty in their justifications than were older children.

Similar results were found by Bempechat, London, and Dweck (1991), who asked children in kindergarten through fifth grade to explain why they judged certain classmates as smart in their schoolwork. Kindergartners’ responses, when given and interpretable, covered a variety of skill domains, including aesthetic (e.g., drawing well), social (e.g., being nice), physical (e.g., running fast), and self-regulatory (e.g., behaving appropriately) reasons. The most common responses for children through Grade 4 focused on outcomes that the “smart” children had obtained. Among fifth graders there was a split between outcome and action responses, suggesting that by this age children consider what one does, not just the results one obtains, in evaluating smartness.

**Summary/critique**

The foregoing review suggests some general conclusions. First, younger children, especially preschoolers and kindergartners, do not easily provide
definitions of and criteria for smartness/intelligence. Moreover, when they do offer definitions or signs of intelligence, their responses cover a broad range of characteristics, prompting some researchers to suggest that children of this age employ a simplistic, “good–bad” scheme for conceptualizing most individual characteristics (Bempechat et al., 1991; Heyman, Dweck, & Cain, 1992; Ruble & Dweck, 1995). We suggest that at these ages, the intelligence concept is not sufficiently differentiated for children to use it reliably to make judgments or guide encoding and retrieval of information.

Second, one of the ways in which theories of intelligence change from early or middle to late childhood is that younger children place an emphasis on having knowledge, whereas older children assign increasing significance to using knowledge, to work habits, and to other behavioral correlates of smartness. This developmental progression, from focusing on “having” to “using” knowledge, is found both in studies where children were asked for definitions or criteria of intelligence and in studies of children’s beliefs about the component structure of intelligence. By the same token, younger children rate verbal skills and acquired information (i.e., crystallized intelligence) as more relevant to intelligence, whereas teenagers and adults allot more importance to nonverbal and abstract processing skills (i.e., fluid intelligence) (Chen et al., 1988; Nicholls et al., 1986b).

Third, the varied methodologies used in the studies reviewed above attest to the fact that children use their developing theories about intelligence in a variety of ways. As they observe differences in performance outcomes throughout early childhood, they learn that intelligence or “smartness” refers primarily to cognitive or academic skill, thereby reflecting the cultural beliefs of their own societies. As it will be seen in the subsequent sections, children’s developing theories also include ideas about links among intellectual skill, effort, and performance, as well as characteristics of intellectual ability such as its stability, to which we turn now.

**Children’s beliefs about the stability of intelligence**

Children’s ratings of stability vary according to how researchers themselves have conceptualized the term “stable” and, therefore, according to how they have assessed children’s beliefs. Pomerantz and Ruble (1997) categorized these different conceptions of the stability of intelligence as beliefs about constancy, (un)controllability, and capacity. Constancy refers to beliefs about the stability of intelligence over time and situations. Beliefs about controllability index children’s views of the malleability of intelligence, or the extent to which it is possible to effect a change in ability. Finally, the conception of ability as capacity hinges on the extent to which it is inversely related to effort. We use Pomerantz and Ruble’s rubric in reviewing the literature in this area. Related issues discussed here include children’s
understanding of the origins of intelligence and the mechanisms by which intelligence might change.

Children’s beliefs about constancy

Numerous studies have addressed children’s beliefs about the constancy of intelligence across time and across situations. Such studies form a substantial part of a larger body of work examining the development of trait understanding in children. In fact, Yuill (1992) argued that the issue of temporal consistency has received more research attention than other aspects of the development of trait understanding—whether the trait of interest has been smartness or a variety of other person characteristics.

Researchers who have studied beliefs about constancy across time have investigated children’s predictions of whether or not change will occur, whether or not change is possible, and the likely direction of change. Results of these studies indicate the seemingly paradoxical result that whereas older children are more likely to report temporal constancy than younger children, they are also likely to report that change in intelligence is possible. To assess beliefs about constancy, researchers have generally asked children in kindergarten through sixth grade to rate their own or classmates’ smartness currently and in the past or future (e.g., Droege & Stipek, 1993; Rholes & Ruble, 1984; Ruble & Flett, 1988; Stipek & Daniels, 1988, 1990). For example, Stipek and Daniels (1988) asked kindergartners and fourth graders to rate their own smartness at the time of the interview and the next year. While kindergartners rated their current competence lower than their future competence, fourth graders showed no differences (i.e., constancy). Using a similar procedure with kindergarten, fourth, and eighth grade children, Stipek and Daniels (1990) found that fourth and eighth grade participants predicted greater stability in classmates’ level of smartness than did kindergarten children. Taken together, these studies suggest that a key shift in children’s beliefs seems to occur between second and fourth grades (Droege & Stipek, 1993), in that older children show a stronger belief in the temporal constancy of ability.

Caveats to this general finding seem warranted, however, based on the distinction between constancy and possibility of change. Yussen and Kane (1985) asked first, third, and sixth graders if it would be possible for someone who is smart to be less smart when s/he grows up, or for someone who is not so smart now to be smart when s/he grows up. Although the bulk of the research on children’s belief in constancy would suggest the older children would be less likely to answer that change is possible, the majority of children in all three grades (80% of first graders, 91% of third graders, and 96% of sixth graders) endorsed the possibility of change. Perhaps children think of “growing up” as covering a longer period of time and affording more opportunity for change than the day, week, or year referenced in the questions.
posed by other researchers. Or perhaps “growing up” means more than simply the passage of time to children, and the question posed by Yussen and Kane is accessing a belief about change along a different dimension (e.g., maturational change) rather than a change in relative standing compared to other individuals. On the other hand, older children may believe that change is possible but not probable.

Although children are ready to endorse the possibility of change, their predictions vary depending on the direction of possible change, and studies examining the direction of change have produced inconsistent results. Some studies have shown that younger children seem to be less willing than older children to endorse loss of ability and more optimistic in their predictions of increases in ability. Yussen and Kane (1985) found that while children in all three grades (first, third, and sixth) they interviewed gave affirmative responses when simply asked if change in the level of intelligence was possible, first graders’ responses to follow-up questions suggested they were less sure about the possibility of changing from bright to dull than from dull to bright. Whereas 92% of first graders, 96% of third graders, and 83% of sixth graders indicated a person could increase his/her level of smartness, only 48% of first graders endorsed change in the negative direction as compared to 70% of third graders and 65% of sixth graders. Moreover, Droege and Stipek (1993) analyzed difference scores calculated from students’ ratings on a 5-point scale of past, current, and future smartness of “not so smart” classmates, and concluded that kindergartners in their study expected greater improvement over time than did third and sixth graders.

Other studies have failed to find age differences and have been less clear in the endorsement of one direction of change. Using a method borrowed from Nicholls (1978), Stipek and Daniels (1990) presented their child participants with a column of 20 stick figures with the top stick figure identified as the smartest kid and asked them to rate classmates they had nominated as “smart” and “not smart” by pointing to one of the figures in the column. Current and future (one-year) ratings were obtained. Based on these ratings, Stipek and Daniels concluded that all the students (kindergarten, fourth, and eighth graders) in their study expected children with high ratings one year to decline somewhat over the following year and children with low ratings to increase over the same time period. Using a similar methodology, Pomerantz and Saxon (2001) found similar results. These findings seem to suggest regression toward the mean in ratings for children of all ages; thus, the discrepancy among studies may be due to different methodologies. Having reviewed studies addressing constancy over time, we turn next to research concerning constancy over situations or tasks.

