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Birth Order and Its Sequelae

Ordinal position among siblings is related to potential eminence and educational attainment.

William D. Altus

The relation of order of birth to achievement has been investigated for nearly a hundred years. The first known data appear in Sir Francis Galton's *English Men of Science*, published in 1874. Galton selected his scientists according to objective criteria, such as being a Fellow of the Royal Society, and then asked them for biographical data, including their order of birth. He found more only sons and first-born sons among them than his calculations showed chance should have allowed. This finding he thought easy to interpret: Through the law of primogeniture, the eldest son was likely to become possessed of independent means and to be able to follow his own tastes and inclinations. Further, Galton argued, parents treated an only child and a first-born child (who is also an only child for a period of time) as a companion and accorded him more responsibility than other children were given. Thus first arrivals on the family scene were favored from the start.

A generation later Havelock Ellis (*1*) published *A Study of British Genius*, based on 975 eminent men and 55 eminent women selected from the 66 volumes of the *Dictionary of National Biography*. In the main, he chose those to whom three or more pages were devoted in this dictionary, but excluded those who were of the nobility and also those whom he judged to be notorious rather than famous. Among those eminent people, Ellis found some striking linkages to order of birth: The probability of appearance was much greater for a first-born than for an intermediate child, and the youngest likewise was favored over the intermediate child, though not to the same degree. Ellis does not interpret his finding; he merely reports that it is congruent with an American study (*2*) published a decade earlier:

> This predominance of eldest and youngest children among persons of genius accords with the results reached by Yoder in studying an international group of 50 eminent men; he found that youngest sons occurred oftener than intermediate sons and eldest sons than youngest.

About the time Ellis published his survey of eminent Britishers, the American psychologist Cattell (*3*) published data based on 855 American scientists, which showed the same relation between birth order and eminence, the eldest and then the youngest being favored.

In 1915, Corrado Gini (*4*) showed a linkage between order of birth and being a university professor. From 445 replies to a questionnaire he sent to his fellow professors in Italian universities, he found that twice as many were first-born as would have been expected from chance, and that all the other birth orders were below expectancy or no higher than expectancy. Gini's published data do not allow comparisons between the youngest and the in-between. I report these data with considerable diffidence, since most of us have had personal experience with university professors who would not qualify as eminent people, no matter how lax a criterion one employed. Still, it is of some interest to know that the first-born also takes precedence in the academic milieu, if data

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gathered a half century ago in Italy have generality beyond that time and place.

In his dissertation, on the nature and nurture of American men of letters, E. L. Clarke (*5*) reported that eldest and youngest sons appeared in greater than chance numbers. He rationalized his findings in a somewhat different way from his predecessors:

> First-born and last-born children frequently enjoy greater educational opportunity than do their intermediate brothers and sisters. First borns often succeed in getting a start before adversity befalls the family, or before the expense of caring for an increasing family of young children becomes so great that it is necessary to curtail the education of some of the older children.

He also notes that the youngest comes along when older brothers may be grown up and in a position to help the youngest through school.

In 1938, the American geographer Ellsworth Huntington published a book (*6*) primarily concerned with what he felt were sequelae of one's season of birth. He collected data on 1210 Americans whom he thought to be the most distinguished of those whose vitae he found in genealogical works. Of those who came from two-child families, 59 were first-born and 33 were second-born. While his finding is typical of all those reported thus far, his explanation of the linkage is not typical: He argued that the first-born probably tend to be physically stronger and healthier. The more vigorous eminent, he claimed, tended to be born early in the year (perhaps, though he doesn't say so, as the first fruits of the traditional June wedding). One may safely accept his data on the birth order of the eminent without accepting his explanation.

In a study of the birth order of Rhodes Scholars, mainly those from the United States, Apperly (*7*) found the first-born to be overrepresented. Among two-child family representatives, 144 were first-born, 91 second-born. He also found the youngest child to take precedence over the in-between one.

