Revision notes 6.2
Section 6.2 Cognitive development

Learning outcomes

- Evaluate theories of cognitive development.
- Discuss how social and environmental variables (for example, parenting, educational environment, poverty, diet) may affect cognitive development.

Cognitive developmental psychology focuses on how cognitive processes (such as reasoning, perception, memory, intellectual development) change over time. They question how these changes can account for behaviour shown at different ages. It is assumed the major changes occur during childhood and developmental psychologists look at how these impact the individual as they move through their life.

Piaget (1896–1980)
Piaget described himself as an epistemologist. Epistemology is the study of the scope and limitations of knowledge and deals with questions such as:

- What is knowledge?
- How is knowledge acquired?
- What do people know and how do they know what they know?

Piaget believed these questions could be answered, or at least more appropriately framed, if researchers focused on the genetic context behind them. As a result, his theories of cognitive development and his epistemological views are known collectively as genetic epistemology.

While working as a teacher in Paris, Piaget was helping to grade responses to an intelligence test when he noticed that children consistently gave the wrong answers to certain questions. More specifically, younger children made the same pattern of mistakes that older children and adults did not. This, as well as his intense studies with his own children in the 1920s, led him to the following assumptions (which he spent the rest of his career testing).

- Intelligence is under genetic control and develops in the form of predetermined stages.
- Children do not passively receive their knowledge; they are curious, self-motivated and seek out information to construct their own understanding of the environment.
Children think qualitatively differently from adults. Previous thought dictated that children were the same as adults but ‘less than’ – that is, they had the same thought processes but were not as advanced or as sophisticated. Piaget argued that children are completely different and their mental processes cannot be viewed in the same way.

Individuals construct their view of the world through mental frameworks of understanding.

**Piaget’s theory of cognitive development**

Piaget argued that knowledge developed through cognitive structures known as schemas. Schemas are mental representations of the world and how the individual interacts with it. As a child develops, his or her schemas develop as a result of his or her interaction with the world. All children are born with an innate range of schemas, such as a schema for sucking, reaching, and gripping. These are in turn modified as a result of experience; Piaget called this process of modification **adaptation**. He also argued children actively **construct** knowledge themselves as a result of their interaction with new objects and experiences. For this reason Piaget is also known as a constructivist. The child’s interaction with new events and objects as well as the intermingling of these with existing knowledge cause him or her to develop cognitively.

There are two types of adaptation.

- **Assimilation** – This process occurs when new events (such as objects, experiences, ideas and situations) can be fitted into existing schemas of what the child already understands about the world.

- **Accommodation** – This process occurs when new events do not fit existing schemas. Either a schema has to be modified to allow the new world view, or a new schema has to be created. Accommodation is the creation of new knowledge and the rejection or adaptation of existing schemas.

Piaget proposed that any child moves through four stages in sequential order during cognitive development:

- the sensorimotor stage
- the pre-operational stage
- the concrete operational stage
- the formal operational stage.
The sensorimotor stage (0–2 years)

This stage is characterized by the infant having no formal schema for the world or itself. It can only know the world via its immediate senses and the motor or movement actions it performs. This stage is illustrated by the following.

- Profound egocentrism – The infant cannot distinguish between itself and the environment as has no real knowledge of the world around it.
- A lack of object permanence – When an infant cannot see or act on an object then the object effectively ceases to exist for the infant.

However, Piaget’s claims have been contradicted by other researchers. Bower (1982) constructed a simple experiment whereby a child was shown an object and then had a screen placed between it and the infant. The object was then removed and the screen taken away. Bower claimed the children showed enough surprise at the disappearance of the object to argue object permanence was a much more flexible phenomenon than Piaget had envisaged.

The pre-operational stage (2–7 years)

Operations are logical mental rules and Piaget argued that, at this age, the child cannot internalize these disciplines and therefore still relies on external appearances rather than consistent internal logic (hence the label, pre-operational).

This stage begins with the establishment of object permanence and ends with the emergence of concrete operations. Pre-operational stage children have a lack of conservation – the realization objects can remain the same despite a change in appearance.

