



Formal Operational Stage

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By Saul McLeod, published 2010

The formal operational stage begins at approximately age twelve and lasts into adulthood. As adolescents enter this stage, they gain the ability to think in an abstract manner by manipulate ideas in their head, without any dependence on concrete manipulation (Inhelder & Piaget, 1958).

He/she can do mathematical calculations, think creatively, use abstract reasoning, and imagine the outcome of particular actions.

An example of the distinction between concrete and formal operational stages is the answer to the question "If Kelly is taller than Ali and Ali is taller than Jo, who is tallest?" This is an example of inferential reasoning, which is the ability to think about things which the child has not actually experienced and to draw conclusions from its thinking.

The child who needs to draw a picture or use objects is still in the concrete operational stage, whereas children who can reason the answer in their heads are using formal operational thinking.

Formal Operational Thought

Hypothetico Deductive Reasoning

Hypothetico deductive reasoning is the ability to think scientifically through generating predictions, or hypotheses, about the world to answer questions.

The individual will approach problems in a systematic and organised manner, rather than through trial-and-error.

Abstract Thought

Concrete operations are carried out on things whereas formal operations are carried out on ideas. The individual can think about hypothetical and abstract concepts they have yet to experience. Abstract thought is important for planning regarding the future.

How Did Piaget Test Formal Operations?

Piaget (1970) devised several tests of formal operational thought. One of the simplest was the 'third eye problem'. Children were asked where they would put an extra eye, if they were able to have a third one, and why.

Schaffer (1988) reported that when asked this question, 9-year-olds all suggested that the third eye should be on the forehead. However, 11-year-olds were more inventive, for example suggesting that a third eye placed on the hand would be useful for seeing round corners.

Formal operational thinking has also been tested experimentally using the pendulum task (Inhelder & Piaget, 1958). The method involved a length of string and a set of weights. Participants had to consider three factors (variables) the length of the string, the heaviness of the weight and the strength of push.

The task was to work out which factor was most important in determining the speed of swing of the pendulum.

Participants can vary the length of the pendulum string, and vary the weight. They can measure the pendulum speed by counting the number of swings per minute.

To find the correct answer the participant has to grasp the idea of the experimental method -that is to vary one variable at a time (e.g. trying different lengths with the same weight). A participant who tries different lengths with different weights is likely to end up with the wrong answer.

Children in the formal operational stage approached the task systematically, testing one variable (such as varying the length of the string) at a time to see its effect. However, younger children typically tried out these variations randomly or changed two things at the same time.

Piaget concluded that the systematic approach indicated the children were thinking logically, in the abstract, and could see the relationships between things. These are the characteristics of the formal operational stage.

Critical Evaluation

Psychologists who have replicated this research, or used a similar problem, have generally found that children cannot complete the task successfully until they are older.

Robert Siegler (1979) gave children a balance beam task in which some discs were placed either side of the center of balance. The researcher changed the number of discs or moved them along the beam, each time asking the child to predict which way the balance would go.

He studied the answers given by children from five years upwards, concluding that they apply rules which develop in the same sequence as, and thus reflect, Piaget's findings.

Like Piaget, he found that eventually the children were able to take into account the interaction between the weight of the discs and the distance from the center, and so successfully predict balance. However, this did not happen until participants were between 13 and 17 years of age.

He concluded that children's cognitive development is based on acquiring and using rules in increasingly more complex situations, rather than in stages.

References

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Further Information

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