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HOW FATHER ABSENCE IN THE HOME AFFECTS THE MATHEMATICS SKILLS OF FIFTH-GRADERS

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ABSTRACT

Past research has shown that young adults who experience early father absence in the home tend to have weak mathematical skills relative to their verbal skills. The current research demonstrates that this effect of father absence manifests itself as early as age eleven and is more pronounced among girls.

Mathematical ability has been linked with a variety of physical and psychological variables, even some as unlikely as height (Stafford, 1963) and eye color (Stafford, 1970).[1] Extensive research has been done, of course, on the host of variables more conventionally associated with scholastic performance such as personality factors, home life, etc. Many of these studies have yielded quite interesting results.

Good personal adjustment, for example, was found to correlate positively with achievement in math concepts and problem solving, whereas achievement in the rote arithmetic fundamentals showed little relationship to personality factors (Cleveland and Bosworth, 1967). Also interesting is the Helson and Crutchfield study (1970), in which adult mathematicians were compared with other scientists and found to be lower in "assertive self-assurance" but higher in autonomy and humanitarian conscience. The mathematicians were further described as conventional in behavior but highly unconventional in their thoughts. Mathematically talented youngsters have likewise been characterized as independent and unconventional thinkers (Krutetskii, 1969) although they tend to come from "autocratic" homes (Kennedy and Willcutt, 1963).

Attitudes toward math have been widely researched because they are considered fundamental to motivation and achievement. However, in the primary grades, attitudes have been found to have surprisingly little predictive power for either short-term or long-term mathematics achievement. On the other hand, extremely positive or negative attitudes among secondary school students do appear to in-

[1]Tallness and light blue eyes were a significantly related to problem-solving ability!

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fluence achievement (Aiken and Dregar, 1961; Anttonen, 1968; Cleveland and Bosworth, 1967; Cristantiello, 1962; Jackson, 1968). This was confirmed cross-culturally in a study of secondary school students from twelve countries (Husén, 1967).

In addition to personality factors, age and sex have also been studied extensively in relation to math achievement. Piaget's work on the importance of age in cognitive development has had a notable impact on educational theory and has stimulated considerable research on this subject.[2] An interesting study by Dye and Very (1968), for example, considered the role of age in mental growth from a factor-analytic point of view. They found that particularly in the area of mathematical reasoning, as people grow, their intellect differentiates from one general ability to an array of different, specific abilities. Furthermore, these reasoning abilities develop earlier and are more pronounced in males. Females appear to compensate by a superiority of verbal skills.

Sex differences have been noted in much of the research on math ability and achievement. Although mathematics is often regarded as a "masculine activity" and males are thought to do better at it, the research has yielded mixed results. Sex differences in math achievement seem to vary with the subject population under study and the particular math test that is used.

However the preponderance of evidence shows the following pattern. Boys are generally superior to girls on tests of arithmetic reasoning, problem solving, and spatial ability while girls do better in arithmetic fundamentals and matters of rote memory (Aiken, 1971; Aiken, 1973; Davis, 1973; Jarvis, 1964; Muscio, 1962; Sweeney, 1953; Very, 1967; Wozencraft, 1963). Sex differences also become greater and favor boys as students advance from primary to secondary school where the emphasis shifts increasingly from rote fundamentals to mathematical concepts (Aiken, 1973; Bardwick, 1971; Unkel, 1966). The mathematical superiority of secondary school males also received cross-cultural validation in a twelve-country study (Husen, 1967).

This "female ineptitude" in mathematics has been explained by cultural differences in sex training; witness the stereotype of man as the "reasoning animal" (Carey, 1958, p. 256). Kagan (1966) postulates that perceived sex incongruence is an inhibitory motive in learning which causes girls to become deficient in mathematical endeavors as they mature. Indeed, studies have verified experimentally

[2]Due to wide variation among individuals in the rate of cognitive development, Piaget's theories have not been fully substantiated though they have received some degree of support (Dodwell, 1960; Lovell, 1968).

that sex differences in attitude toward mathematics at least partly account for these achievement differences (Berry, 1958; Carey, 1958; Poffenberger and Norton, 1959).

The sex stereotype associated with mathematics raises the deeper question of whether mathematical ability is linked in both sexes to strong male role identification. The majority of evidence seems to support this "masculine identification theory." For example, Plank and Plank (1954) confirmed through psychoanalytic investigations that mathematical activity requires a masculine identification, among females as well as males. Elton and Rose (1967) compared college girls who had high math and average English ACT scores with those who were high in English but average in math. Masculine identification was again stronger in the high-math group. On the other hand, Lambert (1960) found no correlation between masculinity and mathematical proficiency in college men. In fact, the mathematically talented women in Lambert's study actually showed up as more *feminine*.

Milton (1957, 1959) made a clever contribution to this research. He first found a positive relationship between masculine identification and problem solving ability both within and across the sexes. But he was able to reduce this correlation by making the problems less appropriate to the masculine sex role. (Their content was changed, for example, from material on batting averages to recipe measurements.)