As with children’s beliefs about the temporal constancy of intelligence, a significant shift in children’s beliefs about situational constancy seems to
occur between second and fourth grades. For example, Rholes and Ruble (1984) presented participants of various ages from 5 to 22 with videotaped or oral vignettes describing an actor’s behavior in a given situation and of a particular valence (e.g., high or low intellectual problem-solving ability). Participants then predicted the actor’s behavior in another situation. Children aged 9 and above expected substantial cross-situational stability in the actor’s behavior, whereas the younger children did not. Similar age trends appear when children are asked to rate the smartness of classmates or hypothetical children if they were to go to a different school, have a different teacher, go to a class with different children, or sit at a different desk (Droege & Stipek, 1993).

Summary/critique

In summary, a significant shift in children’s theories seems to occur between ages 7 and 9, with older children more likely to believe that ability is both temporally and contextually constant. Tentative evidence implies that younger children are less likely to believe that change in a negative direction is possible. However, results concerning the direction of change are inconsistent.

The finding that children’s beliefs about the temporal and situational constancy of ability become apparent around ages 7–9 fits nicely with research examining children’s understanding of traits in general. Traditionally, it was thought that trait understanding did not appear until 7 or 8 years of age. Both theoretical and empirical arguments were made in support of this belief. From a Piagetian cognitive developmental perspective (Piaget, 1970), the transition from preoperational to concrete operational reasoning which occurs at this age includes the development of an understanding that the basic nature of an object or person does not change simply because of changes in appearance (i.e., invariance). This development lays a foundation for the understanding of traits as stable, underlying characteristics of personality. Empirically, younger children failed to use trait terms when prompted for descriptions of persons (e.g., Livesly & Bromley, 1973) and failed to make trait-consistent predictions of behavior (e.g., Rholes & Ruble, 1984).

When the Piagetian view came under fire for underestimating children’s cognitive competencies because of overly complex assessment procedures, simplified methodologies were designed to demonstrate that young children could make trait-consistent behavioral predictions (Dozier, 1991). However, the simplified methods also allowed for the possibility that children were not actually using trait reasoning but perhaps some other inferential process (e.g., behavioral matching strategies, Rholes, Newman, & Ruble, 1990; evaluative reasoning, Ruble & Dweck, 1995) to provide trait-consistent responses. Recently, Alvarez et al. (2001) have empirically demonstrated
that, at least for some traits, younger children’s (kindergartners) trait-consistent predictions are mediated by evaluative reasoning whereas older children (fourth graders) use trait reasoning to make trait-consistent predictions. Consequently, evidence for development of a conception of smartness as constant around 7–8 years of age lends support to the argument for the concurrent appearance of general trait understanding. As we will see next, developmental trends are not so evident in children’s beliefs about the controllability of intelligence.

Children’s beliefs about controllability

A facet of children’s beliefs about stability posited to influence motivation in achievement settings is the malleability of intelligence. Presumably, to the extent that children believe intelligence is controllable, they will be more likely to persist on difficult tasks and when faced with failure. Dweck and her colleagues (e.g., Dweck & Bempechat, 1983; Dweck & Leggett, 1988) began to explore children’s conceptions of intelligence in order to understand what might give rise to different achievement goals. Bandura and Dweck (as cited in Cain & Dweck, 1989) hypothesized that differences in the way children construe intellectual ability might lead to different aims in intellectual achievement settings. Some children might have an “entity” theory of intelligence and view intellectual ability as a stable, uncontrollable trait. Achievement settings potentially provide such children an opportunity to assess the quantity or quality of their intelligence and orient them toward a performance goal. Other children might espouse an “incremental” theory of intelligence and view intellectual ability as a malleable characteristic that they could improve or increase with effort. Such children would more likely endorse learning goals in achievement situations with the aim of increasing their level of intellectual ability.

Dweck and her colleagues have primarily explored the relationship between children’s beliefs about the malleability of intelligence and other achievement beliefs and behaviors. However, some work has examined the development of the beliefs themselves. Bempechat et al. (1991) posed a forced choice question pitting an incremental view of intelligence against an entity view to children in kindergarten through fifth grade. No differences in beliefs were found between younger (kindergarten through second grade) and older (third through fifth grade) children. Cain and Dweck (1995) asked first, third, and fifth graders to rate their agreement with statements about the fixedness of intelligence (e.g., How smart you are is something about you that you cannot change very much). Although children’s responses indicated clear individual differences in endorsement of an entity versus incremental view, no grade differences were found. A second rating (within a week’s time) indicated that children’s beliefs were very stable.
Summary/critique

Dweck’s work shows the theory-like nature of children’s beliefs, and as noted above, she uses the terms “entity theory” and “incremental theory” to identify the entire rubric of children’s beliefs about the malleability of ability and its relationships to performance goals and outcomes. Dweck’s finding of no developmental difference in children’s theories might seem inconsistent with research in children’s beliefs about the constancy of ability; this issue will be discussed below.

Children’s beliefs about capacity

Just as Dweck has focused her work primarily on children’s beliefs about the controllability of intelligence, so Nicholls (1978, 1989) concentrated on children’s conception of ability as capacity. Nicholls distinguished ability—a reference to general competence—from intelligence—one specific area of competence—a distinction that he felt few others had made (e.g., Dweck, 1986). Since Nicholls’ research on children’s conceptualization of intelligence was discussed in an earlier section, the focus here will be on his exploration of the concept of ability. In a series of studies, Nicholls and his colleagues (Miller, 1985; Nicholls, 1978; Nicholls & Miller, 1984; Nicholls et al., 1986b) argued—consistent with the notion that children develop a sophisticated theory about intelligence—that children’s conceptions of ability develop interdependently with their conceptions of other constructs such as luck, difficulty, and effort. It is the relationship between the constructs of ability and effort that delineates what Nicholls identified as children’s beliefs about ability as capacity.

The mature conception of ability as capacity as put forward by Nicholls (1989) holds that an individual’s present capacity in a given instance places limits on the extent to which effort will improve his or her outcomes relative to the outcomes of other individuals. Children with this mature conception would be expected to believe that when other things (e.g., task difficulty, time constraints) are equal, individuals who have to try harder than others to attain a certain level of performance have less capacity and will perform worse than others if they applied equal effort. To investigate endorsement of this conception of an inverse relationship between effort and ability, Nicholls and his collaborators (Miller, 1985; Nicholls, 1978; Nicholls & Miller, 1984; Nicholls et al., 1986b) used film, videotape, or a sequence of photographs to portray two children working on a task. While one child showed focused and sustained effort, the other child worked in an irregular fashion, demonstrating off-task behaviors such as playing with a ruler or eraser and gazing around the room. Both children in the portrayal received the same score on their work. Nicholls (1978) identified four levels of differentiation of ability and effort based on responses of participants, who ranged from the age of 5 to adults.
At Level 1 (mostly 5- and 6-year-olds), children fail to grasp the cause and effect relationships among effort, ability, and outcome (Nicholls, 1978). Explanations of outcomes are tautological (e.g., someone who gets a higher score is said to have worked harder—even if s/he didn’t). At Level 2 (mostly ages 7–9), children view effort as the cause of outcomes. Equal effort is expected to lead to equal outcomes. If outcomes are equal but effort varies, the child either has no explanation or offers idiosyncratic explanations (e.g., the lazier student must have worked really hard for a while). At Level 3 (mostly ages 9–11), effort is partially differentiated from ability as a cause of outcomes. When different amounts of effort lead to equal outcomes, children’s explanations imply that the person who worked less is brighter. However, children at this stage offer such explanations inconsistently. At Level 4 (mostly ages 12 and above), ability and effort are clearly differentiated. Low ability may limit the effect of effort on performance, whereas high ability may increase it. When performance is equal, less effort implies higher ability.

