DOCUMENT RESUME

ED 198 101 SP 017 352

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TITLE Beyond Brain Growth: Other Factors Affecting Cognitive Development.
PUB DATE Nov 80
NOTE 17p.; Paper presented at the National Middle School Conference (Nashville, TN, November 13, 1980). Best copy available.

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Aspiration; *Cognitive Development; Cultural Influences; *Developmental Stages; Experiential Learning; *Individual Development; *Intellectual Development; *Mental Age; Parent Child Relationship; Peer Influence; Physical Development; Social Influences; Student Attrition
IDENTIFIERS *Piagetian Theory

ABSTRACT

The intellectual model of Jean Piaget asserts that individuals pass through a series of various intellectual stages as they mature. Human development is categorized into four basic stages: (1) sensory motor stage, which lasts from birth to about eighteen months; (2) preoperational stage, lasting from eighteen months to about seven years; (3) concrete operational stage, which lasts from seven years to about eleven years; and (4) formal operational stage, which is attained at about eleven or twelve years and lasts throughout life. From the stage-age perspective, Piagetian theory is seriously limiting when one considers appropriate educational experiences for a group of early adolescent learners. The time an individual spends at each level varies and may be influenced by many factors, including: innate ability; biological maturation; experiences; social influences; equilibration; parent child relationship; peer influence; life role aspirations; academic overload; and cultural diversity. (CJ)

Beyond Brain Growth:
Other Factors Affecting Cognitive Development

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The intellectual model of Jean Piaget asserts that each individual passes through a series of various intellectual stages as s/he matures. Piaget (1936, 1954, 1961, 1967, 1972) categorizes human development into four basic stages: 1) sensory motor stage, which lasts from birth to approximately 18 months; 2) preoperational stage lasting from 18 months to about 7 years; 3) concrete operational stage, which lasts from about 7 years of age to 11 years; 4) formal operational stage, beginning at ages 11 or 12 and lasting throughout one's life. An area of essential consequence is that the ages he has given are not fixed. The time an individual spends at each level varies and may be influenced by many factors. Factors discussed in this paper include: 1) innate ability, 2) biological maturation, 3) experiences, 4) social transmission, and 5) equilibration.

Renner and Phillips concisely state a fundamental difference between the traditional educational program and one based on Piagetian developmental theory.

> Traditionally, a person's intellectual development was considered to be a function of all his/her educational experiences; in other words, learning determined intellectual development. The Piagetian model states the converse, intellectual development determines what can be learned (Renner and Phillips, 1980: 194).

The hypothesis presented here is that knowledge of general Piagetian psychology, particulary from an age-stage perspective, is seriously limiting

when one considers appropriate educational experiences for a group of early adolescent learners. Piaget himself states that any explanation of the child's development must take in two considerations: an ontogenetic dimension and a social dimension (Piaget and Inhelder, 1969: 157).

Innate Ability

The significance of basic intelligence as an important factor in cognitive development is stated by Piaget and supported by numerous studies determining cognitive level of students of different abilities. Piaget states, concerning the problem of intelligence . . . from its beginnings, due to the hereditary adaptation of the organism . . . intelligence does not therefore appear as a power of reflection independent of a particular position which the organism occupies in the universe but is linked, from the very onset, by biological apriorities. It is not at all an independent absolute, but is a relationship among others, between the organism on things (Piaget, 1952: 19).

In investigating 26 high school seniors from three academic tracks, Chiappetta (1975) found the highest track to exhibit the highest degree of formal attainment, 73%; students in the general track indicated 46 having formal operation; and students in the vocational track attained the smallest percentage of formal operation, 38.5%. Lovell's (1961) replication of ten tasks presented by Inhelder and Piaget (1958) yielded results comparable to that of Chiappetta for the three academic tracks.

Biological Motivation

The importance of biological motivation as a factor affecting cognitive development is cited in Piaget and Inhelder. They state:

> . . . even though the appearance of formal thought is not a direct consequence of puberty, could we say that it is a manifestation of cerebral transformation due to the maturation of the nervous system and these changes do have a relation, direct or indirect, with puberty? Given that in our society the 7-8 year old child (with very rare exceptions) cannot handle the structures which the 14-15 year adolescent can handle easily, the reason must be that the child does not possess a certain number of coordinations whose dates of development are determined by stages of maturation (Piaget and Inhelder, 1958: 336).

From the above statement we would infer that there should be considerable differences between cognitive levels of males and females in early adolescence; however, recent studies done in the United States do not show clear distinctions. In a summary of Piagetian research reported between 1975 and 1978, studies generally noted no significant differences (Gable, et al., 1980: 446). Keating and Clark (1980: 28) did reflect higher scores for adolescent females on the intrapersonal reasoning written test.

