Prep to Year 10
Learner Characteristics

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Victorian Essential Learning Standards

VICTORIAN CURRICULUM AND ASSESSMENT AUTHORITY

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Introduction

The last 30 years has seen a dramatic shift in the ways in which we conceptualise children's *learning* and development. The shift is reflected in the emergence of a new field of study called the *Learning Sciences*. The *Learning Sciences* has its own academic journals and several academic institutions have created professorial chairs in the area (e.g., University of Cambridge in the UK and University of California at Berkeley in the USA). A major attribute of the new field is its multidisciplinary nature. Individuals from a variety of traditionally separate academic disciplines contribute to the *Learning Sciences* – various areas of education, cognitive and social developmental psychology, cognitive science, and the cognitive neurosciences to name a few. We strongly believe that recent advances in the *Learning Sciences* have major implications for educational practices in the Preparatory Year to Year 10 period.

Until the mid 1970s children's learning tended to be described in terms of either Piagetian or behaviourist theory. Both positions suggested ways of organising learning activities for children. Piagetian theory focused on limitations in thinking and ipso facto the nature of the to-be-learned material, while behaviourist theory focused on ways of arranging to-be-learned material. Although the two approaches differed in their views of children's learning capacities, they both saw children as independent, isolated learners and ignored, among other issues, the social nature of learning (Brown, 1997). Since the mid 1970s researchers have offered new conceptions of the learning process and the development of competent performance. Recent research provides an understanding of the development of children's reasoning and problem-solving skills, and how competencies in school subjects are acquired (Bransford, Brown & Cocking, 1999). Although there is a growing tendency to treat each curriculum area as a separate, independent knowledge and/or ability domain, and indeed there is merit to this tendency, we consider it equally important to emphasise general learning competencies across the curriculum.

The paper is divided into three interrelated sections. First, we present **an orienting perspective** on why it is important to focus on cross-curricula cognitive competencies. We briefly review research that emphasises the importance of links between cognitive competencies and curricula practices. Specifically, we make the point that cognitive competencies, in part, reflect classroom socialisation practices. Second, we consider **the development of the thinking child** from two complementary perspectives. In the first we describe some of the ideas motivating recent advances in the learning sciences; and in the second we review some of the core cognitive competencies that underpin contemporary accounts of learning and cognitive development. Third, we present an overview of research on **children's views of themselves as learners**. The focus of the latter section is on factors affecting the development of children's motivation and self-concept. We review the so-called cognitive and motivational learning factors separately for convenience only; the two areas are intimately linked in reality. Finally, in order to highlight developmental changes in competencies, we summarise the core concepts in terms of what might be expected in (1) Preparatory to Year 4, (2) Years 5 to 8, and (3) Years 9 and 10 (see the **table** on pages 16 and 17 for an overview of these developmental changes).

Section 1: An orienting perspective

We believe it is important to emphasise the development of cross-curricula cognitive competencies for three major reasons. (The *nature* of the core competencies are outlined in the next section.)

First, age-related core cognitive competencies could be used to exploit cross-curricula linkages for learners. First, core cognitive competencies could be used to make and/or enhance cross-curricula linkages. While we recognise the importance of domain-specific competencies, a focus on specialisation per se is not without its dangers. An overly strong emphasis on domain-specific learning competencies may foster the view that all learning is encapsulated, and that problem-solving techniques are unique to particular discipline areas. The danger of such a view is twofold. First, it may inhibit students from using their general reasoning competencies to solve problems in different or new knowledge areas. Second, it may foster the view that the problem-solving competencies learned in school are unique to school subject matter and are irrelevant to lifelong learning. These two points were forcefully made by John Dewey (1916) nearly a century ago. A focus on the development of core cognitive competencies not only serves an integrative function across curricula, it also emphasises the view that the competencies learned in school are important to lifelong learning.

A second reason for emphasising cross-curricula cognitive competencies is to provide continuity in approaches to learning from the first years of school to Year 10. An emphasis on core competencies in the early years provides a foundation, or a touchstone, for students' later learning – in school and out of school. It is important to note that an emphasis on core cognitive competencies in the early years of schooling reflects existing educative practices, and it is only in the later years that approaches to learning become differentiated by discipline. We would maintain that core competencies should be emphasised throughout formal schooling. A continued emphasis on core learning concepts across the school years and across curricula serves to reinforce the view that a common set of competencies underpin learning and that these can be employed to solve problems in a wide range of in-school and out-of-school contexts.

