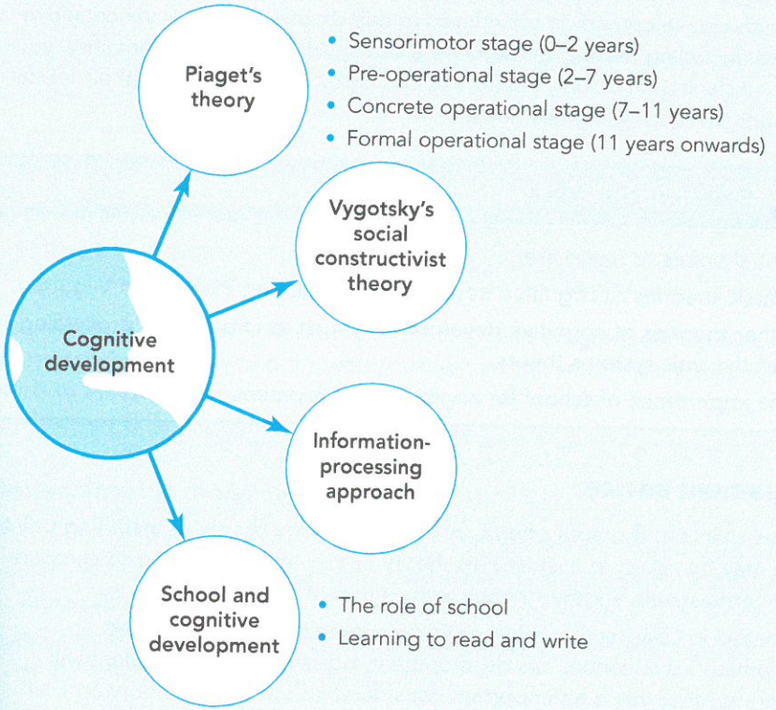
7

Cognitive development



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Introduction

Cognition is an important area of developmental psychology. Much of the focus in this area concerns understanding how a child conceptualises the world. Piaget remains one of the key figures in this area, even though many of his claims have been criticised. However, his constructivist approach and his description of the way in which development moves from being dependent on actions and perception in infancy, through reasoning based on concrete examples in early childhood to the ability to use abstract rules and principles in adolescence, is still generally accepted. Moreover, research continues into many of the phenomena he described. You also need to be aware of alternative theories, including Vygotsky's social constructivist theory and information-processing approaches. It is also important to remember that this field of developmental psychology has informed educational practices and so the impact of schooling on cognitive development is considered in this chapter. Higher-level cognitive functions, including meta-cognition, are also considered here. In summary, you need to understand not only what develops and when but also the theories of how cognitive functioning develops.

Revision checklist

Essential points to revise are:

- ❑ Classic theories of cognitive development, including Piaget and Vygotsky.
- ❑ Other theories of cognitive development, such as information processing and dynamic systems theory.
- ❑ The importance of school for cognitive development.

Assessment advice

- Assessments in this area often take Piagetian stage theory as a starting point. You may be asked to evaluate his theory or you might be asked to compare and contrast with another theory such as that of Vygotsky.
- As noted in Chapter 1, neither of these approaches has mentioned discontinuous v. continuous development; however, a good student will recognise that this is an important consideration in Piaget's theory and will talk about this explicitly.
- The nature–nurture issue is also relevant and consideration of the importance of environmental factors for development is often essential when considering cognitive development.
- A lot of cognitive development in childhood takes place at school and so some understanding of the relationship between these two things will demonstrate the ability to make links between theoretical and applied psychology.

- This chapter outlines the main issues regarding the theories of cognitive development, but you should also refer to Chapter 1 to remind yourself of the relevance of major themes to this topic.

Sample question

Could you answer this question? Below is a typical essay question that could arise on this topic.

Sample question — *Essay*

Critically evaluate the importance of the social context to the development of cognitive functioning in childhood.

Guidelines on answering this question are included at the end of this chapter, whilst further guidance on tackling other exam questions can be found on the companion website at: **www.pearsoned.co.uk/psychologyexpress**

Piaget's theory

As you saw in Chapter 1, Piaget believed that children gradually develop an understanding of the world through active and motivated exploration, which leads to the development of mental structures called *schemas*. Thinking is qualitatively different at each stage as follows.

Sensorimotor stage (0–2 years)

- Development depends upon the infant using senses and motor skills to explore and learn about the world. This stage is further subdivided into six substages (see Table 7.1).
- According to Piaget, the most important achievement of this stage of development is *object permanence*.
- According to Piaget, in the early months of life infants behave as if an object that they can no longer see has ceased to exist. He tested this in the hidden toy experiment as follows:
  - the infant is shown an attractive toy
  - the toy is left within reach and covered with a soft cloth
  - despite having the abilities needed to retrieve the toy, infants do not search for a toy that is completely hidden until around eight or nine months of age.

