

How does formal operational fit with the way that adults think?¹

Being formal operational for the adolescent means that for the first time in his or her life he or she has the mental capacity to think as well as adults and the ability to solve all classes of problems. While formal operational thinking requires time for the brain to develop; time alone is not sufficient to guarantee that formal operational thinking will develop and one should not assume that all adolescents and adults fully develop formal operations. In fact many adults may never advance beyond concrete operational reasoning. However, the training and experiences a person has had with formal operational thinking will make a significant difference to his or her ability to use formal operational thinking. Additionally one may have the ability to use formal operational thinking in one or more particular areas and still not be able to generalize or transfer their formal operational knowledge to other areas and rely on concrete operational thinking in those areas.

What does it mean to be formal operational?

Piaget claimed that after the development of formal operations any gain in a person's thinking abilities relates to a person's ability and experiences with the use of logical operations. This will depend on access to mental structures that can perform logical operations and the number of meaningful experiences the individual can associate with the use of a specific logical operation or combinations of operations. Differences in reasoning among formal operational thinkers may result from working in different fields of knowledge and the ability to be creative or flexible in transferring formal operational thinking from one field of knowledge to another. Formal operational thinking is mostly associated with scientific thinking, but it is just as important in communication, philosophy and artistic endeavour.

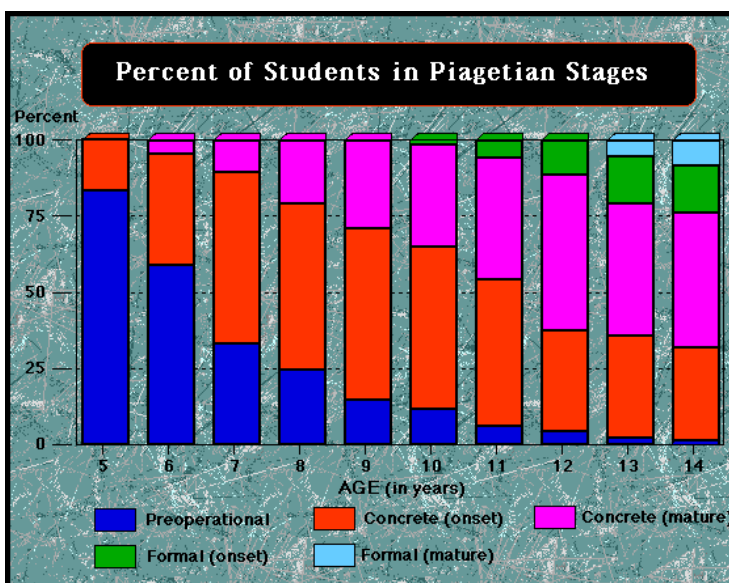
Formal thought and concrete thought are similar in that they both use the logical operations of deduction and induction. Concrete thinking, however, lacks that range, of comprehensiveness, power, imagination, flexibility, and depth of reasoning, because their mental operations are closely tied to observations and manipulations that occur in the real world, whereas a formal operational thinker is aware that logically derived conclusions have a validity independent of "facts" of the real world.

Formal Operational thinkers:

- can use **theories, models, and hypotheses** to create solutions to problems. Hypothetical reasoning goes beyond the confines of everyday experience to things for which we have no experience. This is reasoning that is beyond perception and memory. Young adolescents with formal operations can reason about hypothetical problems entirely symbolically in their minds and can create logical conclusions.
 - They become **Idealistic** – they can think about what is possible - about the ideal characteristics of themselves, others, and the world.
 - Their **moral reasoning** develops. They move from moral realism (concrete and pragmatic) to **moral relativism** (the imagining of multiple moral universes) and the ethical challenges of deciding their own moral compass
 - They become more logical in their planning to solve problems and in the management of complex tasks.
- are able to think about his or her own thoughts and feelings (**metacognition**) as if they were independent of themselves.
- can argue on the logic of an argument (solution or problem) that is **independent of its content**. For example, they could create a logical argument for something they did not believe in, like the proposition that adolescents have far too much freedom
- can deal with **complex problems** simultaneously and systematically by coordinating multiple thinking and reasoning strategies and or variables to derive solutions.
- can use **inductive reasoning** by combining similar solutions to **create generalizations, principles, models, and theories**.

¹ Annotated notes from Sweetman, R. (nd) Formal Operational The Middle School Student (Fifth Grade - Adult), Retrieved from <http://www.huntel.net/rsweetland/pedagogy/theories/development/formalOperations.htm>.

- have a highly developed **understanding of causation** and how cause and effect relationships play out over time. They understand the need to **Identify and control all variables** when attempting to validate a relationship or inference
 - The development of serious problems from substance abuse can take place slowly over a long period of time and can be influenced by a number of variables such as general health, safety precautions taken, amount and frequency of use, quality of the product, etc
- Can use **deductive reasoning**. The use of a premise to create conclusions or the use of general ideas to create specific ideas. They understand that inferences or conclusions created with deductive reasoning are true only if the premises used to create them are true. However, reasoning can use false premises and create logical conclusions.
 - Suppose snow is black? Formal operational can reason logically or analyze the structure of an argument, independent of the truth or falseness of its content.
- Can use **hypothetical deductive reasoning** or reasoning with the use of a hypothetical premises (rather than facts) to create conclusions.
 - $A < B$; $B < C$ what is A compared to C?
 - Chris is left of Sam and Sam is left of Ben, Where is Chris in relationship to Ben?
 - Given an equal arm balance constructed so that the weights can be hung at equal increments from the centre if three weights of the same mass are placed six units from the centre how many weights of equal mass have to be placed three units on the opposite side to balance?
- **Combinatorial reasoning** is thinking that systematically considers all possible relations of experimental or theoretical conditions, even though some may not be realistic.
- **Proportional reasoning**: If my family's share of the profit is 50%, and my partner gets 70% of this, how much of a \$100 profit will my partner get?
- **Probabilistic reasoning**: What are my chances of getting lung cancer, if smoking increases the chance by 50% and normally my chance would be 10%?
- Can use **correlational reasoning** to recognize a comparison between the number of confirming and disconfirming cases of a hypothesized relationship to the total number of cases.
 - There is a correlation between age and traffic accidents and there is a correlation between age and getting intoxicated, what is the likely relationship between these two correlations?



ARGUMENTY

Piaget's research methods were based primarily on case studies [they were descriptive]. While some of his ideas have been supported through more correlational and experimental methodologies, others have not. For example, Piaget believed that biological development drives the movement from one cognitive stage to the next. Data from cross-sectional studies of children in a variety of western cultures seem to support this assertion for the stages of sensorimotor, preoperational, and concrete operations (Renner, Stafford, Lawson, McKinnon, Friot & Kellogg, 1976).

However, data from similar cross-sectional studies of adolescents do not support the assertion that all individuals will automatically move to the next cognitive stage as they biologically mature. Data from adolescent populations indicates only 30 to 35% of high school seniors attain the cognitive development stage of formal operations (Kuhn, Langer, Kohlberg & Haan, 1977) OBRAZOK. For formal operations, it appears that maturation establishes the basis, but a special environment is required for most adolescents and adults to attain this stage.