

"Understanding the World Through Grasping"



Level 1

Sensumotoric stage (Piaget)

General cognitive development

- Perception-based classification and formation of categories
- Development of object and depth perception
- Forming and remembering simple contexts
- Action-bound dealing with the environment
- Development of object permanence (child recognizes that objects exist, even if they do not see them)
- Spontaneous actions (e.g. sucking, gripping)
- Development of schemes (e.g. suction scheme, gripping scheme)

Development of mathematical skills

- Physical and mathematical core competences are available at an early stage or from birth (e.g. solid materials cannot be "penetrated" by others, rudimentary ideas of quantity)

"Knowing Oneself and Others"

Level 2

Sensumotoric stage (Piaget)

General cognitive development

- More variable and complex exploration and discovery
- Comprehending and imitating simple action patterns
- Initial understanding of cause and effect, of resource/purpose relationships
- As-if games
- Understanding one's self
- Increase in observational learning of entire courses of action
- Object permanence even with complicated and sequential search actions
- Classification of objects on the basis of the overall shape

Development of mathematical skills

- Simultaneous comprehension of 2 to 3 elements at a glance
- Scheme of comparison (equal – not equal; more – less)



"The Way I Think, Others Think, Too"

Level 3

Preoperational stage (Piaget)
(approx. 3-6 years)

General cognitive development

- General knowledge of abstract facts
- Better understanding of causal relationships (in everyday, child-appropriate problems)
- Building "dense" knowledge networks in selected areas of interest through suggestions
- Ego-centric speaking (controlling thinking and action through one's own language)
- Social role playing
- Enhancement of classification skill
- Beginning understanding of class hierarchies (e.g. plant – tree – maple)

Development of mathematical skills

- Simultaneous comprehension of up to 4 elements at a glance
- Decomposition of specific quantities into partial quantities
- Pro-quantitative schemes (e.g. total quantity can be divided into partial quantities among different types)
- Reciting the series of number words from any number onwards
- Adding up two specific quantities by continuing counting
- Cardinal concept (numbers as quantities)
- Initial calculation strategies
- One-to-one assignment of number words to objects, later assignment of a quantity to a number
- Cardinal understanding of numbers (counting specific perceptible objects from the number 1 onwards)
- Schemes of multiplication and reducing
- Numbers are counting numbers

"I'll Remember That"

Level 4

Concrete preoperational stage (Piaget)
(approx. 7-12 years)

General cognitive development

- Capable of mental operations
- Insight into quantities, masses, and numbers
- Understanding of the scientific causal concept
- Improvement of verbal memory performance
- Application of memory strategies (e.g. internal repetition, sorting by topics or elaboration, i.e. linking ideas/experiences with the thing to be remembered)
- Development of procedural metacognition (planning, control, and monitoring of memory processes)

Development of mathematical skills

- Transition from counting specific objects to mental counting, where the children imagine numbers as quantities
- Dividing imaginary quantities into partial quantities
- Further development of the number range
- Counting of larger summands
- Dividing a task into two easier tasks
- Different levels of competence from the knowledge of adding (in the number range up to 20) and the basics of multiplication up to context-free calculation in the number range up to 100, half-written calculation in the number range up to 1000, and the application of several basic arithmetic operations in complex situations