As expected, children holding the mature conception (Level 4) of ability as capacity inferred that the lazier child performed as well as the hard worker because of superior ability (Nicholls & Miller, 1984). Moreover, children with the conception of ability as capacity predicted superior performance by the lazier child with the application of effort equal to that of the other child. Similar results emerged when the child’s own level of effort was manipulated and compared to another child’s (Nicholls & Miller, 1984). Other researchers (e.g., Butler, 1999; Pomerantz & Ruble, 1997) have replicated all or portions of this developmental sequence.

Summary/critique

Nicholls’ four levels show a gradual developmental progression that maps well onto other changes in children’s cognitive abilities. Whereas younger children failed to differentiate between effort expenditure and ability in Nicholls’ results, older children had developed a coherent theory linking performance outcomes to unique combinations of underlying ability and effort.

The increasing coherence and abstractness of children’s intelligence theories are also reflected in the work by Nicholls, showing that children differentiate their prediction of teachers’ reactions to performance based on their own conception of ability (Nicholls, 1978). In particular, children with the most sophisticated understanding predicted that teachers would show high approval of high effort/low ability children. These children were also more likely to want to be like high ability/low effort students than were children with less mature concepts (Nicholls, 1978). Having reviewed the work on children’s disparate conceptions of the stability of intelligence, we next address closely related beliefs about the origins of intelligence and possible mechanisms of change.
Origins of intelligence and mechanisms of change

Intimately related to the question of the stability of intelligence are questions concerning the origins of intelligence and mechanisms by which intelligence level might change if change is considered possible. Often, children’s beliefs about these issues have been indirectly assessed by the way investigators posed questions about stability. Not only have researchers asked questions about different types of stability (as discussed above) but they have also confounded stability with other issues in those assessments. For example, in assessing children’s entity versus incremental beliefs about intelligence, Pomerantz and Ruble (1997) had students react to the statement “kids who are smart in school were born that way.” Such a statement possibly confounds beliefs about the origins of intelligence lying in biological inheritance with beliefs about the fixed and uncontrollable character of intelligence.

Studies examining children’s beliefs about the origins of intelligence have consistently shown strong emphasis on nurture, and an increase with age in children’s endorsements of nurture or experience. For instance, when Yussen and Kane (1985) asked in free response format where smartness/intelligence comes from, most first, third, and sixth graders in their study gave answers related to experience/nurture. In addition, statistically nonsignificant trends appeared, suggesting a decrease in born/nature responses across grades. When asked if smart people are “born that way,” 32% of first graders, 4% of third graders, and 9% of sixth graders said “yes.” When asked if smart people are that way because of things they’ve done or experienced, the percentages answering affirmatively were 44, 65, and 56, respectively. Finally, Yussen and Kane inquired about the relative importance of nature and nurture, pitting the two putative influences directly against one another. With the question posed in this manner, first and third graders sided with nature while sixth graders stated that experience was the more significant influence.

More recently, Heyman and Gelman (2000) examined children’s beliefs about the origins of both physical and psychological traits in humans with a more implicit method. Using a switched-at-birth task (Hirschfeld, 1995), they required participants to judge whether babies sent home from the hospital after birth with the wrong parents would resemble their biological or upbringing parents on a variety of physical (e.g., type of hair, size of feet) and psychological (e.g., niceness, smartness, and shyness) characteristics. In a series of studies using kindergartners, first and second graders, fourth and fifth graders, and adults, Heyman and Gelman found that the kindergartners were like older children and adults in showing systematic beliefs about the important role of nature in the origins of physical traits. However, the youngest children failed to show any systematic endorsement of either nature or nurture as an explanation of general psychological trait origins,
whereas the older children and adults tended to credit nurture for such characteristics.

Most interesting for the current discussion, however, was the finding that fourth and fifth graders and adults differentiated among the psychological traits in terms of the relative influence of nature and nurture but the younger children did not. For all psychological traits (including ‘‘smartness’’), kindergartners’ endorsement of nurture was at chance levels, and first and second graders consistently gave more nurture responses. In contrast, older participants credited nurture more in the determination of ‘‘niceness’’ (82–96% of the time) than of ‘‘smartness’’ (53–63% of the time) across the series of studies (Heyman & Gelman, 2000).

Researchers have also sought explanations from children about the processes by which change in intellectual level might occur. Yussen and Kane (1985) asked children if what a person does or the experiences a person has could change one’s level of smartness. Regardless of whether positive or negative change was considered, experiences were a commonly cited explanation for first, third, and sixth graders. However, older children seem to recognize that there are limits to the extent to which experience can enhance ability. Stipek and her colleagues (Droege & Stipek, 1993; Stipek & Daniels, 1990) have asked children if it would be possible to change one’s level of smartness by trying hard or studying. Droege and Stipek (1993) found that all the children (kindergarten, third, and sixth graders) in their study perceived some effort-related malleability, but the sixth graders appeared to assume there are some limits to what effort could accomplish, especially when asked if someone ‘‘not too smart’’ could become ‘‘very smart’’ (as opposed to ‘‘kind of smart’’). Similarly, Stipek and Daniels (1990) found that eighth graders were less willing than kindergartners and fourth graders to say that a ‘‘not so smart’’ classmate could become one of the smartest students by studying hard.

Summary/critique

To some extent, Pomerantz and her colleagues (Pomerantz & Ruble, 1997; Pomerantz & Saxon, 2001) provided empirical syntheses of the research on the development of children’s beliefs about the stability of intelligence. Using a sample of second through fifth-grade children and measures adapted from some of the protocols described above, Pomerantz and Ruble (1997) confirmed the general findings of studies reviewed earlier. In particular, beliefs about the constancy of ability appear to develop earlier in the elementary school years whereas beliefs about capacity (i.e., ability as a static quantity which limits the benefits of additional effort) are acquired later. No age trends were discernible in children’s beliefs about the controllability of intelligence. Pomerantz and Saxon (2001) examined beliefs about constancy and controllability in a slightly older sample of fourth through sixth-grade children in three waves over the course of a year. Beliefs about constancy increased within
and across grades. In contrast to Pomerantz and Ruble’s results as well as those of Dweck and her colleagues (Bempechat et al., 1991; Cain & Dweck, 1995), beliefs about controllability decreased over the same ages.