Table 7.1 Substages of the sensorimotor stage of development

Substage (age)	*Exploratory actions*	*Understanding of objects*
Reflex schemas (0–1½ months)	Involuntary responses to stimuli, e.g. sucking	Makes no attempt to locate objects that have disappeared
Primary circular reactions (1½–4 months)	Attempts to repeat chance pleasurable actions, on or near the body, e.g. bringing thumb to mouth	Makes no attempt to locate objects that have disappeared
Secondary circular reactions (4–8 months)	Attempts to repeat chance pleasurable actions in the environment, e.g. hitting a mobile, picking up a cup	Begins to search for objects that are partially hidden
Co-ordinated secondary circular reactions (8–12 months)	Can put 'secondary circular reactions' together to solve new problems, e.g. uncover, then grasp	Searches for completely hidden objects, but makes the A-not-B error
Tertiary circular reactions (12–18 months)	Will deliberately vary an action pattern to discover the consequences, e.g. dropping ball from different heights	Can follow visible displacements of an object
Beginnings of symbolic representation (18–24 months)	Can solve problems using representation, e.g. opening and closing mouth	Can follow invisible displacements of an object

- However, it is possible that even though infants under nine months of age can both reach and grasp, it may be difficult for them to retrieve the toy because they cannot co-ordinate the actions necessary to remove the cloth.
- Experiments using visual gaze and habituation techniques (see Chapter 3) to overcome the motor co-ordination problem confirm this idea, demonstrating that infants two-and-a-half months old understand object permanence (Aguiar & Baillargeon, 2002; Baillargeon et al., 1985).
- However, a lack of motor co-ordination cannot explain another phenomenon noted by Piaget, known as the A-not-B error.
  - Two cloths are placed side by side in front of infants aged 9–12 months and they are shown an attractive toy.
  - The toy is hidden under one of the cloths (location A).
  - Infants older than nine months typically find the toy.
  - After a number of trials, the toy is hidden under the other cloth (location B).
  - Despite watching the toy being hidden in the new location (B), infants under the age of 12 months continue to look for the toy under the first cloth (location A).

- According to Piaget, this suggests infants do not understand that objects can exist independently of their own actions. The infant connects the rediscovery of the object in location A with his or her own actions in lifting the cloth and reasons that, 'If I wish to find the toy again I must do what I did before'.
- This is clearly incompatible with the idea that the understanding of object permanence develops in the first few months of life. However, other explanations include:
  - the fragility of infant memory (Harris, 1989)
  - habit perseveration (Diamond, 1985)
  - changes in neurological functioning (Munakata, 1998)
  - no single cause adequately explains this behaviour and multi-causal theory has been proposed (Smith et al., 1999); the ability to search for the toy under the correct cloth is the result of a combination of cognitive, perceptual and motor skills, which unfold over time at different rates – only once all have developed fully can the correct search behaviour occur.

Key terms

Schemas: a schema is a basic cognitive structure that individuals use to make sense of the world. According to Piaget, a schema includes both a category of knowledge and the process of obtaining that knowledge. New information gathered through experience is used to modify previously existing schemas. This takes place through two processes described in Chapter 1, **assimilation** and **accommodation**. For example, a child may have a schema about animals. If the child's sole experience has been with small domestic animals such as dogs and cats, a child might believe that all animals are small, furry and walk on four legs. On a trip to the zoo the child then encounters an animal that does not fit this schema, such as a kangaroo. The child will need to take in this new information – that not all animals are small and walk on four legs – and modify their animal schema accordingly. Piaget believed that we try to strike a balance between assimilation and accommodation. This is achieved through a mechanism called **equilibration**. According to Piaget, when we first encounter new information that does not fit into our existing schemas, this creates a state of disequilibrium as we realise our current level of knowledge is deficient. This is unpleasant and produces tension or cognitive conflict that motivates us to change our schemas and so progress to a new, more advanced level of understanding. We therefore adapt our existing schemas to include the new information encountered so as to once again achieve equilibrium. Equilibration is therefore one of the most important mechanisms in cognitive development according to Piaget, as it is the means by which children progress through the four stages of development.

Object permanence: the understanding of objects and the realisation that objects continue to exist even when we cannot see them. According to Piaget, object permanence is one of an infant's most important accomplishments as it demonstrates that the child has developed a mental representation of an object. Without mental representations, cognitive functions such as memory, symbolic thinking and later abstract reasoning would not be possible.

CRITICAL FOCUS

Multi-causal explanations of the A-not-B error

In revisiting the A-not-B error, Smith et al. (1999) take a new approach, attempting to explain what infants do in the A-not-B task rather than what they cannot do. Their explanation focuses on performance and ultimately raises profound questions about what it means to know. The idea of knowledge as an enduring mental structure that exists independently of behaviour dominates in the study of cognitive development. Indeed, this idea of mental structures that gradually develop over time underlies Piaget's seminal theory of cognitive development. Thus achieving the AB task has always been taken to represent a qualitative change in infant thinking; the task can only be successfully completed once the infant has developed a new schema: the object concept. Smith et al. challenge this idea. They argue that although successful completion of the A-not-B task suggests a *qualitative* change in infant behaviour, this change in behaviour in fact represents a number of *quantitative* changes in a complex dynamic system. The A-not-B error is explained in terms of general processes of goal-directed reaching; the erroneous reach back to A is seen as the *behavioural* product of a number of graded processes, including those involved in looking, in discriminating locations, in posture control and in motor planning. All these processes are brought together and self-organised by the task of reaching for a particular object in a particular context. In this perspective, behaviour and cognition are not separate and there are no causal mechanisms such as an object concept that generates a thought or a behaviour. Thus what we commonly and casually call knowledge and concepts are distributed across and embedded in behavioural processes.

This model represents a major shift in thinking and is known as dynamic systems theory. How easy do you think it is to explain human cognition and behaviour with reference to function only? Should we no longer aim to explain psychological functioning by the study of mental structures? Might it be useful to retain these ideas as a shorthand, a convenient way to describe common human thought and behaviour?

