Cognitive Development

Cognitive development refers to age-related changes that occur in mental activities such as attending, perceiving, learning, thinking, and remembering.

Cognitive Developmental Theory and Processes

According to Jean Piaget (1896-1980), we inherit a method of intellectual functioning that enables us to respond to our environment by forming cognitive structures. Our intelligence is essentially a form of organization, cognitive structures being its organizational properties. Two important psychological mechanisms are responsible for the development of cognitive structures. In other words, children actively construct their cognitive worlds through the two processes of:

1. **Organization**
   - Organization refers to the connections among cognitive structures that enable us to engage in more complex thinking. We organize to make sense of the world (e.g. separating important ideas from less important ones); **Organization** is Piaget's concept of grouping isolated behaviours into a higher order, more smoothly functioning cognitive system. Every level of thought is organized. Continual refinement of this organization is an inherent part of development. Organization occurs within stages of development as well as across them.

2. **Adaptation**
   - According to Piaget, we adapt our thinking to include new ideas and further our understanding. We adapt in two ways:
     
     (i) **Assimilation** (occurs when children incorporate new idea into existing knowledge or cognitive structures, and changing them to fit those structures); and

     (ii) **Accommodation** (occurs when children adjust to new information so that they in turn produce corresponding behavioural changes. In other words, it refers to ways in which children's current means of understanding the world change in response to new experience).

In some ways adaptation is analogous to taking in food. We take in food by chewing it so that it can fit in (assimilation) and then digest it, which may produce corresponding behavioural changes (accommodation).

Piaget considered adaptation and organization two inseparable and complementary processes of a single mechanism. Because we use these two mechanisms constantly throughout our lives, they are called Functional Invariants.

Another important developmental process is termed equilibration. It refers to our efforts to strike a balance between assimilation and accommodation. We make mistakes, but by continually interacting with the environment, we correct our mistakes and change our cognitive structures. It explains how children shift from one stage of thought to the next. The shift occurs as children experience cognitive conflict or a disequilibrium in trying to understand the world. Eventually a child resolves the conflict and reaches a balance, or equilibrium, of thought. It is a three-stage process. First, children are in a state of equilibrium. Then failure to assimilate new information leads to their becoming aware of shortcomings in their current understanding. Finally, their mental structure accommodates to the new information in a way that creates a more advanced equilibrium.

This is how the process of cognitive of development explained according to Piaget’s theory:

a) Stimuli come from the environment and are filtered through the functional invariants.

b) Functional invariants use stimuli to form new structures or to change existing structures.
c) Our behaviour (content) changes because of the changes in your cognitive structures.

This may be illustrated as follows:

![Diagram](image_url)

*Fig. The Process of Cognitive Development*

_Schemes_ are organized patterns of thought and action, i.e. cognitive structures and behaviour that make up an organized unit. They help adapt to our environment and may be best thought of as inner representations of activities and experiences. A scheme is named by its activity, hence the grasping scheme, sucking scheme, throwing scheme etc. For instance grasping scheme might include a child’s knowledge about blanket and the act of reaching out for it. In other words, a _scheme_ refers to the basic unit of an organized pattern of functioning.

Cognitive structures change with age, and hence subject matter must be presented in a form that matches the cognitive structures of the students.

**Piaget’s Four Stages of Cognitive Development**

Piaget believed that we go through four stages in understanding the world, which are age-related and qualitatively different (knowing more information does not make a child’s thinking more advanced).

His theory is considered _stage invariant_, but _age variant_. This means that we all go through the same stages, but the age at which we may achieve them can vary.

1. ** Sensorimotor Thought** (birth - 2, infancy)

Children develop the ability to organize and coordinate their sensations and perceptions with their physical movements and actions. This stage is divided into 6 sub-stages.
Some important characteristics of this stage are:

- Cognitive development mainly comes through the use of our bodies and the senses, hence the label sensorimotor.
- Children are egocentric. They are unaware of others' point of view (e.g. the moon follows them wherever they go or children may be talking to each other about completely unrelated topics).
- Children begin to distinguish their actions as causes (casuality).
- They achieve object permanence. Object permanence refers to the understanding that objects and events continue to exist even when they cannot directly be seen, heard or touched. The AB error is the object permanence concept in which an infant progressing into sub-stage 4 makes frequent mistakes, selecting the familiar hiding place (A) rather than the new hiding place.
- Children are able to represent the world through language.