A third reason for emphasising the cross-curricula cognitive competencies is to highlight the claim that reasoning abilities are now thought to emerge, and are practiced initially, in social contexts and particularly in classroom settings. As noted earlier, this claim signals an important shift in our view of cognitive development – away from a view that the process of learning is common for all individuals, independent of contexts, and toward a view that learners are participants in a social practice and that context affects the nature and the processes of learning (Brown, 1997; Brown & Palincsar, 1989; Palincsar & Brown, 1984; Rogoff, 2003; Rogoff, Goodman-Turkanis, & Bartlett, 2001). It has long been known that classroom norms and values affect modes of participation and encourage different forms of reasoning in students (Bransford et al., 1999; Dewey, 1916; Stodolsky, 1988). However, it is only in the last decade or so that researchers have begun to exploit this knowledge to modify classroom practices in an attempt to facilitate the development of cross-curricula reasoning and problem-solving abilities (see Bielaczyc & Collins, 1999; Brown & Campione, 1994, 1996; Bruer, 1993; Greeno & Goldman, 1998; Scardamalia, Bereiter & Lamon, 1994; Vye et al., 1998, for examples).

At least three common themes unify these approaches to curricula and cognitive development.

- Classrooms are conceived as a cohesive community of learners which embodies 'a culture of learning in which everyone is involved in a collective effort of understanding' (Bielaczyc & Collins, 1999, p. 271).
- Such classrooms are designed to allow students' thinking processes to be externalised so that they can be shared by others (Brown & Campione, 1994, 1996). The overt discussion of reasoning activities is an attempt to externalise the strategies used in problem solving so that they are accessible to others who, in turn, can internalise them for their own purposes. Brown (1997), among others, has argued that curricula practices should be based on the socialisation of cognitive reasoning practices and reflect what we know about cognitive development. She argues that there is little evidence to suggest that when children begin school they spontaneously engage in deliberate, goal-directed problem-solving activities; a major function of the educative practice is to socialise children into using appropriate reasoning processes.
- This approach to the development of problem-solving competencies has a strong cross-discipline integrative focus (Scardamalia et al., 1994). Although some reasoning competencies are likely to be domain specific, many are likely to be general reasoning competencies with wide application (Stodolsky, 1988). It is worth emphasising that researchers who have focused on the relationship between curricula and cognitive development have also highlighted the importance of effective cognitive socialisation for development of self-worth and engagement. Children familiar with classroom values and practices tend to be more confident of their interactions with others in the classroom.

Section 2: The development of the thinking child

This section is divided into two subsections. In the first we review some of the overarching ideas that currently guide research in the learning sciences. In the second, we describe some of core cognitive competencies that underpin the development of thinking and reasoning abilities.

Overarching ideas

From a developmental perspective, a number of overarching concepts underpin contemporary *Learning Sciences*, namely: (1) expert performance, (2) transfer of learning, (3) children as learners, (4) learning communities, and (5) assessment practices (see Bransford, Brown & Cocking, 1999).

Expert performance

Experts have developed particular ways to think and reason effectively. Understanding the acquisition of expertise is important because it provides insights into the nature of thinking and problem solving. It is not simply general abilities, such as memory or intelligence, nor the use of general strategies that differentiate the experts from novices. Experts have acquired extensive knowledge that affects what they notice and how they organise, represent and interpret information (Greeno & Goldman, 1998). This in turn affects their abilities to remember, reason and solve problems. Key scientific findings have come from studies of individuals who have developed expertise in diverse areas (mathematics, physics, chess etc.). These examples are important not because children are expected to become experts, but because the study of expertise shows what successful learning looks like and the circumstances under which it occurs.

On the basis of research evidence we believe that it is reasonable to claim that experts notice features and meaningful patterns of information that are not noticed by novices. Experts have acquired a great deal of content knowledge that is organised, and their organisation of information reflects deep understanding of the subject matter. Experts' knowledge cannot be reduced to sets of isolated facts or propositions, but, instead, reflects its applicability. Experts are able to retrieve important aspects of their knowledge with little effort. Although expertise is often domain specific, and expertise in one area does not guarantee that expertise can be transferred to another area, it is important to note that novices are helped by the externalising cognitive practices (Brown & Campione, 1996).