Pre-operational stage (2–7 years)

- So called because children cannot yet perform mental operations (logical thinking tasks), although the beginnings of logical reasoning and symbolic thinking can be seen, especially towards the end of this stage.
- This period is subdivided into two substages:
  - symbolic functioning (two–four years)
  - intuitive thinking (four–seven years).
- A key feature of the symbolic functioning substage is the ability to represent mentally an object that is not present (symbolic thinking). This is necessary for language development.
- This is demonstrated by children's pretend play.
  - Two- and three-year-old children engage in 'symbolic play', using one object to represent another that they do not have access to at the time – for example, a Lego block used as a hairbrush, a finger as a toothbrush (Boyatzis & Watson, 1993).

  - The ability to pretend that a particular object can be something else not present shows the child has a mental representation of the object not present.
  - By the age of four years children no longer need to use an object to symbolise another object that is not present – they can use an imaginary representation – for example, pretend to be holding a toothbrush.
- Children's mental reasoning is limited by *magical thinking and animism*, which limits understanding of how the world works and so reduces the ability to think logically.
- However, some theorists disagree with the idea that children's thinking is more magical than adults, arguing it is social context which determines magical thinking, not age (for example, Woolley, 1997).
  - Adults have been found to be just as likely as children to engage in magical thinking, especially when they do not have the knowledge to explain phenomena.
  - Many of the fantastical ideas children believe in – Father Christmas, the tooth fairy and the Easter bunny – are all actively encouraged by the adults around them.
- Another limitation to logical thinking at this age is *egocentrism*, the inability to distinguish between your own perspective and someone else's, as demonstrated by the three mountains task (Piaget & Inhelder, 1969).
  - The child walks around a model of mountains (see Figure 7.1) to see what the mountains look like from different perspectives.
  - The child is seated at the table and a doll is placed in different locations around the table.
  - At each location the child is asked to select the doll's view from a number of photos.
  - Piaget found that preschool children were unable to choose the correct photo and cited this as evidence of egocentrism.
- A key feature of the 'intuitive thinking' substage is the start of primitive reasoning. However, thinking is still limited by:
  - *centration*
  - lack of understanding of reversibility.

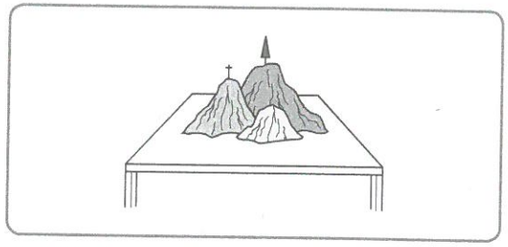

Figure 7.1 Piaget's three mountains task
Source: after Piaget & Inhelder (1969)

- Piaget demonstrated this through *conservation* and *class inclusion* tasks.
- Conservation measures awareness that altering an object's appearance does not change its quantitative properties.
  - In conservation of liquid (see Figure 7.2) the child is shown two identical beakers, each filled to the same level with liquid (a) and asked if these beakers contain the same amount of liquid (most children say yes).
  - The liquid from one beaker is then poured into a third beaker that is taller and thinner than the first two (b) and the child is asked if the amount of liquid in the new beaker is the same as in the original beaker, which has not been altered (c).
  - Children do not answer correctly until the concrete operational stage; in the pre-operational stage most say no, justifying their answers in terms of the differing height of the liquid.
- According to Piaget, children under the age of seven fail on conservation tasks because they:
  - attend to one characteristic of the task (the height of the liquid), to the exclusion of other features, such as the beaker's shape
  - do not engage in the logical reasoning that the liquid must still be the same because it has only been poured from one beaker to another and could easily be poured back.
- Class inclusion demonstrates the understanding of hierarchical classification.
  - Children are shown a picture of a set of objects such as horses and cows and asked 'Are there more cows or more animals?'
  - Despite knowing that cows are a type of animal and being able to count the number of cows and animals correctly, pre-operational children will say that there are more cows.
  - According to Piaget this is because they can only make one grouping at a time. Once they have assigned the cows to the class 'cows' they cannot mentally undo that to include the cows in the larger 'animal' class and

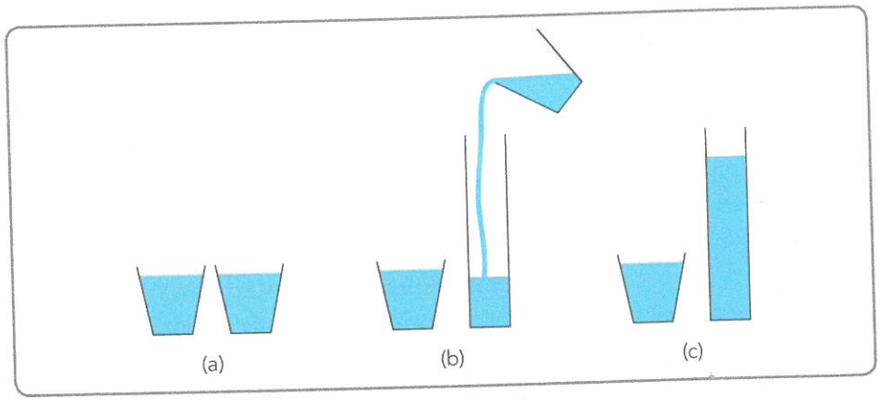

Figure 7.2 The beaker test (conservation of liquid)

so are unable to understand the relationship between cows and animals. Without reversible mental operations, the classes 'cow' and 'animal' cannot exist simultaneously in the child's mind.