Implications for Teachers and Parents

- Provide multiple objects of various sizes, shapes, and colours.
- Talk to children and be sensitively responsive to them. The human face can be the most exciting plaything an infant can experience.

2. Preoperational Thought (2–7 years, preschool child)

It is a time when stable concepts are formed, mental reasoning emerges, egocentrism begins strongly and then weakens, and imaginary beliefs are constructed. Operations are internalized sets of actions that allow children to do mentally what before they had done physically. Operations are highly organized and conform to certain rules and principles of logic. They appear in different forms in concrete and formal operational thought.
Preoperational thought can be divided into 2 substages:

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<thead>
<tr>
<th>SUB-STAGE</th>
<th>CHARACTERISTICS</th>
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<tbody>
<tr>
<td><strong>(1) Symbolic Function substage</strong> (2-4 years)</td>
<td>Child gains the ability to mentally represent an object that is not present). Two limitations that their thoughts still have despite progress in this stage are: <em>Egocentrism</em> (inability to distinguish between one’s own perspective and someone else’s; a salient feature of preoperational thought); and <em>animism</em> (belief that inanimate objects have “lifelike” qualities and are capable of action).</td>
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<tr>
<td><strong>(2) Intuitive Thought substage</strong> (4-7 years)</td>
<td>Children begin to use primitive reasoning and want to know the answers of all sorts of questions.</td>
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Other prominent characteristics of preoperational thought are
- **Centration/ Centering** (focussing or centering, of attention on one characteristic to the exclusion of all others). It is most clearly evidenced in their lack of *conservation* (idea that an amount stays the same regardless of how its container, shape etc. changes).
- Children begin to use symbols, such as language, but are not able to manipulate them.
- **Transductive reasoning** or reasoning from particular to particular in a non-logical manner (e.g. The sun won’t fall down because it is hot).
- **Irreversibility** or inability to reverse their thinking (e.g. although they learn $2 + 2 = 4$, they are not yet able to grasp $4 - 2 = 2$).
- They are intuitive rather than logical at this stage.
- **realism** (children’s growing ability to slowly distinguish and accept the real world)?
- **artificialism** (assumption that everything is a product human creation)

**Implications for Teachers and Parents**
- Preoperational children learn through active explorations and interactions with adults, other children, and materials. They need to be provided opportunities for it.
- Encourage manipulation of materials, provide hands–on experiences, engage in activities such as
  - deferred imitation (imitating animals, activities etc. that are seen earlier);
  - symbolic play (pretend play, e.g. pretending to sleep);
  - drawing;
  - role-plays etc.

3. **Concrete Operational Thought** (7-11, middle and late childhood)
- Children can perform mental operations only on concrete objects or events. They are not able to perform abstract operations such those involving verbal statements. They can coordinate several characteristics and not just focus on a single property of an object as in the earlier stages. In other words, they show conservation skills. *Conservation* refers to the realization that the essence of something remains constant although surface features may change. Children do not conserve quantities or on all tasks simultaneously. The order of the mastery is number,
length, liquid quantity, mass, weight and volume. Piaget’s concept that similar abilities do not appear at the same time within a stage of development is called Horizontal décalage.

- **Reversibility**, the ability to use cognitive operations ‘to take things apart’ to reverse their thinking or mentally reversing action on real, concrete objects is a characteristic of this stage. The conservation skills that the exhibit is largely due to this ability.

- One important skill that characterizes concrete operational thought is the ability to classify or divide things into sets or subsets and consider their inter-relationships. *Seriation* is the term used for the ability to arrange objects by increasing or decreasing size.

- During this stage, logical reasoning replaces intuitive thought when applied to specific or concrete examples, but cannot perform abstract tasks like steps in algebraic equation.