Experiences

Piaget has in his writings referred to a "privileged population" who will probably reach the formal thought stage of cognitive operation at an earlier age than other learners. The "privileged" relates primarily to the environment in which they are raised (Renner and Phillips, 1980: 97).

Piaget (1979: 7) explicitly stated that the potential to accelerate or systematically retard the acquisition of developmental stages is related to an individual's social environment. Furthermore, Piaget and Inhelder (1969: 154) state that the influences of physical and social factors increase as the child grow older. In a summary of research

regarding environmental stimulation and its effects on cognitive functioning, McCrary and Long report:

> A review of related literature yields several sources that consider the effect of activity and isolation in cognitive functioning . . . In a theoretical discussion that reviews related literature, Granick and Friedman (1973) stated: It seems self-evident that education acts as a stimulus to the individual's capabilities and that exercise of these capabilities is likely to maintain and even increase the functional effectiveness. Conversely the function to use one's intellectual capacities on a regular and extensive basis may lead to a sort of intellectual deterioration of the ability to perform even fairly elementary tasks (p. 63) . . . In summary, the literature reviewed, with the exception of one study (Coleman, 1973), supports the positive effect of stimulating activity and the negative effect of decreased environmental stimulations on level of cognitive functioning (McCrary and Long, 1980: 39-40).

Social Transmission

Piaget also claims cultural and educational conditions can accelerate or retard the onset of formal thinking processes (Inhelder and Piaget, 1958: 337). They indicate the child's environment does make a difference when the stages of development start and end, and they are not going to be the same ages for all children even in very similar environments. Preliminary research reported by Renner and Phillips indicates:

> Approximately 20 percent of children in the sixth grade and 46 percent of those in ninth grade have entered the formal stage. (Please do not interpret "entered" the formal stage as "being" formal operational.) In addition our findings indicate that those percentages in the privileged population for exclusive private schools are approximately 40 percent and 65 percent (1980: 197).

Studies reported in Science Educator indicate that instruction using concrete manipulatives tend to aid achievement and the acquisition of

specific schema. Wollman and Lawson, 1978, Sheyens and Cox, 1978, and Boulanger, 1978, reported groups of students who were taught proportional reasoning through the use of concrete manipulative instruction scored significantly higher than did control groups using traditional approaches. J. A. Henry (1978), Calvey (1978), and Johnson and Howe (1978) all reported significant gains in achievement for students if courses were modified according to Piagetian principles (Gabel, et al., 1980: 435-439).

McCrary and Long (1980: 38) in a review of research related to education, report that the literature has demonstrated that a tendency exists for measures of logical operation to be positively related to educational attainment. They also report that in cultures in which there are not formal systems of social transmission that the reasoning of many individuals do not develop beyond the stage of concrete operations (McCrary and Long, 1980: 34).

Equilibration

Piaget emphasizes the need for active participation on the part of the learner as being an essential component of cognitive development. This active mechanism of internal self-regulation is called equilibration which Piaget and Inhelder define as:

> A series of active compensations on the part of subjects in response to external disturbances and an adjustment that is both retroactive (loop body systems or feedbacks) an anticipatory, constructing a permanent system of compensation (1969: 157).

A study reflecting the beneficial effects of forced active participation on the part of the learner was conducted by Raven and Cole (1978) who reported that making students create their own graphic representation of the concept to be learned was effective in improved achievement in the

study of phisiology. Johnson and Howe (1978) reported improved performances through peer interaction conflict training and Fagel (1978) found early concrete learners achieved higher when working with other students of a higher cognitive level. Henry (1978) working with first grade students and Clavey (1978) both showed significant gains in improving cognitive development through course modifications requiring the use of concrete manipulative materials and active student involvement (Gabel, 1980: 438-440).

Of particular importance in this report is that studies have shown that elements of formal operation do not appear until middle or even late adolescence.

Robert Ross (1975: 199) did some empirical studies in 1974 attempting to validate Piaget's assertion that elements of formal operational thinking begin to appear in early adolescence (ages 11-12) with growth continuing until formal operations reach full fruition during middle adolescence, age 15. Ross' results showed basically three things: 1) there is a significant increase in formal thinking from the sixth to the tenth grade, b) formal thinking appears only in high achieving sixth graders, and c) the percentage of tenth graders demonstrating formal thinking is 40-50%.

