The Development of Expertise: The Journey From Acclimation to Proficiency

by Patricia A. Alexander

The Model of Domain Learning (MDL) is an alternative perspective on expertise that arose from studies of student learning in academic domains, such as reading, history, physics, and biology. A comparison of the MDL and traditional models of expertise is made. The key components and stages of the MDL are then overviewed. Discussion concludes with a consideration of evidence-based implications of this model for educational practice.

Without question, the educational research community has garnered much from past decades of expert/novice theory and research. Framed largely by artificial intelligence and information-processing theory, those traditional research programs initially took shape in the 1970s and 1980s around the problem-solving performance of experts. The primary goal was to determine the characteristics and actions of experts so that these features could be programmed in "intelligent" machines or trained in nonexperts (Bransford, Brown, & Cocking, 1999; Chi, Glaser, & Farr, 1988).

Despite this impressive list of contributions, it has proven difficult to translate the findings of past generations of expert/novice research into educational practice (Ericsson & Smith, 1991; Hatano & Oura, 2003). One reason for this translation problem is that traditional programs of expertise research were not undertaken with schools or students in mind (Alexander, 2003). Another translation problem traces to the complex, multifaceted, and dynamic nature of formal schooling and the difficulty of traditional expertise approaches to relate to that unique, sociocultural context (Sternberg, 2003).

For these reasons, models and theories drawn directly from school experiences, rather than superimposed on them, seem required to bridge the chasm between current understandings of expertise and educational practice. The Model of Domain Learning (MDL) is one such model (Alexander, 1997). The MDL portrays the nature of developing expertise in academic domains rather than extracting that nature from particular tasks drawn from nonacademic realms of problem solving. The MDL was derived from extensive research in strategic processing, knowledge acquisition, and motivation as well as expertise (e.g., Pintrich, Marx, & Boyle, 1993; Pressley, Goodchild, Fleet, Zajchowski, & Evans, 1989). Further, the specific dimensions and relations of the MDL discussed here have been substantiated by more than a decade of empirical research.

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Contrasting the MDL and Traditional Models of Expertise

There are distinctions between the MDL and traditional models of expertise that cast the MDL as an alternative perspective. Those distinctions include overarching goals, domains of interest, factors investigated, nature of comparisons, and underlying assumptions. For instance, while researchers of prior generations sought to program "smart machines" or train nonexperts to duplicate expert performance, the goal of the MDL is improved student learning and development. Second, traditional expertise researchers targeted specifically crafted or carefully chosen problems from diverse out-of-school domains—from waiting tables to dance (e.g., Allard & Starkes, 1991; Patel & Groen, 1986). As with the informative research being done in history, science, mathematics, and literacy (e.g., Leinhardt, 1989; Wineburg, 1991), the MDL focuses on learning in academic domains.

This academic focus is relevant for several reasons. First, there is a character to academic domains that cannot be adequately captured in nonschool domains (Phenix, 1968; Shulman & Quinlan, 1996). Moreover, academic domains are powerful means of organizing vast bodies of related knowledge and experience, and important cultural tools that enable socio-cognitive navigation of the world (VanSledright, 2002a, 2002b). Third, traditional expert/novice researchers considered expertise from a "coldly cognitive" perspective, overlooking powerful motivational and sociocultural forces (Pintrich et al., 1993). Yet, individuals' motivations and affect are significant contributors to the development of expertise, both in and out of school (e.g., Csikszentmihalyi, 1990; Winne, 1995). Without understanding those motivational/affective dimensions, educators cannot explain why some individuals persist in their journey toward expertise, while others yield to unavoidable pressures (Bereiter & Scardamalia, 1993). In MDL studies, my colleagues and I took a step toward addressing this limitation of traditional models by exploring the influence of learner interest on expertise.

Finally, within past generations, characterizations of expertise were based on sharp contrasts between experts and neophytes. This approach casts a dichotomous veil over expertise—one is a novice *or* an expert. Within the MDL, the concern is on the journey from novice to expert, conceptualized as systematic changes within and across stages of development. Although sharp contrasts between experts and neophytes are useful starting points, it is the subtle and significant transformations occurring between those extremes that are central to the MDL.

Encapsulating the MDL

The MDL focuses on three components that play a role in the journey toward expertise in academic domains (i.e., knowledge,

strategic processing, and interest) and considers their interplay at three stages in domain learning (i.e., acclimation, competence, and proficiency). The brevity of this overview does not permit me to delve into the empirical studies that substantiate the forthcoming descriptions. However, during the past decade, my colleagues and I investigated the MDL and its predicted relations between knowledge, interest, and strategies for those moving toward expertise (e.g., Alexander, Jetton, & Kulikowich, 1995; Alexander, Murphy, Woods, Duhon, & Parker, 1997; Alexander, Sperl, Buehl, Fives, & Chiu, 2002; Murphy & Alexander, 2002). Those investigations have been in domains of social studies, astrophysics, human biology/immunology, educational psychology, and special education, involving students from elementary through graduate school. Others have conducted studies of the MDL in such domains as history, technology, music therapy, and physical education (e.g., Chen, Shen, Scrabis, & Tolley, 2002; Lawless & Kulikowich, 1998; VanSledright, 2002a). Collectively, those studies using both quantitative and qualitative methodologies, as well as cross-sectional and longitudinal designs, have upheld model predictions.