- Piaget's experiments are reliable – if you replicated them exactly you would get the same results as Piaget – but is his interpretation of the findings valid?
- Piaget's tasks have been criticised for not allowing younger children to demonstrate their logical reasoning. One criticism is that the tasks do not make human sense.
  - Children fail the three mountains task because they do not understand the social context, not because they are egocentric. Given a more familiar task that is socially relevant, young children show they are able to take another's perspective. For example, Hughes (1975) showed children a board with two barriers and asked them to hide a model of a boy where he could not be seen by the toy policemen placed at the end of each barrier (see Figure 7.3). He found that 90 per cent of three- to five-year-olds could do this task.
  - Changing the tasks so that they make sense to the child – giving a reason for transferring liquid to a new beaker, for example – means that even four-year-olds are able to succeed in conservation and class inclusion tasks.

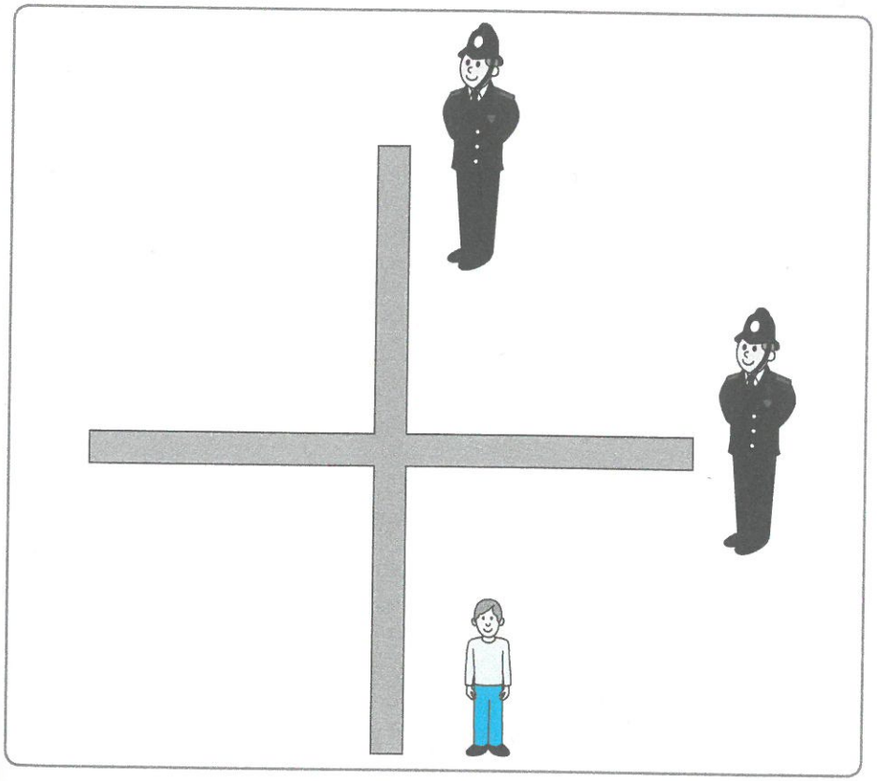

Figure 7.3 Hughes' test of egocentrism
Source: after Hughes (1975)

- Donaldson (1978) also criticised the procedural aspect of these tasks, arguing that the child has to work out the implicit social rules of the situation as well as the explicit problem that is being posed.
  - In the classic conservation tasks, the same question is asked before any changes are made and again after the transformation.
  - Children have learnt that adults usually only ask a question twice if a wrong answer has been given, so assume the adult wants a different response.
  - Since the only thing that has changed since the question was first asked is something to do with the materials, a plausible guess is that the tester wants the child to say the amounts are different.
  - If the children are only asked the question once (after the transformation) the social rules do not present the same problem and younger children are more likely to get the answer right.

Key terms

Animism: the attribution of consciousness to inanimate objects; this is often demonstrated by describing them as having human qualities and feelings. One example might be a child describing rain as 'the clouds crying'.

Egocentrism: According to Piaget, young children tend to perceive the world exclusively from their own point of view. They show no awareness that others have different perspectives. It must be remembered that this represents a cognitive rather than a moral limitation; the egocentric child is not deliberately ignoring everyone else's perspective – they simply do not realise others may not have access to the same information as themselves. Egocentric behaviour in Piagetian terms does not indicate selfishness, but, rather, limited cognitive functioning.

Centration: the tendency to focus on one feature of an object or situation at a time. In conservation of liquid tasks, for example, young children focus on the most salient aspect of the transformation – the height of the liquid in the beaker – to the exclusion of all other features of the task, such as the altered shape of the beaker. Conservation is only possible once children are able to decentre – that is, switch attention from one element of a task to another and take both into account at the same time. According to Piaget, egocentrism also demonstrates this inability to decentre – the egocentric child is unable to consider the perspectives of others as well as their own.

Concrete operational stage (7–11 years)

- Children understand reversible mental operations and can decentre, as demonstrated by their ability to conserve and answer class inclusion questions correctly. More importantly they can give a logical reason for their answers.
- Reasoning is still limited because, although the child can reason logically and understand causal relationships, they can only do so if that reasoning is tied to specific concrete examples; they cannot yet engage in hypothetical or abstract reasoning.

