Research: Brain Spurts and Piagetian Periods

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A central question in the study of human development is the relation between cognitive and physical development. Most developmentalists believe that there ought to be some relation between the two, especially between changes in the brain and periods or levels of cognitive development. However, both scientists and journalists have been too quick to move from interesting findings on brain development to unjustified claims about cognitive development.

Research on the relation between spurts in brain development and Piagetian periods illustrates both the potentials and the pitfalls of studying the connection between physical and cognitive development. Herman Epstein, a biologist, proposed a simple hypothesis: Whenever children enter one of Piaget's periods, their brains show unusually rapid growth, much more rapid than when they are within a period. Although direct measures of brain growth are scarce, several longitudinal studies have collected data on growth of the head, especially its circumference, which is closely related to brain size. Analyses of these data supported Epstein's hypothesis. Children seemed to show spurts in head growth at the approximate ages for the beginnings of the concrete-operational period, the formal-operational period, and the second level of formal operations (Epstein, 1974). There were inconsistencies in some of these data and problems with Epstein's interpretations (McQueen, 1982), but in general his predictions seemed to hold.

Epstein (1980) also used another measure of brain growth to test the hypothesis. The brain normally emits electrical waves, which are measured by the electroencephalograph (EEG), and these waves are affected by cognitive activities such as thinking and problem solving. Some of the waves also show systematic development with age, and Epstein tested whether the development of these waves demonstrated changes at the same ages as head growth changes. In data from several studies of brain-wave development, spurts did occur at approximately the same ages. Also, the inconsistencies that arose with the head-growth data seemed to be absent from the brain-wave results.

Unfortunately, these findings quickly led Epstein and others to make unwarranted claims about cognitive development and education. Based almost entirely on brain-growth curves, they began to make prescriptions about how children should be educated. One of the most publicized statements was that children are incapable of learning new skills at the ages of little or no brain growth, such as 12 to 14 years (Epstein, 1978; Toepfer, 1979). At this time, it was claimed, they can only consolidate skills they have already learned, and so schools should make no effort to teach new skills in 7th and 8th grades. Such prescriptions were not based on studies of children's actual ability to learn new skills at these ages. Instead, they involved enormous assumptions based on the findings about brain growth.

A few investigators have begun to test Epstein's hypothesis more thoroughly. One study searched for a plateau or decline in skills learning between 6th and 8th grade and found instead continued growth in skills (Petersen and Cavrell, 1983). Another investigation examined how spurts in head circumference related to spurts in performance on an intelligence test by individual children studied for many years (McCall and others, 1984). Again, the hypothesis was not supported: There was no correlation between the cognitive changes and the spurts in head growth. A third study tested whether individual children actually do grow in spurts and how any such spurts related to the children's developmental levels (Lampl and Emde, 1983). Every child in the study did grow in spurts—not only for head circumference but for other types of physical growth as well, such as height and weight. For the individual children, however, spurts in head circumference showed no clear relation to change in developmental level.

What conclusion can be drawn about the relation between brain growth and Piagetian periods? In investigations of large groups of subjects, some broad characteristics of the brain do change in spurts during the ages when new periods are beginning. Also, individual children do seem to grow in spurts, and some of the spurts coincide with the start of a Piagetian period. Spurts in head growth for individual children, however, do not appear to coincide with spurts in their cognitive development. Clearly, conclusions about how schools should educate children are not warranted from these findings. They suggest that there is only a broad, nonspecific relation between brain development and Piagetian periods. They do not support the argument that children cannot learn new skills during times when their brains are growing slowly.□

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