Model Components

The MDL distinguishes between two forms of subject-matter knowledge: domain and topic knowledge (Alexander, 1997). Domain knowledge represents the breadth of knowledge within a field (e.g., how much one knows about history). Topic knowledge is about depth; how much an individual knows about specific domain topics (e.g., the Magna Carta or the Boston Tea Party). The MDL emphasizes quantitative and qualitative changes that occur in the knowledge base as individuals progress toward expertise.

The MDL also hypothesizes quantitative and qualitative shifts in students' use of surface-level and deep-processing strategies during text-based learning. Surface-level strategies (e.g., rereading or paraphrasing) are processes individuals use to make sense of the text. Deep-processing strategies, by comparison, involve delving into that text, as when students judge author credibility or form mental representations. This categorization differs from prior research where deep-processing referred to proceduralization, the consolidation of isolated knowledge into relevant problem-solving procedures (de Jong & Ferguson-Hessler, 1986).

Further, the MDL tracks two forms of interest in expertise development: individual and situational interest (Hidi, 1990). Individual interest is the investment one has in a particular domain or some facet thereof. It is the enduring interest that students bring into any learning environment (Dewey, 1913). My colleagues and I have identified two forms of individual interest evident in expertise: general and professional (VanSledright & Alexander, 2002). Through general interest, the individual engages in domain-related activities more available in everyday experiences. For example, in history, general interest might involve reading historical fiction or watching documentaries. Professional interest is a more specialized, goal-oriented interest aligned with vocational activities (e.g., attending a history-related conference or conducting document searches).

In contrast to individual interest, situational interest is tied to the "here and now." It is an arousal or piquing of attention sparked by events or features of the environment. Because it is bound to the immediate situation, such interest is fleeting (Hidi, 1990), although there appear to be certain universals that almost guarantee arousal, including references to sex or violence (Garner, Gillingham, & White, 1989; Schank, 1979).

Component Interplay

The MDL is based on the interrelation of knowledge, strategic processing, and interest. In effect, those components are expected to influence one another at every stage, but differently at each stage. For example, knowledge and strategies are aligned because knowledge acquisition is enhanced by strategic processing, even as the ability to apply strategies efficiently and effectively is linked to individuals' base of domain-specific knowledge (Alexander & Judy, 1988). Surface-level strategies allow learners to function when content is unfamiliar or task demands are novel or complex, whereas deep-processing strategies permit learners to query the message in a more critical, analytic manner (e.g., Pressley et al., 1989).

Students' domain-related interests are also associated with knowledge and strategic processing. My colleagues and I have found that individuals care more about domains for which they know more and know more about domains in which they are individually interested (Alexander, Kulikowich, & Schulze, 1994; Alexander et al., 1997). In addition, because strategic processing takes time and effort, interest in the domain or topic can be a catalyst for strategic engagement (Alexander & Jetton, 2000; Murphy & Alexander, 2002). Thus, individuals' academic goals are relevant to the knowledge they pursue and the strategies they employ (Guthrie, McGough, Bennett, & Rice, 1996). Situational interest can also motivate students' selection and use of strategies, especially when individual interest is low (Mitchell, 1993).

The Stages of Expertise Development

According to the MDL, the components of knowledge, strategic processing, and interest configure differently as individuals progress from acclimation to competence and proficiency/expertise.

Acclimation

Acclimation is the initial stage in domain expertise. This term signifies the demands placed on students as they orient (i.e., acclimate) to a complex, unfamiliar domain. Within acclimation, learners have limited and fragmented knowledge. This fragmentation pertains to domain and topic knowledge, although it is possible for these learners to be well versed in a particular domain-related topic (e.g., Civil War battles). Still, learners in the throes of acclimation lack what Gelman and Greeno (1989) term *principled knowledge*, a cohesive and well-integrated body of domain knowledge. Given their fragmented and fragile state of knowledge, acclimating learners' ability to discern the difference between accurate or inaccurate and relevant or tangential information is understandably hampered (Jetton & Alexander, 1997).

Also, the domain-specific tasks these students encounter in schools are commonly novel and challenging, thereby prompting frequent use of surface-level strategies. The seeds of individual interest, even if planted by meaningful and captivating instruction, have limited opportunity to take root. Thus, there is also an expected reliance on situational interest to maintain novices' focus and spark their performance (Mitchell, 1993).