Formal operational stage (11 years onwards)

- Thinking is more logical at this stage: adolescents develop plans to solve problems and test possible solutions in a systematic and organised way as opposed to the trial and error fashion that typifies the approach of younger children.
- The ability to engage in abstract reasoning also increases; adolescent thinking is no longer tied to specific concrete examples as it was during late childhood, meaning that they can engage in *hypothetico-deductive reasoning*. This change in cognitive skills is reflected in the growing ability of adolescents to handle increasingly complex scientific and mathematical concepts.
- Evidence suggests that changing cognitive skills reflect underlying structural and functional neurological development during adolescence.
  - MRI studies demonstrate considerable structural changes in the prefrontal cortex, believed to represent the fine-tuning of neural circuitry, which in turn increases the efficiency of the cognitive systems they specifically serve.
  - There is also some suggestion that functioning in the frontal cortex increases with age (for example, Rubia et al., 2000).

Key term

Hypothetico-deductive reasoning: this typifies reasoning in the formal operational period and can be defined as using hypothesis and deduction to solve a problem. Hypothetical reasoning goes beyond the confines of everyday experience to include things about which we have no experience or direct knowledge. This represents a vast leap in thinking from the concrete operational stage, where reasoning is based in the physical (concrete) world of experiences. Children and adolescents with formal operations can reason about abstract (hypothetical) problems in their minds (symbolically) and reach logical conclusions without any physical experience.

Further reading Theories of cognitive development

Topic	*Key reading*
Object permanence	Smith, L. B., Thelen, E., Titzer, R., & McLin, D. (1999). Knowing in the context of acting: The task dynamics of the A-not-B error. *Psychological Review, 106*(2), 235–260. Available online at: www.indiana.edu/~cogdev/labwork/SmithThelen1999.pdf
Structure and function	Casey, B. J., Giedd, J. N., & Thomas, K. M. (2000). Structural and functional brain development and its relation to cognitive development. *Biological Psychology, 54*, 241–257. Available online at: www.medinfo.hacettepe.edu.tr/tebad/umut_docs/interests/fmr/aging/MAIN_structural_fonctional.pdf

Vygotsky's social constructivist theory

- Vygotsky also believed that children develop qualitatively different ways of thinking about the world based on active, motivated interaction with the environment.
- However, he believed that cognitive development was based in social interactions, not in individual exploration of the environment.
- As described in Chapter 1, cultural tools such as language are essential to this development.
- This belief is reflected in the zone of proximal development (ZPD), which refers to a child's developmental potential. For learning to take place, a teacher must work within this zone.
- Progression through the ZPD is described in terms of four stages.
  - *Stage 1:* performance is directly assisted by more capable others through scaffolding.
  - *Stage 2:* involves self-guidance as the learner takes over the role of the teacher in relation to their own learning. This may mean talking themselves through the task, remembering instructions previously given, etc.
  - *Stage 3:* performance becomes automatic.
  - *Stage 4:* stressors (for example, fatigue) or changes in the exact conditions of the task may unsettle us, setting us back to an early stage of the process. For example, when we are tired we may find a task much harder and have to rely on self-guidance to complete a task satisfactorily.
- During a learning interaction, the teacher uses techniques such as *scaffolding* (Wood, Wood, & Middleton, 1978):
  - the child is taken step by step through the task
  - the level of help is varied so that it is contingent on the child's needs
  - in the early stages of mastering a task, a child may need direct instruction and modelling
  - as they become more proficient at a task, guidance will become less direct as the child takes control.
- This model presents development as an apprenticeship in which the expert (adult or other more skilled individual) teaches the novice (the child) how to succeed.
- As children develop mastery of tasks, they move from being regulated by teachers and others to self-regulation.

KEY STUDY

Fawcett and Garton (2005). The effect of peer collaboration on children's problem-solving ability

This study investigated the impact of collaborative social interactions on children's problem-solving abilities. A total of 100 children aged between 6 and 7 years of age took part in the study. All the children completed a pre-test, comprising a block-sorting task, which identified them as either high or low on sorting ability. Children were then matched to a partner (or allocated to a control group) on the basis of their sorting ability, resulting in 10 pairs of high/high scorers, 10 pairs of low/low scorers and 20 pairs of high/low scorers. The remaining 20 children (10 high scorers and 10 low scorers) were allocated to the control group and so did not engage in the collaborative activity. Children in the intervention group completed a card-sorting activity, either individually or in same-gender pairs. The pairs consisted of same- or different-ability children who operated under either a 'talk' (encouraged to explain the sorting task) or 'no talk' (talking discouraged) condition. All children were then retested on the block-sorting task. It was found that children who collaborated improved their scores on the sorting task significantly more than children who worked individually. However, the greatest gains were for those children of lower sorting ability who had to talk to each other about the task during the collaboration. This highlights the importance of language as a cognitive tool for learning and development and the value of peer interactions for cognitive growth.

Fawcett, L. M., & Garton, A. F. (2005). The effect of peer collection on children's problem-solving ability. *British Journal of Educational Psychology* 75(2), 157–169

Key terms

Zone of proximal development (ZPD): a central concept to social constructivism, the ZPD is a child's learning potential. It represents the distance between a child's actual and potential developmental levels. A child's actual developmental level is determined by their independent problem solving, while their potential developmental level is determined by the problem solving they can achieve with instruction from an adult or more knowledgeable peer. Children develop new ways of thinking and problem solving through working with more knowledgeable others on tasks that are within this zone – that is, tasks which are neither so easy they can be completed without help, nor so difficult success is beyond the child even with assistance.

Scaffolding: the process through which a teacher or more competent peer assists the learner on a task within the ZPD as necessary. The aim is to simplify a task to make it achievable and to encourage and motivate the learner to engage in and complete the task. To be effective, the assistance given must be contingent upon the needs of the learner and support should be removed as it becomes unnecessary – just as scaffolding is removed from a building during construction. During early stages of engagement with a new task the learner may benefit from being shown what to do (modelling or demonstration) or direct instruction. As they move through the zone, help may become more indirect and include features such as asking questions to help the learner to reach their own solutions.