In a study conducted by Robert Karplus, Elizabeth Karplus, Marina Formisano, and Albert-Christian Paulsen, involving approximately 1800 boys and girls from 13-15 years of age in seven countries, they found only 251 students or 7% used formal thought (Karplus, et al., 1975). Keating and Clark (1980) reported that even at the 11th grade level, 37%

of students fail to show formal reasoning in physical tasks, 67% fail to show formal thought on interpersonal dilemmas, and 30% fail to show it on either. Roberge and Flexer (1980) reported the percentages of sixth graders classified as formal operational at 28%, and 57% of eighth graders were recorded as formal.

The data presented in their report indicate there is considerable evidence that only a relatively small percentage of early adolescents function at the level of formal operations and that this percentage is likely to decrease substantially for certain groups of students including: 1) persons of lower innate ability, 2) individuals who reach pubescence at a later age, 3) individuals who have limited experiences because of socioeconomic and cultural factors. The need for a serious reconsideration of the types of teaching strategies and educational materials used during the early adolescent years should be of paramount concern to middle school educators. Further detail providing data that the development of formal thought processes among adolescents is at best a gradual, an incomplete process can be acquired by investigating recent literature and the findings of well-known Piagetian educators such as Lawson, Renner, Lovell, and Elkind.

Prolonged Childhood

The technological society of the United States has created a life style that adds to the confusion of the transition period of adolescence. Two generations ago the family was an economic unit with a more agarian base. Psychological adolescence was more closely correlated with physical adolescence as the child began to take an active role in providing family needs relative to development of capabilities. Child labor laws and changing life style have now produced a delay in the assumption of adult roles and the longer the period of childhood dependence, the more elaborate the rules that govern behavior. Both adults and children feel an ambivolence about the status of adolescence. In some ways mature, responsible behavior is expected but there is less opportunity to gain the needed experience to develop needed decision-making skills (Stone and Church, 1968).

Adolescents are torn between a desire to be independent and self actualizing and the acknowledgement of their real dependency (Grinder and Spector, 1965). Parents experience the same ambivolence as they rationally want to help their children become self sufficient but emotionally want to prolong childhood through dependency.

Parental Relationship

In an investigation by Sorenson in 1973, 2,042 households were randomly selected from 200 city, suburban, and rural locations in 103 areas of the United States. From these households 411 adolescents responded to questionnaires and another 200 aged 13 to 19 years were interviewed. The data provided some insights into the relationship between parents and adolescents. Three out of four felt they knew their mothers and six of ten felt they knew their fathers. Seventy-eight percent felt a strong affection for their parents and eighty-eight percent respect them. Most

felt their parents cared deeply for them (Sorenson, 1973). There was noted, however, some general problems of communication.

Adolescents are driven to discover who they are. There is the need to begin to assume adult roles and an intense fear of failure. Parents tend to want to help by giving verbal directions and helping the child to profit from their experience. The adolescent needs opportunities for direct personal experience and resents advice. These children felt frustrated when talking with parents and half felt their parents' views were wrong (Sorenson, 1973).

Parent vs. Peer Influence

In early childhood parental attitudes are dominant in directing behavior but in the middle years, as the child becomes an active participant in school, adult influence is balanced by peer approval. When the child moves into adolescence, it appears that peer approval becomes dominant. In an investigation of 280 ninth to eleventh grade girls from both urban and rural settings, however, it was found that they valued both the opinions of parents and peers. Their agreement was selective, depending on the area of choice. Problems of immediate consequence such as clothing selection or resolving school-centered situations were more influenced by peer opinion but substantive issues with long range effects were more influenced by parental attitude (Brittain, 1963). Adolescents tend to hold the same political and religious beliefs as their parents but have a need to test ideas through confrontation. The challenge leaves the impression that they reject family values when in reality it is a way of validating that which they earlier accepted through blind faith (Beeler, Willits, and Maida, 1961; Keniston, 1967).

Therefore, adults should recognize that conflict is necessary for this age child and is usually a temporary condition. Peer group influence is strongest in the most visible and immediate areas of value development which can be misleading. Unfortunately parents have difficulty dealing with confrontation with their children as they are emotionally involved. Adolescents don't really want to change adult ideas nor do they want adults to acquiesce, they just need a sounding board for testing other ideas. Teachers can provide a forum which is more objective and accepting free of parental anxiety.

Group Membership

Sub group membership or cliques exert a strong influence on behavior of adolescents. In the early years the child accepts family membership as an identity model. In adolescence they must make choices as they are moving beyond family into an independent role among their peer group.

No matter what interests are shared or what background experiences, for the adolescent age becomes the most important criterion for commonality. In comparison with adults, adolescents consider themselves to be "...more idealistic, less materialistic, healthier in their sexuality, and better able to understand friendship and the important things in life," than their adult counterparts (Sorenson, 1973).