- Children also learn the number concept or the understanding of the meaning of numbers. Even though they may be able to say numbers, it is at only at this stage that they truly understand its meaning.

**Implications for Teachers and Parents**

- Children at this stage are capable of representational thought, but only with the concrete and tangible. They cannot grasp abstract subtleties.

- It is a good idea to use classification games and activities.

4. **Formal Operational Thought** (11/12 onwards, adolescence and beyond)

- It is at this stage that logical, abstract thinking appears. Adolescent thinking is more abstract. They may conjure up make-believe situations, hypothetical possibilities, or purely abstract propositions and reason about them (“If this, then that statements”).

- Adolescents have the cognitive ability to develop hypothesis, about ways to solve problems. They systematically deduce or conclude which is best path to follow in solving the problem. Piaget termed this hypothetical-deductive reasoning.

- Adolescent thought is idealistic. They often think about what is possible. They think about ideal characteristics of themselves, others and the world. They are also able to separate the real from the possible.

- *Adolescent egocentrism* is characteristic of adolescent thought and is manifested through: *Imaginary audience* (belief that others are as preoccupied with them as they are); and *personal fable* (a sense of personal uniqueness and indestructibility).

**Implications for Teachers and Parents**

- Provide as many concrete examples before asking students to formulate general principles.

- Encourage discussions and reasoning.

- Remember many adolescents and adults never reach the stage of formal operations.

**Piaget’s Contributions**

- Thanks to him that we have a deeper understanding of children’s cognitive development.

- Piaget made us aware of the importance of understanding how children think (the processes they use) and not just what they think (product of their thinking).
Piaget’s Criticisms

- Recent research in infants' perceptual and conceptual development suggests that infants have more sophisticated perceptual abilities and can begin to think earlier than Piaget envisioned. These researchers believe that they are either born with it or acquire them early in their development.
- Some research studies show that object permanence is achieved earlier than Piaget suggest (i.e. 8–12 months).
- Children seem to be able to perform certain specific tasks, such as that of conservation earlier than Piaget suggested when children are taught or given practice, used familiar materials, and reduced the number of objects to manipulate.
- Largely ignores social and cultural influences

Vygotsky and Cognitive Development

Lev Vygotsky (1896-1934) argued that human development occurs in a socio-cultural context. One’s culture teaches one how to think as well as what to think. According to him, our cognitive skills evolve from social interactions, and children gradually acquire new ways of thinking and behaving through dialogues with more knowledgeable members of society. A unique idea exemplifying this is his concept of *zone of proximal development (ZPD)*. It is a term used for the range of tasks that are too difficult for children to master alone but that can be learned with guidance and assistance from adults or more skilled children. Closely linked to this is the idea of *scaffolding*, a technique of changing the level of support depending on the student’s current level of performance. As the student’s competence increases, less guidance is given. Vygotsky believed that language and thought initially develop independently of each other and then merge. Language begins as a preintellectual speech and gradually develops into a sophisticated form of inner speech which becomes their thought.

Implications for teaching

- Use ZPD and scaffolding
- Encourage use of private speech

Piaget and Vygotsky Compared

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<th>TOPIC</th>
<th>PIAGET</th>
<th>VYGOTSKY</th>
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<tr>
<td>Perspective</td>
<td>Individual child constructs view of world by forming cognitive structures (Cognitive constructivist)</td>
<td>Cognitive development progresses through social interactions (social constructivist)</td>
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<tr>
<td>Key processes</td>
<td>Adaptation, equilibration, organization</td>
<td>Social interaction, development through guidance of more skilled others.</td>
</tr>
<tr>
<td>Language</td>
<td>Emerges as cognitive structures develop</td>
<td>Language plays a major role in shaping thought</td>
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<td>Teaching-learning</td>
<td>Teacher is facilitator and guide who should provide support for children to explore their world and discover knowledge.</td>
<td>Teacher is facilitator and guide who should establish opportunities for students to learn with the teacher and more skilled peers.</td>
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References