Sample question *Essay*

Compare and contrast the theories of Piaget and Vygotsky.

Test your knowledge

7.1 What are the four stages of Piaget's theory?

7.2 What is the main achievement of the sensorimotor stage?

7.3 What are the characteristics of the concrete operational stage?

7.4 What is the ZPD?

Answers to these questions can be found on the companion website at:
www.pearsoned.co.uk/psychologyexpress

Further reading Theories of cognitive development

Topic	*Key reading*
Vygotsky	Wertsch, J. V., & Sohmer, R. (1995). Vygotsky on learning and development. *Human Development, 38*, 332–337.

Information-processing approach

This approach analyses how we manipulate information, monitor it and create strategies for handling it (Munakata, 1998), using a computer metaphor to explain development.

- Computer hardware determines the amount of data it can process (capacity) and speed of processing; human capacity and speed of information processing is limited by neurological development.
- Computer software limits the kind of data that can be input and how it can be manipulated (for example, word processing software cannot process statistics); the problem-solving strategies acquired limit human information processing.
- Biological changes in the brain (for example, in the frontal lobes), and the blooming and pruning of synaptic connections, affect functioning at a structural level.
- Myelination (see Chapter 3 for a definition of this process) increases the speed of processing by increasing the speed of electrical impulses in the brain.

- Practice leads to the ability to process information with little or no effort (*automaticity*), thereby reducing processing speed as once a task has become automatic there is no need to engage in conscious thought, so reducing the burden on working memory.
- An increase in capacity improves information processing (Mayer, 2008) – for example, the ability to hold several facts in mind at one time increases with age.
- Processing speed can affect competence in thinking (Bjorklund, 2005) and increases dramatically across the childhood years and into adolescence: 10-year-olds are almost twice as slow at information-processing tasks than young adults, 12-year-olds are 1½ times slower, but children aged 15 years perform as well as young adults (Hale, 1990).
- Encoding speed and the ability to ignore irrelevant information increases with age (Siegler, 1998).
- Information processing is also affected by *attention*: the focusing of mental resources. Attention improves processing. However, children, like adults, can only focus on a limited amount of information at one time.
- Memory is important for cognitive processing. In particular, working memory is a mental workbench where we manipulate and assemble information when making decisions, solving problems or understand written or spoken language.
- Most criticisms of Piaget's theory assume that Piaget is right when he states that human reasoning depends upon mental structures, but maintain that Piaget overestimates the age at which these structures develop. Information-processing models provide a different challenge, proposing that children cannot do these tasks because the demands are too much for developing processes such as memory and attention.
- In response, *neo-Piagetians* have taken some of these ideas and integrated them with Piaget's theory, arguing that development through the stages and changes in logical structures is enabled by increasing working memory capacity and processing efficiency (Demetriou et al., 2002).

Key term

Working memory: refers to the cognitive system that provides temporary storage and manipulation of the information necessary for complex tasks as language comprehension, learning, problem solving and decision making. It is like a mental 'workbench' where we assemble and manipulate information during such tasks. Working memory has been found to require the simultaneous storage and processing of information. It consists of the central executive and two slave systems. The central executive controls the cognitive processes such as attention and the manipulation of information within the slave systems. The slave systems are the visuospatial sketch pad, which manipulates visual images, and the phonological loop, which stores and rehearses speech-based information.

Test your knowledge

7.5 Describe the information-processing approach to cognitive development.

Answers to this question can be found on the companion website at:
www.pearsoned.co.uk/psychologyexpress

Further reading Theories of cognitive development

Topic	*Key reading*
Information processing	Kail, R., & Bisanz, V. (1982). Information processing and cognitive development. In W. H. Reese (Ed.), *Advances in child development* (p. 17). London: Academic Press.

School and cognitive development

The role of school

In Western societies school provides an important context for children's cognitive development. There is, however, a lot of debate about the best way for schools to help this development and the theories of Piaget and Vygotsky have influenced *progressive* teaching methods including:

- a child-centred approach
- active learning (for example, *discovery learning*)
- *readiness to learn*
- *co-operative* and *collaborative* learning.

One important distinction between Piagetian and Vygotskian approaches concerns what can be taught. Piaget believed children had to have the right mental structures in place for learning to occur (for example, reversibility is needed to learn about conservation). Vygotsky, however, believed that anything could be taught as long as it was within the child's ZPD. If Vygotsky is right, then would it be possible to teach a skill such as conservation to children who are not yet at the operational stage of development?

- Field (1981) found that three- and four-year-old preschoolers who are not yet able to conserve can be taught this skill.
- However, four-year-olds were better conservers than the three-year-olds and were more likely to retain this skill over time.
- The short-term nature of the conservation shown by the younger children suggests that they had not actually learnt a new thinking skill, but had simply rote learnt the 'correct' answers.

- This suggests that new ways of thinking can be taught, but a child has to be ready to learn those skills.
- But is school essential to the development of advanced cognitive skills such as hypothetical thinking? Cross-cultural studies of children who do not experience formal schooling suggest that cognitive skills develop at different rates and manifest themselves in different ways, depending on the context in which a child lives (Cole, 1990).
  - Nunes, Schliemann and Carraher (1993) showed that Brazilian child street traders who had not been exposed to formal schooling had difficulty finding the correct solution to maths problems presented in written form, but were successful when the same problem was presented in oral form. This demonstrates that children possess the ability to solve hypothetical problems, but, because of a lack of experience and training in written mathematical problems, they fail when these problems are presented as they would be in a formal school setting.
  - This suggests that development of logical thought is not influenced by schooling – it will develop anyway, but school influences *how* those skills develop and are manifest, by teaching the language and expectations of a specific cultural setting in relation to cognitive tasks (Cole, 1990).