Unfortunately there is one problem with the research on masculine identification. Sex identification was primarily measured by the M-F scale of the MMPI (Minnesota Multiphasic Personality Inventory) and the Terman-Miles M-F test. But these scales in turn are devised by collecting normative data on the cognitive styles of men and women. Hence the positive findings could just be an artifact of the way in which the M-F scales are constructed.

The cognitive processes of males and females seem to differ in rather consistent ways. Males typically take an analytic and conceptual approach to problems, which indeed is helpful in mathematical work. This "analytic approach" is described as the propensity to discriminate among stimuli and pursue a solution directly and objectively, disregarding extraneous information. In contrast, the thought processes of females are seen as "more global" due to their tendency to unite and relate things rather than analyze and separate them. Thus women have less ability to discriminate among stimuli and are more influenced by extraneous information (Bardwick, 1971; Carlsmith, 1964).

These differences have been experimentally verified at least from

age eight on. Males show less field-dependence on tests of spatial discrimination such as the rod-and-frame test, the embedded figure test, and the tilting-room test (Bieri, 1960; Witkin et al, 1962). Women are less able to break the perceptual set by isolating the central figure from misleading cues in the background.

There is evidence that a close relationship with a father figure fosters both analytical thinking and mathematical interests. Case studies of women mathematicians have shown that they tend to identify strongly with a male figure (Iacobacci, 1970; Plank and Plank, 1954). Likewise Lozoff (1973) found that women with high math SATs tend to give verbal self-descriptions that show closeness or even preoccupation with their fathers. Also of interest is the finding by Nelson and Maccoby (1966) that male college students with higher quantitative than verbal skills report that as children they were exclusively punished by their fathers. This is consistent with the other findings if the father's administration of punishment shows his closeness to the child. On the other hand, when the father is weak or less loving, children's verbal skills tend to be higher than their math skills (Baer and Ragosta, 1966).

Mothers hold a complementary role in their children's mental development. A high degree of maternal attention or overprotection has been linked to verbal skills that are developed out of proportion to quantitative skills (Bing, 1963; Klein, 1949; Levy, 1943, Nelson and Maccoby, 1966; Rose et al, 1961). But a weak or difficult mother-child relationship has been found to enhance quantitative rather than verbal skills (Bing, 1963; Plank and Plank, 1954).

These findings on parental input are particularly important in cases when a parent is not just weak, but absent altogether. The effect of father absence has been the subject of some research. Carlsmith (1964) studied college men whose fathers were away in active service during World War II. As expected, the subjects had unusually low mathematical SATs relative to their verbal SATs. Moreover, the math-verbal discrepancy was generally more pronounced the longer the separation lasted and the earlier in life it occurred.

Carlsmith considered and rejected the possibility that the low math aptitude scores were due to greater anxiety of the father-absent subjects. Anxiety has a stronger negative correlation with verbal aptitude than with mathematical aptitude (Alpert, 1957). Hence if the discrepancy was caused by anxiety, then verbal aptitude would show the greater decrement. Another alternate explanation for her findings is that father absence depressed overall intelligence which may particularly be reflected in math scores. However

Carlsmith's data did not suggest this in any way. Futhermore, a study by Landauer and King (1963) showed father-absent students at Dartmouth to actually be higher than the class average on both math and verbal SATs, even though the math-verbal discrepancy showed the usual pattern.

Sutton-Smith, Rosenberg, and Landy (1968) did a similar study with college men and women. They found a curious interaction between father absence and sibling status. The presence of a younger male sibling mitigated the effect of father absence among boys but it exaggerated that effect among girls. That is, boys' ACE quantitative scores did not drop relative to their verbal scores as much if they had a younger brother. But the quantitative scores of girls with younger brothers dropped all the more. This study also yielded some inconsistent findings on the effect of family size, although in general father absence had stronger effects in large families.

Another study by Landy et al. (1969) refines our understanding of father absence still further. The subjects were female college students who had experienced total or partial father absence in childhood. The fathers in the latter group worked on a night-shift. Both total and partial father absence had depressive effects on quantitative scores of the ACE (American College Entrance Exam) particularly if the separation occurred before age ten. The depression of math scores was also more marked among the "total absence" group. Hence father presence and absence may be regarded as a continuum, with effects proportionate to the degree of absence. Futhermore, this finding makes it unlikely that the deleterious effects of father absence are due to compensatory behavior of a mother without her husband. Rather it appears that the effects of father absence actually result from decreased interaction between father and child.

It is noteworthy that all of this research on father absence has been done with college students, using college aptitude tests to measure quantitative and verbal skills. However since the separation is most critical when it occurs in early in life, it is possible that the discrepancy manifests itself earilier. The present study was undertaken to consider the effect on fifth-graders of father absence in the home. It was hypothesized that these younger subjects would also show math skills depressed relative to their verbal skills.

THE STUDY

The subjects were the entire class of 117 fifth graders at an elementary school in a middle-class neighborhood in Maryland. Accord-

ing to permanent records on each youngster, 14 were living with a mother and no father while 103 were living with both parents. The Iowa Test of Basic Skills (fifth grade form) was administered to all students. Each youngster received a percentile rank in reading comprehension, vocabulary, mathematical concepts, and mathematics problem solving. The two verbal test percentiles were averaged as were the two math percentiles.