Jones (*8*) gives some statistics on birth order of persons listed in *Who's Who*. Some 64 percent of the representatives of two-child families were first-born; if inclusion in *Who's Who* were a strictly chance affair, one would expect, of course, a 50-50 distribution of the older and the younger from two-child families. Of the three-child family representatives 52 percent were first-born, instead of the 33 percent to be expected.

The last of the studies relating to eminence to be reviewed here, though it is by no means the latest, is that by Anne Roe (*9*), who published in 1953 her researches on 64 eminent scientists, selected for their distinguished contributions by the elder statesmen in their respective specialties. Thirty-nine, or 61 percent, were first-born. But the evidence for primogeniture of talent is even more overwhelming, according to Roe:

> Of the 25 scientists in my groups who were not first born, five are oldest sons, and two of the second born were effectively the oldest during their childhood because of the death of older sibs, one at birth, one at age two.

Therefore, Roe concludes, some 46 of the 64—72 percent—were actually or effectively the oldest sons in their respective families. Roe's data corroborate in an accentuated way all the evidence which has been marshalled on the topic of birth order and eminence, beginning with Galton's study in 1874. I have found no study that shows trends divergent from those here reported.

Birth Order and Intelligence

Forty years ago Lewis Madison Terman published the first volume (*10*) of his studies of 1000 "gifted" school children—that is, children with IQ's of 140 or higher, which is the IQ of the top 1 percent of the general population. Most of these children came from small families; only a few came from families of five or more children. Among those from families of two, three, and four children, Terman found the eldest the most numerous, followed by the youngest, and then by the in-between children. Terman noted that the breakdown was quite similar to the one Cattell had found for eminent American scientists some 20 years before, but he did not attempt to bind these separate studies together by theory.

Terman's findings, which indicate that—at least among the very bright—birth order may be of some significance, have to my knowledge never been checked on a large sample until quite recently. In June 1964, Robert C. Nichols, of the National Merit Scholarship Corporation, sent me some data (*11*) on 1618 high school students who were finalists in the National Merit competition and who earned exceptionally high scores among this restricted group. Nichols reports the average score of this selected group of finalists to be "almost three standard deviations above the mean of the general population," which would imply an aptitude at least in the top 0.5 percent of the general population. This level of aptitude is superior to that of Terman's gifted group. Nichols reported that of the 568 representatives of the two-child family, 66 percent were first-born. Of the 414 from three-child families, 52 percent were first-born; the other two ranks obviously contributed 48 percent. Of the 244 students from four-child families, 59 percent were first born, the other three ranks contributing 41 percent. Of the 85 representatives of the five-child family, 52 percent were first-born, the other *four* birth ranks contributing 48 percent. In summary, nearly 60 percent of the Merit Finalists who came from families of two, three, four, and five children were first-born. Here is intellectual primogeniture with a vengeance! But Nichols shows that birth order is effectively linked to aptitude *only at the top level*. In the very large number of high school students who took the first round of tests before any were eliminated, birth order does not appear to be related to the scores earned. In one respect Nichols' data do not corroborate the findings on eminence: Youngest children are less numerous among his restricted Merit Finalists than the in-betweens. In fact, Nichols' data show a stairstep progression downward, from the first-born to the last in each family group, whether of two children, three children, four children, or five children.

I have found birth-order linkages to aptitude-test data among students in the University of California (*12*), about whom I have been collecting statistics since 1959. Students at this university are a select group, since in general only those applicants who rank in the top 10 to 15 percent with respect to high school grades are eligible for admission. In two samples, one consisting of 1800 undergraduates and another of 2500, the first-born scored higher to a small though statistically significant degree than did the later-born on tests of verbal intelligence, which measure such things as the size of general vocabulary and the ability to infer correctly the right words to make sense of statements from which

key words have been omitted. On the other hand, measures of quantitative ability were not found to be associated with birth order per se. However, when birth order is linked to another parameter, the sex of the sibling, certain correlations are noted. First-born students, either male or female, from two-child families earned a significantly (.05 level of confidence) higher mean score on a test of quantitative ability if their siblings were male. This finding corroborates in part an earlier study by Helen Koch (*13*), who found that 5- and 6-year-old boys and girls in two-child families earned higher scores on the Primary Mental Abilities Test if the other child in the family was a boy rather than a girl. Koch's finding is independent of birth order: Having a brother for a sibling helped both the younger and the older in the two-child family. My data on college students show a facilitating effect only for the first-born with a brother and only in a measure of quantitative ability.