Key terms

Discovery learning: this approach to teaching is based on the Piagetian principle that children learn about the world around them through active exploration of the environment. For younger children, discovery learning includes hands-on exploration and manipulation of objects and carrying out experiments. As cognitive skills become more sophisticated, it may also include finding out about topics and problem-based learning where learners address real-life and abstract questions and controversies.

Collaborative learning: in this approach, children work together to explore a problem, answer a question or create a project. Simply defined, it is a group of learners working on a shared assignment.

Co-operative learning: this is a specific kind of collaborative learning. In co-operative learning, students work together in small groups on a structured activity. They are individually accountable for their work and the work of the group as a whole is also assessed.

CRITICAL FOCUS

Atypical development and school experiences

As well as looking at the evidence from cross-cultural research, we can look at research that considers the school experiences of children who are developing atypically. In their paper 'School experiences after treatment for a brain tumour', Upton and Eiser (2006) describe how lengthy school absences can impact upon cognitive performance for school-age brain tumour survivors. They discuss how school absence interacts with a range of other factors, including the social context and the child's neurological functioning to influence the special educational needs of these children.

Upton and Eiser also note that long absences from school mean children fall behind their classmates and performance is most affected in subjects such as literacy and numeracy where prior knowledge and skills are vital. This is also true for children with chronic health problems that do not involve neurological difficulties.

What does this tell us about performance, ability and school? Does performance on a task necessarily demonstrate ability? Performance on tests is frequently used as a measure of cognitive ability, but what does this really tell us? You know from reading about cross-cultural studies that children may be able to think logically but cannot demonstrate that skill if the tasks do not make social sense. Is this the same for children who have long school absence due to illness or is a different mechanism at work? Is their cognitive development delayed, disrupted or is it simply that their knowledge of the language of performance testing is lacking? How might such studies help provide a critique of stage theories of cognitive development?

Learning to read and write

Reading and writing are perhaps two of the most significant skills that children learn at school. Vygotsky saw language as an essential cultural tool for learning and he included written language as a part of this. While humans have shared knowledge across generations for centuries through the spoken word, written language expands our ability to transmit information to others in different geographical and temporal locations. Modern technology – for example, the Internet and the World Wide Web – have created even more opportunities to share knowledge and information in this way.

Another advantage of writing is the way it enhances our cognitive functioning (Menary, 2007). For example, writing things down can be a great memory aid and working things out on paper expands our thinking power, allowing us to deal with a larger quantity and complexity of material.

Reading

Learning to read involves mastering and integrating a number of separate skills.

- English and other European languages use an alphabetic script where each symbol (letter) represents a phoneme. The child has to develop a conscious awareness of the sound/symbol association.
- Word recognition may mean segmenting a word into its underlying phonological elements before identifying it. For example, the word 'cat' can be decoded into its phonological form ('kuh, ah, tuh'). Alternatively, we may recognise a whole word by its overall visual appearance.
- Once the word is identified, higher-level cognitive functions, such as intelligence and vocabulary, are applied to understand the word's meaning

Factors affecting reading progression include:

- early exposure to books: understanding that books tell stories, they have a right and a wrong way up, the writing goes from left to right
- knowing the letters of the alphabet when they start school

- children with greater knowledge of nursery rhymes show better phonemic awareness (Maclean, Bryant, & Bradley, 1987)
- programmes encouraging parents and carers to enjoy books with their children from an early age have been found to improve children's scores in maths and English (Hines & Brooks, 2005; Wade & Moore, 1998), suggesting a general impact on symbolic functioning.

Writing

The cognitive and linguistic strategies children use to read are the same ones that they use to write. However, they also need fine motor skills, which can be developed by play activities involving the manipulation of objects, such as:

- art and crafts
- play dough
- jigsaw puzzles
- building blocks.

There is evidence that motor development has a much wider role to play in the development of cognitive skills. Studies of children with *specific learning difficulties* have highlighted the co-occurrence of motor and language difficulties (Viholainen et al., 2002), suggesting that motor and language problems share a common underlying neuro-cognitive mechanism. There is increasing evidence that structurally the interface for the integration of cognitive and motor functioning is the cerebellum (see Figure 7.4).

The cerebellum is responsible for:

- co-ordinating movement
- planning
- motor activities
- learning and remembering physical skills.

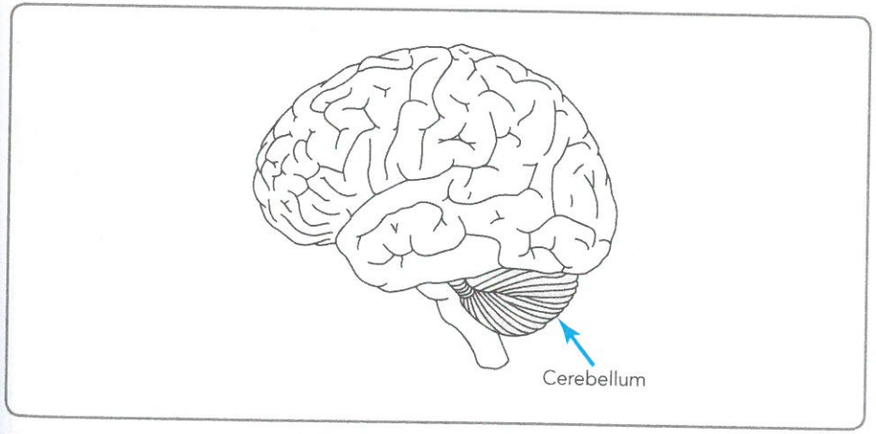

Figure 7.4 A cross-section of the brain, demonstrating the position of the cerebellum