Performance also influences group membership. Those with athletic ability form a sub-culture complete with group rules, those with musical ability share other experiences, etc., but for some adolescents performance in specialty areas is difficult to achieve. Therefore, they often form anti social groups that find solidarity by the pretence of choosing not to be a participant.

Life Role Aspirations

In an investigation by Hollingshead in 1946 it was found that students from middle and upper socio economic levels had more direction in what they planned to do with their lives.

In 1949 it was found that only 7 percent from the lowest social class aspired to business and professional careers as compared with 77 percent from the more priviledged classes. Also, only 1 percent from this class expected to enter service or trade occupations while 25 percent from the lower socio economic group did (Hollingshead, 1949). In the sheltered society today, this may be reversed. Children of working-class parents seem to have a better notion about personal aspirations while many from more priviledged homes are uncertain and confused (Papalia and Olds, 1975).

Affluence has made it possible for parents to maintain them as financial dependents for a longer period of time. This creates a personal identity problem. Choices will have a long range effect on their lives but they have little experience with which to make a sound decision from the many available alternatives.

Parental expectation and support exerts a great influence on career choices. In a study of boys with high IQs it was found that parental ambition and interest in school achievement was a better predictor of vocational aspiration than social class (Bell, 1963). Parent models also influence choices of boys but have little effect on girls. This is probably due to the changing role of women in society.

It has been found that daughters of working mothers are more likely to enter non traditional fields than daughters of homemakers (Etaugh, 1973). In another investigation involving 1,012 college educated wives of graduate students, it

was found that whether their mothers had been employed outside the home had little influence on life role choices. The factor which was most likely to have an impact was whether the mother had been satisfied in her life role. Dissatisfied mothers were more likely to have career-oriented daughters than satisfied mothers (Lipmon-Blumen, 1972).

Meil and Kiester conducted an investigation of a wide variety of influences of homogeneous suburban living on the middle-class child. They found evidence of parental molding and insulation from the realities of the larger society. By the time children reached adolescence they had been so conditioned to compliance with adults that they had difficulty forming solid opinions without guidance. When engaged in round table discussion they continually sought clues from adults before freely expressing themselves (Meil and Kiester, 1967).

Academic Overload

There is evidence that during the primary stages of formal education children will strive to overcome obstacles but as they mature repeated failure is met with less and less effort. Remedial programs for adolescents have a poor record. They drop out psychologically before they are able to drop out officially.

A number of factors seem to influence the instances of school drop outs but the rate is decreasing. In 1955 fifty-eight percent of all students graduated from high school. By 1970, seventy percent graduated (Silberman, 1970). Those who do drop out are more likely to become involved in anti social or criminal behavior (Cervantes, 1965).

Students who voluntarily leave school are not necessarily incapable. In another study involving eleventh and twelfth grade students, 45 percent were

doing passing work (Dillon, in Voss, p. 365).

Personality characteristics of drop outs were examined and found that these boys considered themselves to be leaders more often than their counterparts who graduated but considered themselves to be more impulsive. Generally it was found that drop outs had a lower sense of self-esteem (Combs and Coley, 1968).

Cultural Diversity

The hidden curriculum in public school education is such that there are more obstacles for children of certain ethnic culture groups. Therefore, the drop out rate for those children is significantly higher (Cervantes, 1965).

Public education is dominated by members of the White middle class. School personnel primarily originate from this background and utilize teaching strategies that are associated with their own culture group (Preble, 1968). Early learning in the White middle class home is based on competition with indoctrination through repetition. A child is taught to compete not only with others but with his/her own record. When something is mastered they are praised and then challenged to perform better the next try. Among Hispanics and Native American culture groups, cooperation is the major mode of learning. A child is admonished for trying to surpass another and praised for assisting another to improve to his/her level.

Therefore, when they begin formal education and continually seek and give help to others, they are confused when this is regarded as cheating. Language presents another problem for various culture groups. Not only is the vocabulary different, but verbal interaction differs. In the middle class home language is used for play. In lower socio economic homes, language is used primarily

for obtaining compliance and requests. The language of school is therefore less likely to be reinforced at home. These culturally based phenomena create confusion and frustrate the child. Some learn to compensate but others simply withdraw and learn to expect failure thus contributing to the high drop out rate among particular groups.