Competence

As noted, the transformation into competence is marked by quantitative and qualitative changes in individuals' knowledge base. Competent individuals not only demonstrate a foundational body of domain knowledge, but that knowledge is also more cohesive and principled in structure. Further, as the problems typifying an academic domain become increasingly more familiar, competent learners delve into such tasks by applying a mix of surface-level and deep-processing strategies. Moreover, these knowledge and strategy changes in competent learners are linked to increases in individuals' personal interest in the domain and less dependence on situational features of the environment.

Proficiency/Expertise

In contrast to the transition from acclimation into competence, where the force of any one component could catapult one forward, a synergy among components is required for movement from competence into expertise (Alexander, in press). Not only is the knowledge base of experts both broad and deep, but the experts are also contributing new knowledge to the domain. To create new knowledge, experts must be well versed in the problems and methodologies of the domain and actively engaged in *problem finding*. These experts are posing questions and instituting investigations that push the boundaries of the domain. For this reason, the level of strategy use among experts remains high, although those strategies are almost exclusively of a deep-processing kind (Alexander et al., 2002). Moreover, the individual interest of experts is very high, while reliance on situational interest levels off, conditions that allow experts to maintain a high level of engagement over time.

The Implications of the MDL

The greatest value of the MDL over traditional approaches may lie in its attempt to contribute to improved learning and teaching. Toward this end, several implications can be forwarded based not only on the findings of MDL research, but also on other related programs of research investigating emerging expertise within school contexts (Afflerbach & VanSledright, 2001; Wineburg, 1998).

First, educators should not expect that high-school seniors will exit the K–12 system as experts in any academic domain (Alexander, 2003; Bereiter & Scardamalia, 1993). Such an expectation would be unreasonable given the substantial knowledge, strategic ability, and interest required of experts. Yet, educators can expect students to make significant progress in their journeys toward expertise by the time they complete mandatory schooling. That means educators should expect to see marked changes in learners' knowledge, strategic processing, and interests throughout the educational experience, signifying a movement away from acclimation and toward competence (Murphy & Alexander, 2002).

Similarly, we should keep in mind that few K–12 students have the espoused goal of becoming domain experts (Bransford et al., 1999). In addition, knowledge, interest, and strategic processing demands ensure that expertise in any domain will be realized by a relative few (Alexander, 1997). I do not see these circumstances as problematic, provided that school-aged populations have the opportunities and support required to achieve competence in mainstream academic domains. In effect, I see competence in academic domains as a commendable and attainable goal for the vast majority of K–12 students.

Second, traditional approaches to expertise and the MDL converge in their recognition that the journey toward competence or proficiency requires strategic tools for analyzing and responding to the many problems encountered. Students do not come equipped with the cognitive and metacognitive/self-regulatory strategies they need (Winne, 1995). Such strategies must be acquired and practiced in relevant situations that allow students to witness their inherent value (Schoenfeld, 1985). Further, students must be encouraged to modify and combine strategies in ways that fit them and the problems at hand.

Third, even though knowledge and strategies remain keys to expertise, my colleagues and I have found that individuals' investment in their learning and development is equally critical (e.g., Alexander & Murphy, 1998). We have determined that interest, especially individual interest, is tied to students' knowledge and strategic efforts. If the educational experience is too narrowly focused on the acquisition of domain-specific knowledge, without regard to motivational forces, we may be stressing one aspect of expertise to the detriment of others. Thus, schools can do much to nurture emerging competence by allowing students to pursue topics and tasks of interest and by immersing them in meaningful learning experiences that are fertile ground for the growth of enduring interest.

Fourth, students in acclimation have characteristically limited and fragmented knowledge. This piecemeal knowledge comes with little personal investment in the domain and strong reliance on surface-level strategies. Together, these attributes mean that students in acclimation require guidance in determining what content is central and what is peripheral, what information is accurate and well supported, and what information is inaccurate or unsubstantiated. These students also need explicit instruction on how to be strategic within a domain, since their strategic processing will often be ineffective and inefficient when left to their own devices (Alexander & Judy, 1988; Pressley et al., 1989). Finally, students trying to acclimate will require assistance in forging a personal connection to a domain critical for nurturing the seeds of individual interest (Ball, 1993). This rooted relevance (Alexander, Murphy, & Woods, 1996) will help novices see the value of the academic content and find the will to persist in the face of the inevitable challenges and frustrations that will surely arise.

Finally, let me reinforce that the journey toward expertise is unceasing. Even those who have attained the knowledge, strategic abilities, and interests indicative of expertise cannot sit idly by as the domain shifts under their feet. We, thus, do a disservice to learners by conveying the idea that learning some set body of facts or procedures is the educational end. Rather, those skills and processes are but the means that allow learners to thrive within academic territories that are challenging and uncertain.

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