Transfer of learning

On the basis of extensive *transfer of learning* research we believe that the following conclusions can be drawn. Abilities and knowledge must be extended beyond the narrow contexts in which they are initially learned. It is essential for learners to develop a sense of when what has been learned can be used – the conditions of application. Failure to transfer is often due to learners' lack of this type of conditional knowledge. Learning must be guided by generalised principles in order to be widely applicable. Knowledge learned in a rote fashion rarely transfers; transfer is most likely to occur when learners know and understand the underlying principles that can be applied to problems in new contexts. Children are helped in their independent learning if they have conceptual knowledge. Studies of children's concept formation and conceptual development show the role of learners' mental representations of problems, including how one problem is similar

and different to others, and understanding the part–whole relationships of the components in the overall structure of a problem. Learners are most successful if they are mindful of themselves as learners and thinkers. A student's self-awareness as a learner and awareness of the role of appraisal strategies, keep learning on target; that is, they help keep the learner checking whether he or she understands. Learners can become independent learners who sustain their own learning practices across their lifespan.

Children as learners

While there are commonalities across learners of all ages, young children differ from older children in many ways. Studies of young children show how learning changes across development. However, we now know that even very young children have a predisposition to learn in certain domains, and that young children are actively engaged in making sense of their world. Young children appear to be predisposed to acquire information in biology, number and language, among other domains of knowledge.

These biases toward certain types of learning should pave the way for competence in early schooling. Children lack knowledge and experience, but not reasoning ability. Indeed, although young children are inexperienced, they reason with the knowledge they have. Precocious knowledge may jump-start the learning process, but because of limited experience and underdeveloped systems of logical thinking, children's knowledge contains misconceptions. Misinformation can impede school learning, so teachers need to be aware of the ways in which children's background knowledge influences their understanding. Such awareness should help teachers anticipate children's confusion and recognise why children have difficulties grasping new ideas. Strategies for learning are important.

When children are required to learn about unfamiliar knowledge domains, they need to develop intentional learning strategies. Children need to understand what it means to learn, who they are as learners, and how to go about planning, monitoring and revising, to reflect upon their learning and that of others, and to learn how to determine if they understand. These metacognitive skills provide strategic competencies for learning.

Children are both problem solvers and problem generators. They attempt to solve problems presented to them, and they seek novel challenges. They refine and improve their problem-solving strategies in the face of failure and often build on prior successes. They persist because success and understanding are motivating in their own right. Adults can help children make connections between new situations and familiar ones. Children's curiosity and persistence are supported by adults who direct children's attention, structure experience, support learning attempts, and regulate complexity and difficulty levels of information for children. Thus, development involves interactions between children's early competencies and the environmental supports – strengthening relevant capacities and pruning the early abilities that are less relevant. Learning is promoted and regulated by both the biology and ecology of the children – learning produces development.

Learning communities

Several educational programs in North America have focused on transforming schools into communities of learners in order to foster the competencies (reviewed in the previous section). Educational researchers in Toronto, Tennessee and California, among others, share a common perspective on what it takes to ensure children are active thinkers. Four critical ideas underlie these approaches, namely; agency, reflection, collaboration and culture. The claim is that the process of

becoming an expert responsible for his or her own learning (agency) involves so-called competence socialisation. Reflection for young children best occurs in interactive group contexts in which children collaborate to co-construct an understanding of a problem domain. The careful management of a culture of learning is an essential ingredient in the socialisation of children in order for them to become active, independent learners.

Assessment

A challenge for the learning sciences community is to provide a theoretical framework that links assessment practices to contemporary learning theory. Characterising assessment in terms of components of competence and the content–process demands of the subject matter brings specificity to generic assessment objectives such as 'higher level thinking and deep understanding'. Characterising student performance in terms of cognitive activities focuses attention on the differences in competence and knowledge achievement that can be observed in learning and assessment situations. It is evident that assessment tasks can involve many possible combinations of content knowledge and process skills that vary as a function of children's age and level of expertise. We believe that it is possible to identify the nature of children's expertise by devising appropriate assessment procedures, and that the information obtained from such procedures should inform subsequent instruction.

Core cognitive competencies

What are the core cognitive concepts that characterise contemporary accounts of learning and cognitive development? We focus on core interrelated learning concepts in five areas, namely: (1) memory and the structure of knowledge; (2) analysis of problem solving and reasoning; (3) early knowledge; (4) metacognitive processes and self-regulatory capabilities; and (5) cultural practices. We focus on these concepts because they have been implicated in the acquisition of knowledge and skills in most school curricula from primary to secondary school. It is important to emphasise that these concepts are aspects of a competency manifold rather than unique, isolated competencies. It is also extremely important to note that there are significant individual differences in the competencies we describe. Our descriptions reflect average age-related abilities that could be used for instructional as well as diagnostic purposes.

Memory and the structure of knowledge

Memory has come to be understood as more than simple associations; evidence describes the structures that represent knowledge and meaning. Knowing how learners develop coherent structures of information has been particularly useful in understanding the nature of organised knowledge that underlies effective comprehension and thinking within particular curriculum domains.