BIBLIOGRAPHY

1. Bealer, R. Willits, F., and P. Maida. "The Rebellious Youth Subculture: A Myth." Children, 1964, Vol. II, pp. 43-48.

2. Bell, G. D. "Processes in the Formation of Adolescents' Aspirations." Social Forces, 1963, Vol. 42, pp. 179-195.

3. Brittain, C. "Adolescent Choices and Parent-Peer Cross-Pressures." American Sociological Review, 1963, Vol. 28, pp. 385-391.

4. Cervantes, L. F. "Family Background, Primary Relationships, and the High School Drop Out." Journal of Marriage and the Family, 1965, Vol. 5, pp. 218-223.

5. Chiappetta, E. L. "A Perspective in Formal Thought Development." Paper presented at the National Association for Research in Science Teaching, Los Angeles, March, 1975. (ERIC. ED 108 862)

6. Combs, J. and W. Coley. "Dropouts: In High School and After School." American Educational Research Journal, 1968, Vol. 5, pp. 343-363.

7. Etaugh, C. "Effects of Maternal Employment Upon Children: A Review of Recent Research." Paper presented at the biennial meeting of the Society for Research in Child Development, Philadelphia, 1973.

8. Gabel, Kager, and Sherwood. "Learning and Development, Perspective Studies." Science Education, Vol. 64, #4, September, 1980.

9. Granick, S. and Friedman, A. S. "Education Experience and the Maintenance of Intellectual Function of the Aged: An Overview." in J. L. Jarvik, et al. (eds.) Intellectual Functioning in Adults. New York: Springer Publishing Company, 1973.

10. Grinder, R. and J. C. Spector. "Sex Differences in Adolescents' Perceptions of Parental Resource Control." Journal of Genetic Psychology, 1965, Vol. 106, pp. 337-344.

11. Hollingshead, A. Elmstown's Youth: The Impact of Social Classes on Youth. New York: Wiley, 1949.

12. Inhelder B. and Piaget J. The Growth of Logical Thinking from Childhood to Adolescence. New York. Basic Books Inc., 1958.

13. Karplus, Robert. Proportional Resources and Control of Variables in Seven Countries.

14. Keating, Daniel P. and Lawrence V. Clark. "Development of Physical and Social Reasoning in Adolescence." Developmental Psychology, Vol. 16, #1, June, 1980.

15. Keniston, K. "Heads and Seekers: Drugs on Campus, Counter-Cultures, and American Society." The American Scholar, Winter 1968-69, Vol. 38, p. 1.

16. Lovell, K. "A Follow Up Study of Children and Piagets the Growth of Logical Thinking." British Journal of Psychology, 1961, Vol. 52, #2, pp. 143-153.

17. McCrary, Kay J. and Harry B. Long. "The Roles of Environmental Stimulation in Adult Cognitive Functioning." Journal of Research and Development in Education, Vol. 13, No. 3, Spring, 1980.

18. Meil, Alice and Edwin Kiester, Jr. The Short-Changed Children of Suburbia. New York: Institute of Human Relations Press, 1967, pp. 52-56.

19. Papalia, Diane E. and Sally W. Olds. A Child's World: Infancy Through Adolescence. New York: McGraw-Hill Book Co., 1975, pp. 573-605.

20. Piaget, Jean. The Origins of Intelligence in Children. trans. Margaret Cook. New York: W. W. Norton and Company, Inc., 1952.

21. Piaget, J. and Inhelder B. The Psychology of the Child, New York: Basic Books, 1969.

22. Preble, E. "The Puerto Rican American Teenager in New York City," in E. B. Brody (Ed.) Minority Group Adolescents in the United States. Baltimore: Williams & Wilkins, 1968, pp. 48-72.

23. Renner, John W. and Darrel G. Phillips, "Piagets' Developmental Model: A Basis for Research in Science Education." School Science and Mathematics, Vol 80, #3, March, 1980.

24. Roberge, James J. and Barbara K. Flexer. "Control of Variables and Proportionale Reasoning in Early Adolescence." The Journal of General Psychology, Vol. 103, July 1980, p. 12.

25. Ross, Robert J. "The Development of Formal Thinking for High and Average Achieving Adolescents." Piagetian Theory and the Helping Profession. Ed. G. I. Lubin, et. al., Los Angeles: Publication Department Buokstyre, U.S.C., 1975.

26. Sorenson, R. C. Adolescent Sexuality in Contemporary America. New York: World, 1973.

27. Stone, Joseph L. and Joseph Church. Childhood and Adolescence: A Psychology of the Growing Person, 2nd ed., New York: Random House, 1968, pp. 438-440.

28. Voxx, H., Wendling, A., and D. Elliott. "Some Types of High School Dropouts." Journal of Education Research, 1966, Vol. 59, pp. 363-368.