Piaget demonstrated this with glasses of water. A child is presented with two glasses containing the same quantity of water and then witnesses the contents of one of the glasses being poured into a taller, thinner container. Children at this stage will argue the taller, thinner container contains more water. This shows the child does not understand how objects can remain the same (in this case, the quantity of water is fixed) despite a change in appearance.

Piaget also argued that this stage is characterized by a third cognitive inhibitor, classification limitation. This refers to the early pre-operational child’s inability to classify similar objects into the same groups. This ability begins around the age of four and appears in basic form, such as characterizing objects based on shape or colour.

Piaget and Inhelder (1956) demonstrated the egocentrism of the pre-operational child through their ‘three mountain experiment’. When 4-year-olds were shown a mountain scene, they tended to be unable to describe the same scene from the point of view of a doll on the other side. Six-year-olds showed more awareness of the different viewpoints but still tended to choose the wrong one when asked to specifically identify a scene from the doll’s perspective.
The mountain scene apparatus and the methodology have been criticized as being too far from the normal operating world of the child – children are not used to seeing such scenes. They may have been confused by the layout, by adult objects placed on the scenes and by the need to identify the doll’s position through a photograph (Hughes, 1975).

Hughes devised his own experiment known as ‘the policeman doll’ study where children had to hide a boy doll from two policeman dolls who were arranged around a piece of cardboard apparatus. The children had to consider the viewpoint of the two policeman dolls before making a decision as to where to place the boy doll so it was hidden from the policeman dolls.

Hughes’ sample consisted of children aged between three-and-a-half and five. Of these, 90% gave correct answers suggesting they had overcome the egocentrism that characterizes the pre-operational stage.

There are criticisms of the Piagetian view of this stage. Piaget himself was interested in the pre-operational characteristic of symbol use in play: children often use a single object (e.g. a broom handle) for many different roles (e.g. a horse, a sword). This suggests a more sophisticated understanding of objects than the simple lack of conservation ability can portray. Another criticism is the negative tone Piaget uses to describe this stage. By calling it ‘pre-operational’, he focuses on what children cannot do (three cognitive limitations) rather than what they can achieve.

Children at this stage have been shown to have active imaginations. Field et al. (1982a) found 4–5-year-old children can spend as much as 20% of their playtime constructing sophisticated roles for different objects above and beyond their intended use (e.g. blocks become trucks, brooms become horses). At this stage, children also construct complicated role plays for themselves and others (games of ‘mummies and daddies’, ‘cowboys and Indians’, ‘doctors and patients’). They issue explicit instructions for each member of the group on how to fulfil these roles in sometimes lengthy monologues before play begins (Howes and Matheson, 1992).

The concrete operational stage (7–11 years)
During this stage, the child develops definitive rules or schemas for ordering the world. These rules are termed operations, but they can only be applied to real objects in the real ‘concrete’ world. Piaget claimed the mental agility needed for carrying out logical operations without a real world object to aid them had not yet been developed.

An example of an operation the child has developed by this stage is conservation – the realization objects can remain the same despite a change in appearance. The pre-operational child lacks conservation.

The concrete operational child quantities can remain the same even though the appearance may change. However, McGarrigle and Donaldson (1974) questioned whether Piaget’s methods were suitable for such young children. They used a glove puppet, known as Naughty Teddy, to ‘accidentally’ transform
the beads (Figure 6.2c). Under this condition, they found 63% of 4–6-year-old children could successfully conserve as they recognized the number of beads remained the same.

**The formal operational stage (11 years onwards)**

At this stage, the child’s mental structures are so well developed that ideas and problems can be manipulated mentally without the need for physical objects. Children can think about possible occurrences and imagine themselves in different roles without the need for dolls or play acting. They can also think about hypothetical problems and abstract concepts they have never encountered before, such as:

if \( A > B > C \), then \( A > C \) (where > means ‘is greater than’).

Piaget believed everyone reached this stage by the age of 20.