- **For children in Prep to Year 4** we know that memory and meaning are intimately related. These children possess few deliberate memory strategies to aid their learning, and for information to be remembered it should be contextualised and structured in a meaningful way. Moreover, they possess little insight into their own memory abilities or what to do about their failure to remember. Indeed, remembering for its own sake is a late-developing ability and requires the application of generic memory strategies (rehearsal, elaboration etc.).

- **Students in Years 5 to 8**, by contrast, have begun to develop deliberate, effortful memory strategies and have also begun to understand what is involved in imposing meaning on to-be-remembered information. They have also begun to show evidence of insight into their own memory strategies (metamemory skills). Remembering is still facilitated by meaningful contexts inherent in material; however, older children are beginning to be able to construct contexts for themselves to support their learning.
- **Students in Years 9 and 10** tend to have a repertoire of deliberate strategies at their disposal to help them impose meaning on to-be-learned material, and ipso facto remember that material. The consolidation of planful, effortful, deliberate memory strategies that emerged in the late primary and early secondary school years is the hallmark of children in these years. Nevertheless, although these competencies are desirable, they cannot be guaranteed and there are large individual differences in students' use of memory strategies at this stage.

Analysis of problem solving and reasoning

One of the most important influences on contemporary learning theory has been the basic research on expert learners. Learning theory can now account for how learners acquire skills to search a problem space and then use these strategies in many problem-solving situations. There is a clear distinction between learned problem-solving skills in novice learners and the specialised expertise of individuals who have proficiency in particular knowledge domains. A key concept is the instantiation of meaning.

- **Children in Prep to Year 4** are often referred to as *universal novices*. They are in the process of acquiring information about different domains and often find it difficult to use that information flexibly in the service of a goal (e.g., solving a problem). There are many skills and competencies that support the development of children's problem-solving abilities (e.g., task analysis, means–goal focus, strategy checking). However, although these skills are generic, they depend on a clear specification of problem meaning for their execution. Externalising problem meaning is an essential aspect of problem solving and is necessary for the implementation of generic problem-solving skills. Young children in particular need substantial help in characterising the meaning of problems which is necessary for the development of expertise.
- **Students in Years 5 to 8** tend to have acquired some expertise in school-based problem-solving competencies; however, the acquisition of expertise is slow and often difficult for many children. Like the acquisition of memory strategies discussed above, the acquisition of expertise in most domains requires intentional, planful activity on the part of the learner. Although it is unreasonable to characterise young children as passive learners, they are not exactly active learners or problem solvers either.
- **Many but not all students in Years 9 and 10** exhibit expertise in a variety of domains and appear to possess the associated problem-solving strategies. Nevertheless, it is evident that not all Years 9 and 10 students are deliberate, planful problem solvers. What defines expertise and domain *interest* (see below) for adolescent students is not well understood.

Early knowledge

Methodologies for assessing young children's responses in controlled settings have done much to illuminate early learning. Scientific studies of young children have revealed relationships between children's learning predispositions and their emergent abilities to organise and coordinate information, make inferences, and

discover strategies for problem solving. As a result, educators are rethinking the role of the abilities children bring with them to school so as provide appropriate opportunities for learning in school. Research suggests that young children possess informal knowledge about many domains that could be used to foster more formal learning. Exploiting the links between informal and analogous formal knowledge within different domains requires an explication of the nature of informal knowledge. Indeed, it is suggested that the process of externalising links between informal and formal concepts, or between analogous concepts in general, is an essential aspect of learning per se. It is evident that the ability to reason analogically is a prerequisite for learning across the lifespan and should be regarded as one of the most important generic learning skills.

Metacognitive processes and self-regulatory capabilities

It is evident that children in **Years 5 to 8** can be taught to regulate their learning behaviours and that such regulatory activities enable self-monitoring and executive control of performance. The activities include strategies such as predicting outcomes, planning ahead, apportioning one's time, using self-explanation to improve understanding, noting failures to comprehend, and activating relevant knowledge – these are critically important generic learning skills. It would be useful to stress the value of these skills from the beginning of schooling. They could be integrated into most curricula activities.

It is equally important to stress these capabilities in **Years 9 and 10**. As noted earlier, although children in Years 9 and 10 are likely to engage in deliberate and planful learning strategies more often than their younger peers, it cannot be guaranteed. Fostering metacognitive and self-regulatory practices across the curriculum and across the formal schooling years is now regarded as a core objective by many.