However, it still seems unclear exactly what has been assessed when children’s current and future ratings of smartness are used as indicators of their belief in constancy. Moreover, the finding that many/most children, regardless of age, advocate the possibility of change as a result of experience or actions seems to be at odds with the developing belief in ability as a capacity unaffected by effort. The answer to this inconsistency may lie in the different conceptualizations of ability held by Dweck (1986) and Nicholls (1989). The items used by Dweck and her colleagues to assess children’s beliefs in malleability appear to be aimed at a more general conceptualization of ability not tied to a particular instance of performance, whereas Nicholls and his colleagues have asked children to reason about the effect of effort on ability during a specific achievement episode. Nicholls (1990) himself noted this distinction and cautioned against equating his concept of ability as capacity and Dweck’s entity theory of intelligence. Perhaps more useful information might be gained by asking questions about changeability for each domain of intellectual skill or by distinguishing between short- and long-term change.

There are also inconsistencies in the evidence provided by Yussen and Kane (1985) and Heyman and Gelman (2000) with regard to children’s beliefs about the origins of smartness. Whereas the first graders interviewed by Yussen and Kane appeared to favor nature as an explanation of an individual’s ability, the first and second graders in the studies of Heyman and Gelman opted for nurture. In addition, the older children and adults in the latter work seemed willing to credit both nature and nurture as sources for smartness whereas the sixth graders in the Yussen and Kane study opted for nurture when forced to choose. Interestingly, the sixth graders asked by Droege and Stipek (1993) if experiences could increase ability appeared to believe that there are limits to such improvement. Given the small amount of research on this issue and the methodological differences in the studies reported here, a general statement concerning the developmental progression of children’s naïve theories about the origins of intelligence and mechanisms of change seems unwarranted; additional examination of this aspect of children’s theory-building is clearly needed.

Having outlined our knowledge of how children define intelligence and how they conceptualize its stability, next we discuss research that has examined the relationships among children’s beliefs about intelligence.

**Relationships among beliefs about intelligence**

Very little work has been done with the explicit goal of drawing connections among the myriad beliefs about intelligence that have been studied in
children. But examining such connections becomes critical given the “theory” view we are advocating. The relationships among ability constructs provide the framework upon which the child builds a theory of intelligence. Four studies were identified in the literature that attempted to interrelate various beliefs that children might have about intelligence. We argue that the results of these studies exemplify the increasing coherence, detail, and abstractness of children’s naive theories of intelligence that develop through middle childhood.

**Relationships among beliefs about stability of intelligence and mechanisms of change**

Three studies have distinguished the different constellations of beliefs about the stability/malleability of intelligence held by children and have explored interrelationships among these beliefs. Stipek and Gralinski (1996) complemented Dweck’s (1986) work by examining relationships among beliefs about intelligence, effort, and performance. Children in grades three through six completed a 12-item questionnaire assessing beliefs that ability is stable and unaffected by effort (cf. Dweck’s entity theory), performance is stable and only modestly affected by effort, intelligence is a specific and global cause of academic performance, effort is a cause of academic performance, and effort increases intelligence (cf. Dweck’s incremental theory). Factor analyses of the 12 items produced two interpretable factors which Stipek and Gralinski labeled “ability-performance beliefs” and “effort-related beliefs.” The ability-performance beliefs factor included all the items referring to beliefs about ability and performance (e.g., there isn’t much you can do to make yourself smarter, kids who are not smart don’t do well in any subject), suggesting that children who believe that intelligence is relatively fixed also believe that performance is relatively stable and that intelligence is global in its effect on performance. The effort-related beliefs factor included items referring to positive effects of effort on performance and intelligence (e.g., anyone who works hard could be one of the smartest in the class).

Whereas scores on the two scales were uncorrelated for fourth through sixth graders, suggesting that the two sets of beliefs seem to be distinct, a modest positive correlation was found between the scales for third graders. Stipek and Gralinski (1996) offered the hypothesis that a significant differentiation of intelligence and performance between third and fourth grades could account for this grade-related change in the relationship between the two scales. Moreover, scores on the ability-performance beliefs scale decreased across third, fourth, and fifth grades, whereas scores on the effort-related beliefs scale evidenced no significant changes with grade. These findings support the argument that part of the developmental process with regard to children’s beliefs about intelligence entails continuing differentiation into a multifaceted theory.
As noted above, Pomerantz and Ruble (1997) examined relationships among beliefs about constancy, controllability, and capacity in second through fifth graders. Conceptions of ability as constant and as capacity were only weakly correlated with one another, and each showed near zero correlations with conceptions of ability as uncontrollable. These low correlations held across grades and across sexes. A confirmatory factor analysis in which items assessing each of the three conceptions (i.e., ability is constant, controllable, and a fixed capacity) were forced to load on separate factors exhibited good fit and significantly better fit than two alternative models that tested one- and two-factor solutions.

Pomerantz and Saxon (2001) have sought to refine further our understanding of children’s beliefs regarding the stability of intelligence and have presented evidence suggesting that children distinguish between internal and external forces in their thinking about the stability of ability. They reconceptualized the ideas of constancy and controllability as discussed above as conceptions of ability as stable to either external or internal forces, respectively. In their view, stability across time and situations suggests that ability is unlikely to be influenced by forces external to the individual whereas viewing ability as a fixed entity suggests that it is unlikely to be influenced by forces internal to the individual. Again using measures adapted from earlier studies, Pomerantz and Saxon demonstrated that these conceptions were indeed distinct and inversely associated in a sample of fourth through sixth graders assessed in three waves across 12 months. As mentioned in an earlier section, they found that conceptions of ability as stable to external forces increased across these ages whereas conceptions of ability as stable to internal forces decreased. In addition, the two conceptions were related to self-evaluation in an opposite manner: Conceptions of ability as stable to external forces predicted positive self-evaluation whereas conceptions of ability as stable to internal forces were predicted by negative self-evaluations.

Beliefs concerning ability as capacity and the component structure of intelligence

As noted previously, Nicholls (1989) viewed intelligence as a specific area of competence. Although the work by Nicholls and his associates (e.g., Nicholls, 1978; Nicholls & Miller, 1984; Nicholls et al., 1986b) concerning children’s views of ability and intelligence was discussed earlier, we provide a brief review of the developmental progressions they identified here so that the links between the two areas can be discussed.

With regard to conceptions of intelligence, children at the least mature level did not refer to inherent differences in types of intellectual ability (i.e., verbal versus abstract) and based their evaluations of the importance of the factor for intelligence on subjective difficulty. The most differentiated conception of intelligence distinguished accumulated information or the
content of memory (crystallized intelligence) from abstract reasoning and problem solving (fluid intelligence). With regard to conceptions of ability, children at the least mature level did not distinguish effort, outcome, and ability and gave tautological explanations of smartness. Children then seemed to pass through intermediate levels of conceptualizing effort first as the primary cause and later as one of many causes of outcomes. The most mature conception of ability as capacity differentiates it from effort and acknowledges an inverse relationship between the two constructs.