In order to protect internal validity, the math scores of those with and without fathers were not compared directly. Since the father absent group had small n, those youngsters might as a whole be very bright or very slow simply due to sampling variability. Thus any difference in math scores could reflect a difference in overall intelligence level. But this problem is eliminated by comparing the groups on the basis of how each youngster's math score differs from his own verbal score. Then even if one group happens to have slower students, the math-verbal discrepancy is still meaningful. Moreover, this provides a vehicle for determining whether verbal skills were developed out of proportion to math skills in the father absent group. It is the math-verbal discrepancy which is of interest, not the absolute level of math proficiency.

RESULTS

The hypothesized discrepancy was exhibited across the sexes although it fell just short of significance ($p < .115$). See Table 1. However, further analysis showed an interesting sex difference. Among boys, math skills were insignificantly affected by father absence ($\chi_2^2 = 2.82$, $p < .25$). See Table 2. But among girls, father absence did significantly depress math scores relative to verbal scores ($p < .09$). See Table 3.

DISCUSSION AND CONCLUSIONS

Some of the previous research was done with youngsters whose fathers were absent due to active service during World War II. Presumably these youngsters did not see their fathers at all during the period of absence. But among the present subjects, fathers were absent from the home primarily due to divorce, so they probably had some degree of continuing contact with the child. This can be expected to weaken the effect of father absence as Landy et al (1969) found in a study of "partial" father absence. Perhaps this explains

why the current study fell just short of significance ($p < .115$) across the sexes.

Futhermore, a curious sex difference was observed. Inasmuch as fathers provide a role model for their sons, paternity should be especially important for boys' development. But surprisingly, paternal contact appeared to have more impact on the mental skills of girls than boys. That is, boys' math skills were not depressed significantly below their verbal skills due to father absence, whereas girls' math skills were. Sutton-Smith et al. (1968) found in this regard that father absence depresses boys' math skills more than girls' math skills in two-child families. On the other hand, in three-child families, girls are more affected by father absence. Hence the evidence on how father absence interacts with sex and sibling status is inconsistent. This is a fruitful area for further research.

Other questions are also left open for future research. For example, past research demonstrated that early father absence affects cognitive skills in later life. The current research demonstrates that these effects show up as early as age eleven. This profile could be extended still further by considering how mental skills are affected at other ages and after varying lengths of separation.

Another curious point which could be examined is what effect mother absence has on cognitive development. If mother absence (and father presence) were to cause disproportionately well-developed math skills, this would further support the notion that a masculine influence contributes to mathematical development.

An even subtler question is now uniform the paternal effect on cognitive development is. For example, do fathers who are higher in "femininity" foster weaker math skills in their children than more "masculine" fathers? Or are such individual differences associated instead with whether the father likes math, knows math, or uses it in his work? Perhaps the father's nature doesn't matter at all but the amount of time he spends with his child does.

These considerations on the paternal contribution to cognitive development are fundamental to educational theory. This research, moreover, has clear practical implications. It suggests that students, especially girls, who have no father in the home and are particularly weak in mathematics might be helped simply by increased contact with male teachers.

Table 1

A Comparison of Children Who Live With and Without Their Fathers In Terms of Discrepant Math and Verbal Skills[3]

	Father Absent	Father Present	x^2 - test
Mathematics Scores Exceed Verbal Scores	2	42	
Verbal Scores Equal or Slightly Exceed Mathematical Scores (Discrepancy of 0-14 percentile points)	8	33	$\chi_2^2 = 4.52$ $p < .115$ N. S.
Verbal Scores Greatly Exceed Mathematical Scores (Discrepancy greater that 14 percentile points)	4	28	

[3]The relative strength of verbal skills in both the father present and father absent groups may reflect a greater emphasis on the verbal curriculum at this particular school. In any event, this does not affect how the father present and father absent groups compare.

Table 2

A Comparison of Boys Who Live With and Without Their Fathers in Terms of Discrepant Math and Verbal Skills

	Father Absent	Father Present	x^2 - test
Mathematics Scores Exceed Verbal Scores	2	17	
Verbal Scores Equal or Slightly exceed Mathematical Scores (Discrepancy of 0-14 percentile points)	4	10	$\chi_2^2 = 2.82$ N.S. ($p < .25$)
Verbal Scores Greatly Exceed Mathematical Scores (Discrepancy greater than 14 percentile points)	2	19	

Table 3

A Comparison of Girls Who Live With and Without Their Fathers in Terms of Discrepant Math and Verbal Skills

	Father Absent	Father Present	χ^2 – test
Mathematics Scores Exceed Verbal Scores	0	27	
Verbal Scores Equal or Slightly Exceed Mathematical Score (Discrepancy of 0-14 percentile points)	4	20	$\chi_2^2 = 4.98$ $p < .09$
Verbal Scores Greatly Exceed Mathematical Scores (Discrepancy greater than 14 percentile points)	2	10	

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