Cultural practices

We know that participation in social practice is a fundamental form of learning. Learning involves becoming attuned to the constraints and resources, the limits and possibilities that are involved in learning communities. Learning is promoted by social norms that indicate that the search for understanding is valued. Early learning is assisted by the supportive context of the social environment (family, parents, peers and teachers). These activities have the effect of providing young children with the structure and interpretation of the culture's norms and rules. Recognising that education extends beyond the school walls into the child's community, broadly conceived, is not simply a nice theoretical idea; it has significant practical value for the developing child. Connecting schools, families, parents and the community not only has the potential to inform education stakeholders of the purposes of the educative process, it also provides an integrated support scaffold for children.

Section 3: Children's views of themselves as learners

Closely connected with what we know of children's learning characteristics is our understanding of how children develop ways of thinking about themselves as learners. Young children are commonly considered to be innately curious, actively exploring and eager to learn about all aspects of their world. On the other hand it is often lamented that young adolescents are disengaged from and disaffected by schooling (Eccles & Wigfield, 2002; Fredricks, Blumenfeld, & Paris, 2004). There are a number of related concepts that describe learners and these can be used to define the developmental path of the curious, excited five-year-old to a positive learning outcome in adolescence, or to the negative, less adaptive outcomes associated with disaffection and disengagement. These (curiosity and interest; conceptions of ability; task value; achievement goals; and self-concept and self-perceptions) are described below and some of the interconnections between them explored.

Although we can define broad differences between children in the Prep–Year 4, Years 5–8 and Years 9 and 10 groupings, it should be cautioned that these are general patterns and there are considerable individual differences. When children view themselves as capable, confident learners, strong learning outcomes are maximised. When children are uncertain, lacking in confidence about their knowledge, skills and competence, their learning is constrained and inhibited. At the same time, their perceptions of themselves are responsive to the environmental supports for learning. Hence, knowledge of the general ways children see themselves as learners can inform educational practices.

Curiosity and interest

Curiosity is the normal response of the infant and young child to novelty (Trudewind, 2000). In the early years of schooling (Prep–Year 4) this is a very strong motivation for information seeking and knowledge acquisition. When children confront something that is novel or unfamiliar, their attention is caught or their interest is aroused, and they generally engage in some form of exploratory behaviour (Berlyne, 1960; 1978). This means they are being exposed to and acquiring new information and knowledge. For young children the learning experiences they encounter in school are new and unfamiliar and so it is likely that their interest will be aroused. They engage with the activity, they explore it, try out what can be done, and in the course of all this activity they expand their knowledge. Typically, such engagement is of relatively short duration and children enjoy what they are doing. However, over the course of schooling some of the learning activities will have lower novelty value – they are perceived to be 'more of the same'. More conscious effort will be required to stay on task. Engagement becomes more difficult to sustain. When a learning activity arouses curiosity and students engage with it, the activity can be described as intrinsically motivating. What we see happening across the course of schooling is that students in Years 9 and 10 often find learning activities less intrinsically motivating than do children in Prep to Year 4 (Hidi & Harackiewicz, 2000). This is another way of saying that the activities do not arouse curiosity to the same extent as that observed in younger children. There are a number of self-as-learner issues that underpin this change, such as students' developing patterns of personal or individual interests.

Interest in learning activities can be triggered by features of the task itself or it can be based on students' personal interests, or some combination of both (Hidi,1990). When students have well-developed personal interests that are compatible with the

activities and experiences encountered in their classrooms, they will readily engage with those activities and will expand their knowledge and understanding (Renninger, 2000). Hence, an important function of schooling in Prep to Year 4 is to build students' interest in the new and unfamiliar into more enduring personal interests around the core domains of mathematics, science, language, humanities and the arts. When students have developed strong personal interest in topics or areas of knowledge, they are likely to engage with learning activities based on those interests; conversely, specific topics and areas of knowledge may become the focus of students' personal interests and when curriculum tasks involve such topics, they are associated with stronger engagement. For example, lack of interest in the specific topic of a prescribed text is an important factor contributing to the lower levels of participation in literacy that have generally been reported for boys (Ainley, Hillman, & Hidi, 2002; Gilbert, 1998).

Young students' curiosity and wonder about the world around them provides the basis for building strong patterns of personal interest that will support learning through adolescence. However, the character of students' engagement with learning also depends on their conceptions of their own ability, the perceived value of the task, and their own achievement goals.