The beliefs about intelligence and the conceptions of ability and effort show some parallels conceptually; however, Nicholls and his colleagues (Nicholls et al., 1986b) found it difficult to identify empirical links. The most differentiated conception of ability emerged before (approximately the age of 12) the correspondingly most mature conception of intelligence (only after the age of 15). Nicholls (1989) suggested that the understanding of intelligence depends on awareness not only of the dynamics of performance on tests (conceptions of ability) but also of the acquisition of skills brought to the testing situation. In addition, he asserted that circumstances “demanding” the eventual construal of ability as capacity are ubiquitous, in that people are regularly seen to reach similar outcomes with different efforts, while no such “demanding” circumstances are evident for differentiated conceptions of fluid and crystallized intelligence.

**Summary/critique**

Taken together, these studies show the expanding and elaborated web that constitutes children’s developing theories of intelligence. The older children in Stipek and Gralinski’s (1996) sample, who presumably had a mature concept of ability as distinct from performance outcome, had clearly differentiated beliefs about the respective roles of effort and ability in influencing outcomes. Although the two sets of beliefs (i.e., ability is fixed and performance is stable versus effort shapes performance) were not correlated, ability-performance beliefs decreased from fourth through sixth grade, whereas effort beliefs remained constant.

Pomerantz and Ruble (1997) also found that children’s beliefs about ability as constant and their beliefs about mechanisms of change are unrelated in second-through fifth graders. Pomerantz and Saxon (2001) took these ideas a step further and demonstrated that with development, children’s beliefs in ability as stable to external forces increased, whereas conceptions of ability as stable to internal forces decreased. Importantly, children’s self-evaluations of ability were related to their endorsement of stability beliefs.

The findings from the work of Nicholls and colleagues (Nicholls et al., 1986b) seem to highlight the relative influences of maturational and environmental factors in the development of beliefs and the causal connections made between them. We return to this topic in later discussions of theoretical...
perspectives. Although Nicholls and his colleagues may have failed to find connections between children’s beliefs about ability and beliefs about the structure of intelligence, numerous studies have linked beliefs about ability and other achievement constructs.

**Relationships between beliefs about intelligence and other achievement constructs**

As noted earlier, one of the more practical goals in the study of children’s beliefs about ability has been to connect such beliefs to other achievement-related constructs such as achievement attributions, achievement goals, and achievement behaviors. Moreover, identification of relationships between ability beliefs and other achievement constructs allows additional critical examination of the argument that children make theory-like use of these beliefs in their achievement-related interpretations, predictions, and reactions. Given space restrictions, we will limit our review of this research to a brief summary of each area.

Research in attributions about performance outcomes has sought to distinguish ability from other potential causes of performance and to link certain beliefs about ability to patterns of attributions made in achievement settings. Viewing ability as one element in a constellation of causes of achievement outcomes, Nicholls (1978) and Nicholls and Miller (1983, 1985) produced a body of research on children’s differentiation of ability from luck and task difficulty, paralleling his work on children’s differentiation of effort and ability as discussed earlier. This work showed that older children (i.e., ages 12 and above) were more likely than younger children to correctly distinguish among tasks where outcomes were driven strictly by luck versus a combination of effort and ability (Nicholls & Miller, 1985). Both children’s explanations of outcomes and predictions of future success were linked to their differentiation of the concepts of luck and ability. Nicholls (1978, 1980) and Nicholls and Miller (1983) found parallel results regarding the development of the distinction between task difficulty and ability. In particular, children’s recognition that a puzzle solvable by a smaller proportion of peers requires more ability than one solvable by a larger proportion of peers increased with age.

Whereas the foregoing studies examined the development of children’s discrimination of ability from effort, luck, and task difficulty as potential causes of performance outcomes, Pomerantz and Saxon (2001) investigated links between beliefs about the constancy and controllability of intelligence and children’s performance attributions. These authors found that conceptions of ability as constant (stable to external forces) were related to ability attributions for academic success and effort attributions for academic failure. Longitudinal analyses suggested that conceiving of ability as constant
predicted increases in ability attributions for academic success and increases in effort attributions for failure over time. In contrast, conceptions of ability as uncontrollable (stable to internal forces) were linked concurrently to ability attributions for failure, and these attributions tended to predict conceiving of ability as uncontrollable in the longitudinal analyses. Pomerantz and Saxon interpreted these results as evidence that beliefs about the constancy of ability promote self-enhancing attributions whereas self-deprecating attributions tend to produce conceptions of ability as uncontrollable.

Several studies have examined the relationships among beliefs about ability, achievement goals, and achievement behaviors in various combinations. In some instances, arguments have been made for causal paths from beliefs to goals to behaviors (e.g., Dweck & Leggett, 1988) but empirical support for this complete set of linkages is notably lacking. Still, investigators have documented differences in beliefs that parallel, and occasionally predict, differences in goals and/or differences in behaviors (e.g., Butler, 1999; Mueller & Dweck, 1998; Stipek & Gralinski, 1996).

Nicholls (1989, 1990) argued that individuals and situations differ in the extent to which they are task- or ego-oriented—that is, to what degree they are characterized by goals of learning and mastery versus goals of performing well relative to others, respectively. A less differentiated view of ability (i.e., effort and ability are positively associated) could suffice for a task-oriented individual or in a situation that seems to place an emphasis on mastery and learning. Conversely, an ego-oriented individual or a situation that emphasizes demonstration of ability would likely activate the more differentiated conception of ability (i.e., effort and ability are negatively related). Butler (1999) has taken this particular belief-goal connection a step further to show that beliefs and goal conditions can interact to influence attitudes and behaviors in achievement situations.

Although linkages between constancy beliefs and goals are largely lacking, evidence linking such beliefs to behaviors does appear in the research literature. For example, Ruble and Flett (1988) found that belief in the constancy of ability was related to interest in information considered diagnostic of performance. Also, Rholes, Jones, and Wade (1988) have shown that belief in stable personality dispositions interacts with performance outcomes to influence persistence. That is, success bolsters persistence on a task and failure undermines it among children who have a more highly developed sense of stable dispositions.

As noted previously, Dweck and her colleagues have found connections between entity beliefs and performance goals and between incremental beliefs and learning goals in both correlational and experimental studies with children in the higher elementary grades (see Cain & Dweck, 1989, for a discussion of unpublished studies). In a series of studies with fifth graders examining the role of feedback in fostering certain beliefs about intelligence, Mueller and Dweck (1998) demonstrated that praise for intelligence versus
praise for effort produced concomitant changes in beliefs, goals, and behaviors. More specifically, children praised for intelligence were more likely to rate intelligence as being fixed, more likely to choose performance goals over learning goals, more likely to choose performance information over strategy information, and less likely to want to persist on problems than were children praised for effort. Causal relations among beliefs, goals, and behaviors were not examined in this work, however.

Cain and Dweck (1995) looked for connections between beliefs about the malleability of intelligence and patterns of achievement behavior in younger children. The results of their study suggested that group differences in implicit theories of intelligence did not appear until fifth grade, when such differences were associated with the distinctly different achievement behavior patterns found in earlier research (i.e., helpless children were more likely to endorse an entity view of intelligence). As early as first grade, however, children differed in their broader patterns of beliefs about ability and achievement, and these differences were related, even at first grade, to the behavioral patterns observed in achievement situations. The helpless children were more likely than mastery-oriented children to emphasize the final evaluation of a product, such as what kind of marks it received, than the processes—such as effort and classroom conduct—that contribute to outcomes. Conversely, mastery-oriented students focused more on controllable processes.