**Evaluation of Piaget’s theory**

**Positive criticism**

- Piaget produced the first comprehensive theory of child cognitive development.
- He modified the theory to take account of criticism and envisaged it constantly changing as new evidence came to light.
- A great deal of criticism has been levelled at the ‘ages and stages’ part of his theory but it is important to remember the theory is biologically based and demonstrates the child as a determined, dynamic thinker, anxious to achieve coherence and test theories.
- Piaget was the first to investigate whether biological maturation drove cognitive development and his vision of a child having cognitive changes regulated by biology is now widely accepted and supported by cross-cultural research.
- He also developed the notion of constructivism – he argued children are actively engaged with constructing their knowledge of the world rather than acting as passive receivers of information. This now widely accepted idea changed the view of childhood and significantly influenced the education profession.

**Negative criticism**

- Piaget’s methods have been criticized as too formal for children. When the methods are changed to show more ‘human sense’, children often understand what is being asked of them and show cognitive ability outside of their age appropriate stage. The small sample sizes also mean caution should be used then generalizing to large groups and cultures.
- He failed to distinguish between competence (what a child is capable of doing) and performance (what a child can show when given a particular task). When tasks were altered, performance (and therefore competence) was affected.
The notion of biological readiness has also been questioned. If a child’s cognitive development is driven solely by innate factors, then training would not be able to propel the child onto the next stage.

Piaget has been criticized for under-estimating the role of language in cognitive development.

He has also been criticized for under-estimating the role of social development in cognitive development. The ‘three mountain experiment’ is a presentation of a social scene and yet Piaget focused on it solely as an abstract mental problem.

The theory is very descriptive but it does not provide a detailed explanation for the stages. Piaget’s supporters would suggest that, given his broad genetic explanations, the technology did not exist for him to research his assumptions in depth.

The model can be seen as too rigid and inflexible. However, its supporters argue that Piaget never intended it to be seen in such a light, and it should be seen more as a metaphor and a guiding principle for teaching and learning.

**Vygotsky (1896–1934)**

Vygotsky focused on:

- how children play and socialize
- language development in the context of their understanding of the world
- the culture and language in a child’s cognitive development.

The Vygotskian child makes sense of the world through shared meaning with others whereas the Piagetian child makes sense of the world as the result of innate maturation process that drives cognitive development.

The primary way we communicate with the world is by language not physical gestures. Language for children is primarily a way to produce change in others. However, when language becomes internalized, it converges with thought, and eventually we are able to direct and control our thinking with the use of language. We develop an inner voice for thinking and a more complex, vocabulary-rich voice for communication with others.

**Vygotsky’s theory of cognitive development**

Vygotsky divided the intellect into basic innate capabilities which he termed elementary functions (e.g. attention and sensation) and higher mental functions. Vygotsky argued elementary functions can only develop into higher functions via the input of culture. Vygotsky thought of culture as a body of knowledge held by persons of greater knowledge or in books – ideas transmitted through language – hence the importance he placed on language development as part of overall cognitive development.
Thus, cultural knowledge is the means by which cognitive development takes place. Vygotsky envisaged language progressing in three stages.

- **Pre-intellectual social speech (0–3 years)** – Thought is not constructed using language and speech is only used to enact social change (e.g. receiving objects from a parent).
- **Egocentric speech (3–7 years)** – Language helps to control the child’s own behaviour and is spoken out loud (e.g. when children play games they often verbalize their actions).
- **Inner speech (7+ years)** – The child uses speech silently to develop their thinking and publicly for social communication.

Vygotsky articulated the importance of culture through the zone of proximal development (ZPD). A more useful translation is the zone of potential development as the ZPD is seen as the distance between the child’s current and potential abilities under adult supervision. Instruction from an expert wakens a whole series of embryonic functions that can be extended under supervision from an expert (usually an adult).