Conceptions of ability

- **Young children** (e.g., Prep to Year 4) generally believe that they learn as a result of effort; that is, when they try, they learn. They show an interest in what their peers are able to do but they do not usually compare their own performance with that of their peers. General interest in what peers are doing indicates a desire to find out about the task and know what to do**.**
- **Around 7 years of age** children are seen to base judgments of their own ability and the abilities of their peers on the levels of performance they observe. They have become aware that among their peers there are different levels of competence, whether it be in mathematics, reading or sports. Social comparison becomes increasingly important in the appraisal of self and others.
- **Around 11 or 12 years of age** children have acquired what is called a 'differentiated concept of ability'. Performances and achievements of peers are perceived as an indicator of a person's ability, and ability places limits on what can be achieved from effort. It is common for young adolescents to believe that when two children achieve the same result but with different levels of effort, the person who expended less effort is more able. This is taken to mean that if a person who had achieved the same result with very little effort had tried harder their result would have been even better. The student who has to try harder for the same result is not as smart (i.e., as able) as their peer. This 'differentiated concept of ability' becomes the general yardstick of personal and social evaluation in adolescence.

In short, at different developmental levels there are different understandings of the relationship between ability and effort (Butler, 2000; Nichols, Patashnick, & Nolen, 1985). Awareness of these differences in students' conceptions of ability and its relationship with effort is required to maximise the effectiveness of encouragement and support provided in classroom feedback.

Task value

With development there are changes in the importance or value attached to specific kinds of activities and experiences.

- **For young learners** (Prep to Year 4) the importance or value of the task is intrinsic. This is another perspective on what it means when we say that young children are typically curious. They approach new experiences eager to explore, to find out, and to acquire new information and skills. What is novel, unfamiliar, uncertain or ambiguous will attract attention. At the same time, these characteristics prompt children to explore and build on what they already know. Novelty, unfamiliarity, uncertainty and ambiguity arouse curiosity and exploratory behaviour because they connect with some existing knowledge and open up possibilities to extend knowledge (Berlyne, 1960; Trudewind, 2000).
- **Young adolescent students** (Years 5 to 8) make distinctions between what is liked and what is important. Not all learning activities are novel and there are many that students do not readily see as either interesting or intrinsically important. Many curriculum activities are completed because of external encouragement or instruction. External rewards or incentives are introduced to promote task engagement and learning is often externally regulated (Deci, 1992).
- **Older students** (Years 9 and 10) are more likely to judge learning activities and experiences by what they will lead to. The value of the activity adheres in something external; the task is a means to an end. Such instrumental value can relate to short-term or long-term goals. Many of the activities and experiences that are required within the school curriculum may not trigger curiosity and so do not directly activate information seeking or the development of competence. However, these experiences often occur within a social context where their pursuit is encouraged, praised and rewarded by parents and teachers. For school-related competencies this external regulation may develop into internal regulation (i.e., it becomes internalised). Activities undertaken to maintain a sense of self, to avoid the displeasure of adults (parents, teachers) or to receive their praise, become internally regulated. The internalisation process may develop further to the point where a student values and finds the activities themselves to be important, not just a means to an external goal. The experience of achievement in the relevant domain provides important information, confirming and re-affirming the self. Achievement behaviour that was initially externally regulated may become internally regulated. Achievement may not be intrinsically motivating, but in relation to a broader perspective on the self it may be personally important to do well. In adolescence it is often the case that personal importance gives value to learning activities, relating to lifestyle choices or future career goals. Adolescents who do not develop some form of internalised value structure for the knowledge they encounter in their schooling will continue to require external regulation of their learning (Deci, 1992; Eccles & Wigfield, 2002; Hidi & Harackiewicz, 2000).

Achievement of goals

Early learning is task focused. It is about skill acquisition and the development of competence. The novelty and interest triggered by the task itself initiates exploratory behaviour and information seeking. Goal and purpose are triggered and encompassed by the task itself. Goals are about task mastery (variously referred to

as task, mastery, or learning goals). But not all activities children encounter in their classrooms are intrinsically interesting or compelling, and rewards or goals external to the activity are invoked. Children's developing achievement goals are influenced by the goal structure of the classroom (see Elliot, 1999; Linnenbrink & Pintrich, 2001; Pintrich, 2000; 2003)

The development of the differentiated concept of ability is linked to the increasing occurrence of achievement goals that emphasise social comparison in terms of individual differences in ability. This orientation to achievement has been referred to as performance or ego enhancement, in contrast to task mastery or learning goals. Performance goals emphasise level of achievement in relation to peer performance or to norms of achievement. They serve the self in terms of looking good in front of peers, or meeting expectations of authorities such as parents and teachers. In the last few years a distinction has been made between approach and avoidance patterns within performance goals. Wanting to do well and wanting to get good marks (performance-approach goals) have been associated with positive learning outcomes, while doing the work in order to save face or to not appear stupid (performance-avoidance goals) are less likely to be associated with positive learning outcomes. Another goal that has been measured in achievement settings is referred to as work avoidance. There is some debate over whether this can legitimately be called an achievement goal as the focus is to do as little work as possible, to get by with the minimum effort. However, what is clear is that this goal orientation is associated with poorer performance and disaffection from schooling.