Summary/critique

In summary, as children proceed through the elementary grades, their theories of intelligence become both more precise—in distinguishing ability as one of several possible causes of performance outcomes—and more elaborated, with an increasingly rich constellation of linkages among various ability-related beliefs, achievement goals, and achievement behaviors. The findings reviewed above also support the contention that beliefs about intelligence develop within a larger network of concepts which together comprise a working theory about both the nature of ability and its functioning. With a more mature understanding of ability, children are able to appropriately specify how various causes may differentially influence performance depending on other contextual factors. Beliefs not only influence achievement striving contemporaneously but may also have a long-term influence through shaping the development of future beliefs. In addition, individual differences emerge in children’s theories with development (e.g., entity versus incremental beliefs). Although the paths by which children arrive at these perspectives have yet to be elucidated, three broad theoretical approaches have been applied to our understanding of the development of children’s beliefs about intelligence. We turn next to a summary of these approaches.
Theoretical considerations

Much of the research on children’s beliefs about intelligence has progressed in a piecemeal fashion with little attention to possible theoretical underpinnings of developmental change. However, some researchers have attempted to provide such a theoretical framework. A brief review of these efforts is provided with an eye toward an ultimate integration of compatible viewpoints into a multilevel model of the development of children’s beliefs about intelligence. Interestingly, some of these approaches have implied, if not explicitly proposed, the development of a framework of beliefs compatible with the “theory” view advocated here.

Review and critique of previous theoretical perspectives

Cognitive-developmental views

Leahy and Hunt (1983), advocating a cognitive-developmental view, sought to apply the ideas of Piaget (1932/1965) and Kohlberg (1969) to the study of children’s beliefs about intelligence. They expected social constructs to show qualitative, structural changes with age reflective of the changes seen in other nonsocial cognitive constructs (e.g., number, size) and argued for a shift in beliefs about intelligence paralleling the shift from preoperational to concrete operational thought. Development of decentering, seriation, and classification skills was seen as prerequisites for psychological conceptions of intelligence and the use of social comparison. Although Leahy and Hunt placed primary emphasis on cognitive-developmental maturation as the force driving development of children’s conceptions of intelligence, they did not wholly neglect social factors. Citing Piaget’s (1970) discussion of socialization of thought, which holds that: (a) thinking develops through dialogues with others in which symbols take on shared meaning, (b) one’s views may be checked with others, and (c) individual interests are considered within the context of group interests; they allowed for changes in the structuring of social interactions as a factor shaping children’s conceptions.

Nicholls (1989, 1990; Nicholls, Jagacinski, & Miller, 1986a) posited an alternate cognitive-developmental viewpoint. For Nicholls, the concept of ability develops in an age-related process of differentiation through which it is gradually distinguished from other constructs that influence achievement outcomes such as effort, luck, and task difficulty (as discussed in previous sections). Development of children’s conceptions also follows a progression from a self-referenced perspective to a more external and social perspective. Although Nicholls (1989) proposed age-related stages in the differentiation of the concept of ability, he acknowledged that not all older children and adults would use the most mature conceptualizations because situational characteristics and individual differences may affect the conception of ability.
employed in a given instance. When learning or mastery is seen as an end in itself, a less differentiated view of ability (i.e., effort and ability are positively associated) might suffice whereas the more differentiated conception of ability (i.e., effort and ability are negatively related) becomes activated in ego-involving situations where demonstration of ability is the goal. Similarly, individuals differ in the extent to which they are task-oriented or ego-oriented and in concomitant differences in their conceptions of ability. Stepping back to examine the educational enterprise and American society as a whole, Nicholls noted that there is great concern in our culture with ability relative to others and that competitive contests and evaluation lead to use of the more differentiated conception of ability.

Given their strong reliance on maturational premises (i.e., age-related change in thinking about ability), Leahy and Hunt (1983) and Nicholls (1978, 1989) argued for a combination of biological and mentalistic views. Children develop new conceptions of intelligence as their thought apparatus (i.e., the brain) matures and as the acquisition of other cognitive skills (e.g., decentration, classification) progresses. Putting aside critiques of maturational stage theories in general and Piagetian stages in particular (e.g., Brainerd, 1978), some connection between the cognitive skills thought to mark children’s progression through stages of cognitive development and their beliefs about intelligence is needed to defend this argument. However, neither Leahy and Hunt nor any other investigators have concurrently measured children’s cognitive skills and their beliefs about ability to determine if a relationship between them exists. Leahy and Hunt simply suggested that in their study because the older children, assumed to be concrete operational, showed a different conception of intelligence than the younger children, assumed to be preoperational, maturation of thought processes might explain the difference. Similarly, Nicholls and his colleagues (1978; Nicholls & Miller, 1984) merely described the apparent belief structures of children across a range of ages with regard to ability as capacity without examining empirically their relations to other markers of cognitive maturation.

In much of the early work on children’s beliefs about the constancy of intelligence (see Stipek & MacIver, 1989, for a review), a similar argument was made that the shift toward a view of ability as more stable could be expected to occur when it did because of prior or concomitant changes in thought processes (e.g., development of the ability to engage in social comparison), which had been demonstrated in other studies (e.g., Frey & Ruble, 1985; Ruble, Parsons, & Ross, 1976). However, evidence that children are capable of certain mental abilities earlier than it was previously thought has brought the purely maturational cognitive-developmental view into question in the realm of children’s beliefs about intelligence (Cain & Dweck, 1989, 1995; Ruble, 1994). Furthermore, in later discussions of his own work, Nicholls (1989, 1990), while continuing to endorse the importance of maturation as an explanatory factor, also acknowledged the role of situations and societal
structure in the determination of the type of belief system an individual endorses. Socially acquired information plays a larger role in information processing views, which we will describe next.

Inference processing views

Cain and Dweck (1989) proposed that children’s understanding is determined not by their progression through a sequence of age-related cognitive-developmental stages but by their cumulative acquisition of general and domain-specific knowledge and that development of conceptions of intelligence proceeds because children find achievement outcomes meaningful and engage in mental work to understand them. In this view, the child’s overall task is to construct a theory of intelligence as an abstract, internal cause that plays a significant role in achievement situations based on causal analysis of factors influencing achievement outcomes. Cain and Dweck argued that this process occurs in three steps. Upon exposure to the achievement domain (e.g., entrance into school), the child undertakes an initial analysis and comes to the realization that behavior plays a role in outcomes. Next, the child formulates a rudimentary model of achievement outcomes based on the beliefs that one must attend to or engage in tasks and possess some knowledge or skills with which to complete tasks. At the final stage, intelligence is viewed as a complex system containing the three components of effort, knowledge, and capacity or some subset of them; the components are seen as independently manipulable and combinable in multiple ways; and the system is viewed more in psychological rather than in behavioral terms.