**Evaluation of Vygotsky’s theory**

**Positive criticism**

- The concept of scaffolding has been useful from a teaching perspective. Conner, Knight and Cross (1997) argued that the quality of the scaffolding provided by a mother and father could predict the success of the child in the classroom.
- The value Vygotsky placed on inner speech has also received support. He argued the inner voice was a key part of learning and cognitive development; Behrend et al. (1992) quantified inner speech by observing the amount of whispering and lip movement children engaged in when given a task. They found children who used the greatest amount of inner speech tended to perform better on tasks.
- Vygotsky makes an important contribution to developmental psychology as he emphasizes the importance of social interaction on cognitive development – an area lacking in Piaget’s approach.

**Negative criticism**

- Vygotsky can be criticized for being too vague in his outline of social influence.
- There is a lack of empirical support for Vygotsky’s ideas – this is largely explained by his emphasis on processes rather than outcomes (processes are harder to test for).

Vygotsky died at the age of 38, so his work as a cognitive developmental researcher was still in its infancy. Had he lived longer, he would have advanced his theories and been able to respond to peer review.

Vygotsky and Piaget’s ideas should not be seen as diametrically opposed to each other. In many ways
they complement each other and an integration of both views might be a productive way forward.

Social and environmental variables

Diet
The effect of diet begins before the child is born; for example, seafood is the primary source of omega-3 fatty acids which are essential for neural development. Hibbeln et al. (2007) compared two groups of women (those consuming high levels of omega-3 fatty acids and those consuming low levels of the same). They found the children of those mothers who had a low seafood intake during pregnancy had lower motor (movement and coordination) skills and lower social development and communication skills than the children of mothers who consumed high levels of seafood. Raloff (1989) studied 1023 6th-grade children over the course of one year and found those who were given free school breakfasts improved their maths and science scores.

Breakfast has wide cognitive–behavioural benefits: A meta-analysis of breakfast programme studies by the Food Research Action Centre (FRAC) in the USA came to the following conclusions.

- Children who skip breakfast are less able to distinguish among similar images, show increased errors, and have slower memory recall.
- Children experiencing hunger have lower math scores and are more likely to have to repeat work – or even an academic year.
- Behavioural, emotional and academic problems are more prevalent among children with hunger.
- Children experiencing hunger are more likely to be hyperactive, absent and tardy, in addition to having behavioural and attention problems more often than other children.
- Children who are undernourished score lower on cognitive tests when they miss breakfast.
- Teens experiencing hunger are more likely to have been suspended from school, have difficulty getting along with other children, and have no friends.

Caution should be used when attributing improved cognitive functioning to a healthy diet. A healthy diet can have less quantifiably measurable affects on a child such as increased self-esteem, improved personal discipline and a greater sense of responsibility all of which would have an effect on school grades.

Parenting
In the USA, the Michigan Department of Education (MDE) in 2001 argued that the most consistent predictors of a child’s academic achievement and social adjustment were parent expectations: parents of high-achieving students set higher standards for their children’s educational activities than parents of low-achieving students and this drove educational achievement and therefore cognitive development.
The MDE stated that when parents are involved, students have:

- higher grades, test scores and graduation rates
- increased motivation and better self-esteem
- better school attendance
- lower rates of suspension
- decreased use of drugs and alcohol
- fewer instances of violent behaviour.

Family participation in education was twice as predictive of students’ academic success as family socio-economic status; the more intensely parents were involved, the more beneficial the achievement effects.

Overall, the MDE found families whose children are doing well in school exhibit the following characteristics.

- They have an established daily family routine such as providing time and a quiet place to study, assigning responsibility for household chores, being firm about bedtime and having dinner together.
- They monitor out-of-school activities such as setting limits on TV-watching, checking up on children when parents are not home, arranging for after-school activities and supervised care.
- They model the value of learning, self-discipline, and hard work, such as communicating through questioning and conversation, demonstrating that achievement comes from working hard.

Wood et al. (1976) introduced the notion of scaffolding as development of Vygotsky’s ZPD theory, in which the disorganized and spontaneous thoughts presented by the child are responded to with the more systematic, logical and rational concepts of a more knowledgeable (usually adult) helper. The parental strategies above can be seen in the Vygotskian scaffolding sense.