By the time they have reached Years 5 to 8, most children have well-defined achievement goals and these have been investigated as:

- mastery goals (sometimes referred to as task goals or learning goals)
- performance-approach goals (concern over marks, and public acknowledgment of achievements)
- performance-avoidance goals (concern over appearing stupid in front of peers, teachers and/or parents)
- work-avoidance goals (getting by with the minimum of effort).

Achievement goals are personal perspectives on the self as learner but their salience is sensitive to the climate of the classroom (Ames & Archer, 1988). Classrooms that emphasise the task and the learning challenges it presents are more likely to generate mastery goals. Task involvement is likely to be high, with students confident they can succeed, and the outcome is that existing skills are extended and new skills acquired.

Classrooms that emphasise social comparison and encourage relative ability appraisals are more likely to foster performance goals. Such climates have different effects on students depending on their ability levels, or more precisely their *perceptions* of their own abilities. For high-ability students, performance goals and task mastery goals are closely connected, especially when students are confident of their own ability. However, when students are not confident about their competence, classrooms that focus on performance goals are more likely to lead to specific maladaptive behaviours such as cheating (Anderman & Midgley, 2004); or, longer-term effects such as learned helplessness – 'Why try when I have no chance of success?' – (Dweck, 1986; Peterson, Maier, & Seligman, 1993). Differences in classroom climate have a stronger impact on students' achievement goals once a differentiated concept of ability is acquired. These effects are particularly salient in adolescence including the middle years of schooling (Years 9 and 10) when a range of challenges to the developing sense of self are being

confronted. Self-as-learner is only one of a number of selves adolescents are working through for personal integration.

Self-concept and self-perception

Fundamental to all of the characteristics that have been described so far is acknowledgment of the importance of the learner's self-concept or self-perception. The developmental literature includes a number of these concepts: self-esteem and self-concept, self-efficacy and self-competence, agency or control beliefs, attributions (Harter, 1998; Marsh, 1989; Wentzel, 2000). All refer to some aspect of the way students see themselves in relation to their learning.

Self-esteem focuses on the global evaluative component of the self, while self-concept refers to the multiple dimensions children use to describe themselves. Self-efficacy and self-competence both have to do with students' assessment of their ability; self-efficacy is generally an estimate of ability in relation to a specific task, while self-competence judgments usually refer to broader domains, for example, self-competence in mathematics or reading. These terms are not always used consistently in the research literature. Agency or control beliefs and attributions refer to the students' beliefs about the general causes of success and failure, ability and effort beliefs, especially in relation to their own power to influence learning outcomes.

One of the strongest themes in relation to the developmental trajectory for self-concept is that the sense of self is multidimensional, that is, the self can be described in relation to a number of domains. From childhood into adolescence there is increasing differentiation of the specific relevant domains of self-concept.

- **Young children** describe themselves in relation to a relatively small number of domains.
- **By the time they reach Years 5 to 8** they are differentiating between their own attributes in relation to family, school, and peers. More importantly within the school domain they are also differentiating themselves in terms of their competence within verbal and mathematical domains, as well as domains concerning non-academic areas such as physical abilities.
- **By the time they reach Years 9 to 10** self-concept has become more differentiated. Of critical importance for adaptive development is their integration of these multiple selves into a consistent self-concept.

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In sum, our understanding of students' perspectives on the self-as-learner provides some strong indicators of dimensions of school experience that will impact on students' development as learners. Experiences that encourage students to view themselves as capable, confident learners maximise strong learning.

Section 4: ICT and student engagement with learning

Use of information and communications technologies (ICT) in classrooms provides a good example of how personal factors and environmental supports for student learning combine to steer the course of engagement with learning activities, and point to the importance of understanding some of the motivational supports for learning at different ages.

Claims for the motivating properties of ICT are often related to the immediate novelty value of specific software or hardware. Curiosity is aroused, interest is triggered and it is not difficult to get students started. However, when engagement is a response to novelty value, the exploration and information seeking motivated by curiosity are satisfied and exhausted when the novelty feature becomes familiar – intrinsically rewarded engagement is maintained while there is something new to explore. In many cases, however, novelty is used as a 'hook' to draw students into something that does not have intrinsic value. Novel electronic features capture students' attention, but to stay the distance and achieve significant learning the instructional content needs to be involving and meaningful. In other words, to maintain engagement when the novelty has faded, students must perceive value in the learning activity itself (see Cordova & Lepper, 1996; Lepper & Henderlong, 2000; Mitchell, 1993). The way this plays out across the years from Prep to Year 10 is summarised below.