Ruble (1994) has also proposed a developmental model for children’s understanding of ability that emphasizes social information acquisition and processing. The basic premise of this model is that the child goes through three “phases” that are associated with distinct orientations toward social information. The three phases are characterized by distinctive knowledge representations and cognitive-motivational orientations. The initial phase, construction, occurs when individuals enter a new psychological situation where old categories/expectations may not apply (e.g., when children enter formal schooling). At this phase, knowledge is low and limited to superficial, observable aspects of a topic, and the individual engages in active information seeking to construct new representations. For example, young children show early, heightened interest in information about the new school system they have entered and its performance and evaluation processes, and their feelings about school and judgments of competence are clearly influenced by these settings (e.g., Stipek & Daniels, 1988; Valeski & Stipek, 2001).

The second phase, consolidation, is reached when fundamental knowledge has been acquired and the individual attempts to draw some conclusions about the topic and how it applies to the self. Children in the middle elementary grades develop an organized structure of knowledge
about ability as a measurable trait and begin to seek ability assessment information (e.g., social comparison). In the final phase, integration, the child maintains and elaborates the conclusions drawn about a topic, integrating them with other knowledge and self-structures and promoting more flexible functioning. Individual differences among schoolchildren in knowledge and conclusions about ability may function at this phase to influence variations in achievement-related goals.

The theoretical frameworks suggested by Cain and Dweck (1989) and Ruble (1994) are notably less maturational than the cognitive-developmental views summarized above. Each of these information-processing models credits children’s acquisition and interpretation of achievement-related knowledge with determining their level of conceptualizing ability. Children develop new conceptions of intelligence as their store of knowledge increases and their knowledge structures undergo reorganization. Such a model fits well with the “theory” view of development as outlined by Gopnik and Wellman (1994) and the nature of conceptual change as discussed by Carey and Spelke (1994). What remain unclear, however, are the nature of the reorganization and the cause(s) of the transition to a new conceptualization of ability. If the change is abrupt, is it a critical amount or a critical type of information that prompts the shift?

An interesting avenue of research to explore along this line is the identification of what in the dynamic systems literature (e.g., Fogel & Thelen, 1987) are called control parameters—particular stimuli or patterns of stimuli that trigger the reorganization of a system. If the change is more gradual, as both models seem to allow, then the methods used to assess children’s conceptions should reflect more of a continuum of beliefs rather than dichotomous categories as have sometimes been used (e.g., Bempechat et al., 1991; but see also Bempechat, 1998, for similar criticism). Both of these predominantly mentalistic theories do take account of some environmental influence by suggesting that the formal educational setting provides a context in which knowledge about ability becomes meaningful, and information about ability is made available. The question left unanswered is whether simple exposure or some specific quality of schooling (e.g., teacher behaviors, peer comparison) provides the vital data for children’s analyses of ability.

**Sociological view**

Rosenholtz and Simpson (1984) completely discounted cognitive-developmental explanations and argued that the situation (i.e., school setting) strongly influences individual development. Drawing on sociological traditions, these authors posited that the educational system, by means of classroom organization and structure, teacher behaviors, and peer interaction, inculcates in students an institutionalized view of ability reflective of the value system of the larger society. They argued that the interaction and
feedback process which is part of daily school activities leads children to accept a traditional model of ability as a general, stable, consensually validated characteristic which differs from person to person. For example, unidimensional classroom structure, characterized by all students performing the same tasks upon which they all are similarly formally evaluated, implies a single underlying dimension of ability upon which all can be compared. Teachers mediate the influence of the structure of schooling through the information they provide, whether verbal or behavioral, and peers mediate the flow of information from teachers to individual students through conversation about and comparison of ability evaluations. Behavioral norms that differ across grade levels also promote diverse formulations of ability, such that conduct and effort are associated with ability in early grades but not in later grades. Children develop new conceptions of intelligence that are consistent with these various behavioral norms at different levels of schooling.

Although Rosenholtz and Simpson (Rosenholtz & Rosenholtz, 1981; Simpson, 1981) provided some direct evidence of the effects of differential classroom structure on children’s beliefs—particularly self-assessment of ability and the conception of ability as a general trait upon which all individuals can be measured—ruling out any kind of maturational component seems at best premature. The accumulation of ability-related information made available in the school setting may play a central role in the development of children’s ability conceptions, as even Cain and Dweck (1989) and Ruble (1994) seemed to suggest. Nonetheless, the possibility still exists for age- and/or knowledge-related differences in how that information is processed and interpreted. In fact, Stipek and Daniels (1988) have demonstrated that age-related cognitive changes in the child and characteristics of the classroom environment interact to influence children’s conceptions of competence. Given this and other evidence as reviewed above, we propose in the following section an integration of the three perspectives such that maturational, mentalistic, and environmental factors are all considered in the development of a child’s theory of intelligence.

Children’s theories of intelligence: A new perspective

The most profitable approach to understanding the development of children’s beliefs about intelligence may lie in addressing the multiple aspects of children’s beliefs, the multiple aspects of development, and the cumulative nature of change. This approach also allows an integration of ideas expressed by the earlier theoreticians into a broader perspective.

The body of research on children’s beliefs about intelligence seems to have reached a point where both more differentiated and more integrated investigation is required. Some researchers have tried to encapsulate children’s conceptions of ability in singular terms and constructs. For example, one investigator might ask whether a child holds an entity or incremental theory.
assuming that is the crucial aspect of the child’s belief, while another asks whether the child thinks ability is constant or inconstant. However, the preceding review suggests that a child’s conception of intelligence actually embodies a configuration of beliefs (or naïve theory) concerning particular aspects/qualities of ability. Concurrent examination of the multiple components of children’s conceptions might prove more fruitful (e.g., does the child hold an entity or incremental theory? and does the child think ability is constant or inconstant?).

Some researchers actually took a more comprehensive approach initially (e.g., Yussen & Kane, 1985) when making early attempts to discern the general nature of children’s thoughts regarding intelligence. Others have recently begun to address the multifaceted nature of children’s beliefs about intelligence and relations among them using the various constructs identified thus far in the literature (e.g., Pomerantz & Ruble, 1997; Pomerantz & Saxon, 2001). This more differentiated method of research will require that the constructs studied as part of children’s belief structures be more distinctly operationalized so as to avoid confusion in the literature such as that caused by the unclear relations between Dweck’s (1986) entity theory of intelligence and Nicholls’ (1989) view of ability as capacity.

This differentiated view may also be required in contemplating the development of various aspects of children’s conceptualization of intelligence. In light of the growing evidence that different beliefs are distinct and show different developmental trajectories (e.g., Pomerantz & Ruble, 1997; Pomerantz & Saxon, 2001; Stipek & Gralinski, 1996), it seems prudent to consider that development of these beliefs is guided by different influences. In fact, Pomerantz and Saxon (2001) have suggested such a possibility with regard to beliefs about constancy and controllability. In their view, beliefs about constancy (conceptions of ability as stable to external forces) have a cognitive basis because of their apparent stability and immutability in response to self-evaluative processes. In contrast, beliefs about controllability (conceptions of ability as stable to internal processes) have a social basis because of their apparent instability and susceptibility to influence by self-evaluation. Additional support for the role of social influence in shaping beliefs about controllability comes from Mueller and Dweck’s (1998) demonstration that different types of praise can promote either entity or incremental views of intelligence.