Evidence from neuroimaging studies suggests that the cerebellum also plays an important role in a range of high-level cognitive functions such as language, previously believed to be under the sole control of the cortex (Booth et al., 2007). For example, there is some evidence that dyslexia is associated with cerebellar impairment in about 80 per cent of cases (Nicolson, Fawcett & Dean, 2001). This suggests that cognitive functioning may rely on shared motor and cognitive neural systems (Diamond, 2000; Ojeman, 1984).

Key terms

Specific learning difficulties (SpLD): this is an umbrella term that covers a wide range of difficulties, including dyslexia (reading and writing difficulty), dysgraphia (writing difficulty), dyspraxia (motor difficulties), dyscalculia (difficulty with numbers and mathematical calculations), attention deficit hyperactivity disorder (ADHD, concentration difficulties and heightened impulsiveness) and autistic spectrum disorder (ASD, emotional, behavioural and social difficulties). All SpLDs typically affect a student's motor skills, information processing and memory.

Dyslexia: the most common form of SpLD, dyslexia, causes reading, writing and spelling problems. Difficulties persist despite appropriate learning opportunities. Dyslexia is due in part to processing difficulties, including visual and auditory perceptual skills. People with dyslexia may also show difficulties with short-term memory, concentration and organisation. Dyslexia varies between individuals and can occur in people of all abilities.

Test your knowledge

7.6 How have theories of cognitive development influenced teaching methods?

7.7 What is the relationship between school and cognitive development?

7.8 In what way is context important for cognitive functioining?

Answers to these questions can be found on the companion website at: **www.pearsoned.co.uk/psychologyexpress**

? Sample question — *Problem-based learning*

The couple who live next door had their first child, a girl called Alice, six months ago. The health visitor has told the parents about Bookstart and has suggested they start reading to baby Alice. Alice's dad thinks this is nonsense – how can a baby understand stories? Books, he insists, are for three- and four-year-olds. Alice's mum asks you what you think she should do. She doesn't want Alice to miss out on any learning opportunities, but also doesn't want to argue with her husband. What would you advise? Is there any evidence you could give to your neighbour to try and convince her mum that reading to Alice is time well spent?

? Sample question — *Essay*

Critically evaluate the importance of formal schooling for children's cognitive development.

Further reading School and cognitive development

Topic	*Key reading*
Culture and learning	National Research Council (1996). *Mathematics and science education around the world: What can we learn from the survey of mathematics and science opportunities (SMSO) and the third international mathematics and science study (TIMSS)?* Washington, D.C.: National Academy Press.
Social context and cognitive development	Nunes, T., Schliemann, A. D., & Carraher, D. W. (1993). *Street mathematics and school mathematics.* New York: Cambridge University Press.
Reading programmes	A number of studies assessing the effectiveness of Bookstart are available from the following website, including the study carried out in Sheffield by Hines, M., & Brooks, G. (2005). *Sheffield babies live books: An evaluation of the Sheffield Bookstart project.* Sheffield: University of Sheffield. Visit: www.booktrust.org.uk/show/feature/search/Bookstart-studies.
Dyslexia	Nicolson, R. I., Fawcett, A. J., & Dean, P. (2001). Developmental dyslexia: The cerebellar deficit hypothesis. *Trends in Neurosciences, 24*(9), 508–511.

Chapter summary – pulling it all together

- Can you tick all the points from the revision checklist at the beginning of this chapter?
- Attempt the sample question from the beginning of this chapter using the answer guidelines below.
- Go to the companion website at **www.pearsoned.co.uk/psychologyexpress** to access more revision support online, including interactive quizzes, flashcards, You be the marker exercises as well as answer guidance for the Test your knowledge and Sample questions from this chapter.

Answer guidelines

Sample question — Essay

Critically evaluate the importance of the social context to the development of cognitive functioning in childhood.

Approaching the question

Your answer should aim to provide an analysis of how cognitive development occurs in childhood and the impact that social factors may have.

Important points to include

- Begin by outlining how this issue is relevant to cognitive development.
- Discuss the different theoretical approaches, including:
  - constructivist
  - social constructivist
  - information processing.
- For each you will need to:
  - highlight the relative importance given to social factors
  - give examples of how social context has been shown to influence the way cognitive development unfolds and how social context may influence whether or not children can demonstrate cognitive skills
  - evaluate the ability of each theory to explain development and identify any gaps in the theories by comparing and contrasting approaches.

Make your answer stand out

It is really easy to fall into the trap of simply comparing and contrasting Piaget and Vygotsky. A good answer will remember to take a critical stance, evaluating the importance of social context for each. Linking your evaluation to applied issues, such as the importance of school context, will demonstrate your ability to reach beyond theory into practice.

Explore the accompanying website at www.pearsoned.co.uk/psychologyexpress

→ Prepare more effectively for exams and assignments using the answer guidelines for questions from this chapter.
→ Test your knowledge using multiple choice questions and flashcards.
→ Improve your essay skills by exploring the You be the marker exercises.