- **Prep–Year 4**: Information-seeking, exploratory behaviour triggered by novelty.
- **Years 5–8**: Novelty triggers interest, catches attention, but the content needs to be personally involving to maintain the interest through to achievement. ('Personally involving' may mean it is an important and valued activity; it is consistent with goals, whether mastery or performance goals; or it may lead to the achievement of some other important outcome.)
- **Years 9 and 10**: Again, novelty triggers interest and attention but what becomes personally meaningful and involving is evaluated in relation to the broader social context, including expanded peer-group activities and out-of-school opportunities.

Summary

We have reviewed some of the important findings on the development of the thinking child, describing some of the ideas motivating recent advances in the learning sciences, the core cognitive competencies that underpin contemporary accounts of learning and cognitive development, and have presented an overview of findings from recent research on children's views of themselves as learners.

In the table that follows we present a summary showing how the major concepts we have discussed relate to the broad three stages of schooling: Prep to Year 4, Years 5 to 8, and Years 9 and 10.

Table: Development of the thinking child

Some Generic Competencies	Prep–Year 4	Years 5–8	Years 9 and 10
Knowledge			
Informal–formal transition	Some concepts are intuitive and part of everyday problem solving, but are not accessible to reflective thinking.	Beginning to understand link between informal knowledge and formal concepts; starting to structure and organise knowledge in service of problem solving.	Capable of representing knowledge using abstract formal concepts and systems.
Knowledge base ...knowledge acquisition noticing, organising, representing, interpreting.	The universal novice: limited knowledge base upon which to build expertise.	Expansion of knowledge base to support acquisition of expertise.	Growth and consolidation of knowledge base, supporting expertise.
Expertise *Transfer* …recognising the *when* and *how* of knowledge generalisation	Little awareness of the *when* and *how* of transfer. Attracted by new information and experience; willingly explores what is novel.	Growing recognition of the similarities and differences in problems that may support transfer.	Awareness of problem feature that may support learning transfer.
Memory			
Deliberate memory strategies	Few	Beginning intentional strategies.	Repertoire of intentional strategies.
Context & structure	External provision of context to support learning.	Beginning to construct context in support of learning.	Competent construction of context to support learning.
Problem solving and learning			
Identifying problem meaning			
Application of problem analysis	Externally provided.	Beginning to accurately extract problem meaning.	Competent extraction of problem meaning.
Examples			
Goal identification Strategy choice evaluation	External prompts required to facilitate problem analysis.	Transition between external prompting and self-initiated activities.	Capable of self-initiated analysis of problems.

Self-as-Learner			
Curiosity and interest	Attracted by new information and experience; willingly explores what is novel.	Developing personal interests. Response to new knowledge and experiences becoming increasingly dependent on relationship with emerging interests.	Responses to new knowledge and learning experiences more dependent on personal interests; e.g., boys and literacy.
Conceptions of ability	Learning occurs through effort.	Increasingly likely to notice differences in performance levels of peers; views learning as a result of a person's ability level, not just their effort.	Differentiated concept of ability: the more effort required to achieve a given level of performance, the lower the person's ability level.
Task value	Intrinsic interest in task.	Alongside tasks with intrinsic value, experiencing more tasks requiring external regulation – i.e., not perceived to be enjoyable or to have any immediate value.	Differentiation between learners whose learning is: • internally regulated (knowledge, skills and understanding are important, often linked to personal future) • externally regulated (learning experiences not valued, not personally important).
Achievement goals	Goal is in mastery of the activity itself.	Comparison with peers leads to performance goals becoming differentiated from mastery goals. Performance goals as: • self-enhancement • getting good marks.	Further consolidation of achievement goal orientations differentiated into: • mastery and understanding • performance–approach • performance–avoidance • work avoidance.
Self-concept and self-perception: • self-efficacy • self-competence • agency or control beliefs • attributions.	Global school, self and peers – judgments	Becoming more differentiated into specific learner domains – general school, verbal and mathematics, more differentiated self. Attribution and agency beliefs built around comparisons between self and peers – perceptions of differences in ability and effort.	Differentiated concept of ability: • the more effort that is required to achieve a certain result, the lower the student's level of ability • self-perception of competence high – generally associated with adaptive learning outcomes • self-perception of competence low – associated with maladaptive outcomes e.g., 'learned helplessness'.

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