Just as the nature of children’s beliefs is complex and multifaceted, so too is the nature of development. To more completely capture and fully understand children’s developing conceptions of ability, a more integrated approach seems advisable. While each of the theoretical perspectives discussed above has covered important elements in the developmental process concerning children’s beliefs, none has sufficiently addressed its totality. An interactional perspective, such as that described by Magnusson (1990; Magnusson & Cairns, 1996), seems best suited to provide such a comprehen-
sive framework. Three propositions summarize the basic view of this interactional perspective:

1. An individual develops and functions as a total, integrated organism; current functioning and development do not take place in single aspects per se, in isolation from the totality.

2. An individual develops and functions in a dynamic, continuous, and reciprocal process of interaction with his or her environment.

3. The characteristic way in which an individual develops and functions, in interaction with the environment, depends on and influences the continuous reciprocal process of interaction among subsystems of mental and biological factors (Magnusson, 1990, p. 196).

In order to more precisely study, understand, and explain how children’s beliefs about intelligence develop, researchers must consider all three realms within which development occurs—biological, mental, and environmental—since none functions in isolation from the others. Biology, cognitive processes, and situational stimuli reciprocally act upon each other to determine the course of development. Dynamic interactions among these levels provide the ongoing context in which children formulate their beliefs.

An example of such interrelations might serve to elucidate this point (Bempechat, 1998). A child’s temperament, widely regarded as primarily connected to biological makeup (Goldsmith et al., 1987), might lead him or her to react differently to environmental stimuli presented in the school setting (Lewis, 1995). A more highly reactive child, for example, may be more cogently affected by the strength or tone of a teacher’s feedback about his or her performance and more readily incorporate such information into a cognitive belief structure about ability. Moreover, such a highly reactive child may elicit differential feedback from the teacher, thereby influencing the type of information concerning ability available for processing.

Within this interactional view, development occurring in any of these domains may impact development in the others. With regard to children’s belief systems, the nominal focus is on cognitive developments but other areas must necessarily be taken into consideration. The current structure and functioning of a child’s cognitive system reflect the influence of past development through continuous interaction between the child and the environment. Ongoing interaction with the environment at all levels (e.g., physical, social, and cultural) shapes the development of the child’s mental structures and their contents. Concurrently, the child’s readiness to interpret and respond to environmental information results from the interaction of the child’s level of biological development (e.g., nervous or sensory system maturation) and any cognitive structures formed as a result of previous experiences. In turn, the child’s conceptions of the world and the self will influence which environments are sought and avoided, which environmental cues are attended to, and how these cues are interpreted. In essence, the pattern that
takes shape is one of multiple threads of influence woven in and out of a spiraling tapestry of development. Often, theories and models implicitly portray the world outside the individual as static, offering up a relatively constant set of stimuli for interpretation and reaction. However, that outer world itself must be recognized as a dynamic, multilevel system (Bronfenbrenner, 1989). The child plays a role in transforming the immediate environment through actions directed toward that environment and also through the search for and avoidance of certain situations. As an example of the latter, consider the child who, through a given sequence of maturation and experience, develops a view of intelligence as a fixed quality which he or she lacks and who, consequently, purposefully avoids potentially challenging situations for fear of demonstrating that deficit (cf. Dweck & Leggett, 1988; Elliott & Dweck, 1988). Such a response could result in a noticeable reduction in the number of future opportunities that child might have to exhibit mastery in the face of challenge and thereby possibly initiate a change in beliefs.

Attention must also be given to change within broader levels of the environmental system. Some investigators (e.g., Rosenholtz & Simpson, 1984; Stipek & Daniels, 1988; Stipek & Maclver, 1989) have noted the need for studying the educational setting itself and the differences in student work assigned, evaluation of that work, and patterns of interaction among students, teachers, and peers which occur as one progresses from elementary to middle grades in school. For example, Pomerantz and Ruble (1997) demonstrated that teacher perceptions of competence predict conceptions of ability as capacity and as constant, and that such beliefs are related to children’s ability to interpret teachers’ appraisals of performance. The argument of Rosenholtz and Simpson (1984) points out an even broader sphere of influence on children’s developing beliefs about ability—the society or culture in which the child lives. Even Nicholls (1990) in later writings suggested that the current competitive culture of the United States might be shaping children’s conceptions of ability (see also Stevenson & Lee’s (1990) research on cultural differences in attributional beliefs). As yet, there has been very little published on explorations of children’s beliefs about intelligence in different countries or cultures (cf. Little & Lopez, 1997; Schlangen & Steinsmeier-Pelster, 1997). Yet to the extent that cultural systems shape the development of individuals’ beliefs (and there is evidence of cultural differences in use of dispositional explanations (e.g., Miller, 1984)), it would be expected that the development of beliefs about intelligence might vary widely across cultures (Bempechat, 1998; Bempechat & Drago-Severson, 1999; Yuill, 1992). Another intriguing question, which at best will be difficult to answer and will most likely require sociological methods, concerns whether historical changes in a given society’s view of intelligence are mirrored in children’s beliefs.
The literature on children’s beliefs about intelligence is sadly lacking in longitudinal studies. Most of the research presented previously came from cross-sectional or single-age studies (cf. Pomerantz & Saxon, 2001; Stipek & Gralinski, 1996, for notable exceptions). Therefore, the preponderance of stage-based views of development is not surprising. The development of conceptions of intelligence within individual children remains a mystery. Repeated assessments of children’s beliefs could illuminate the extent to which changes in children’s beliefs are qualitative or quantitative (e.g., is the adolescent’s belief about constancy in ability a different kind of belief than the child’s or simply a stronger form of the same belief?). If quantitative change is identified, longitudinal research could assess the validity of apparent age-related shifts in children’s beliefs and identify age-related trajectories in beliefs as suggested in the cross-sectional literature (e.g., Pomerantz & Ruble, 1997). Innovative longitudinal statistical techniques, such as hierarchical linear modeling and latent growth curve analysis (Bryk & Raudenbush, 1987; McArdle & Epstein, 1987), could explore what factors influence the different trajectories identified.

Conclusion

Despite the identification of what would seem to be normative stages or transitions (Cain & Dweck, 1989; Nicholls, 1989; Ruble, 1994) in some of children’s beliefs about ability, a stage theory in this area seems premature at best and invalid at worst. The lack of clear delineation of the various aspects of children’s beliefs, the lack of exploration of biological and environmental factors which might influence those beliefs, the lack of longitudinal work, and the lack of attention to the issue of qualitative versus quantitative changes serve to bolster this argument. The more flexible perspective put forward here suggests that the ongoing interaction of biological, cognitive, and environmental factors must be acknowledged and explored in order to better understand the child’s developing theories about intelligence.

We have proposed here that children’s developing beliefs might best be understood as simultaneous concept and theory development. We have shown that children’s intuitive theories of intelligence encompass conceptual structures that are abstract, intricately interrelated, and mutually determined. These naïve theories comprise a network of beliefs that link an increasingly articulated concept of intelligence to a variety of achievement cognitions and behaviors. As is the case with other naïve theories, the causal relations incorporated in children’s beliefs enable coherent predictions, inferences, and explanations of ability-related experiences. Using the interactionist approach outlined above, researchers can strive toward a fuller understanding of children’s intelligence theory development and its links to other elements of cognitive and social development.
References