Nichols' data on the National Merit Scholarship contestants suggest that there may be hierarchies of aptitude related to birth order and family size. For instance, the first-born with three siblings had the highest mean aptitude scores of all birth ranks among those who came from families of two, three, four, and five children. The mean score of contestants with two older siblings was the lowest of all these ranks, significantly lower (.01 level of confidence) than that of the first-born from four-child families. My data from the University of California confirm these findings: The first-born in the four-child family is significantly brighter (.01 level of confidence) in verbal aptitude than the youngest from the three-child family; he has the highest verbal aptitude among all students who come from families of two, three, and four children—a group which accounts for four-fifths of the student population. The only child scores even higher, but he is eliminated from these comparisons because Nichols did not include the only child in his reported data. Schachter (*14*) shows the only child to be markedly overrepresented among graduate students at the University of Minnesota. These two items of data may be related: The only child may be the ablest and thus persist longer as a student.

It seems reasonable to infer from the foregoing that order of birth may well be associated with aptitude if the population is quite bright. Terman's findings, Nichols', and mine all point in this direction. The data are obviously neither conclusive nor definitive, but they are consistent and compelling. There is, additionally, some evidence that the sex of the sibling, where there is only one, may affect one's aptitude score. Finally there is a suggestion that there may be hierarchies of aptitude levels among the intellectually able related to birth order and family size.

Birth Order and College Attendance

Given the data on birth order and eminence and birth order and aptitude, one would expect to find some degree of correspondence between birth order and college attendance. I first became aware of the correspondence in tabulating the birth ranks of certain of the students on the Santa Barbara campus in 1959. During the next 4 years, 1960 through 1963, I gathered annual data for all—or nearly all—students who matriculated there for the first time. Of the 1817 representatives of the two-child family, 63 percent were first-born. The figures for men and women are almost exactly alike. During the same period, 1299 representatives of the three-child family matriculated; 50.5 percent of these were first-born, 30.8 percent were second-born, 18.7 percent were third-born. Matriculants from four-child families numbered 538, of whom 50.5 percent were first-born, 25.8 percent second-born, 14 percent third-born, 9.7 percent fourth-born. We noted this downward progression by birth order also in Nichols' data for Merit Finalists. Here the data on college attendance and Merit Finalists part company with the data on eminence: The youngest is not favored over the intermediate sibling; he is at the bottom step in the progression.

Are the data on college attendance and birth order thus far reported merely a parochial accident? Sufficient data are not at hand for a definitive answer, but there is some evidence that it would be no. At Yale, 61 percent of an undergraduate sample proved to be first-born (*15*); at Reed College (*16*), 66 percent; at the University of Minnesota, slightly over 50 percent (*14*). The differences in percentages may be a function of the degree of selectivity exercised by the various institutions—the more stringent the standards for admission, the higher the percentage of first-borns. This inference is based, of course, upon what has been found in the realm of aptitude testing. If the inference proves to be correct, then public junior colleges should have the lowest percentage of first-borns, since in most states, if not all, their entrance requirements are least stringent. Cal Tech, Rice University, and Harvard should, according to this hypothesis, enroll a very high percentage of first-borns. It does not seem likely, however, that in any college the percentage should much exceed the 66 percent of the Reed College sample.

Mary Stewart, in 1962, reported (*17*) a study of 7000 boys and girls in grammar and modern secondary schools in a London borough. The grammar school is mainly college preparatory and is entered by virtue of passing a state examination, the "11 plus." Those who do not pass may attend the modern school. Stewart found the first-born to be overrepresented in the grammar school, and the later-born in the modern school. However, of those who remain in school after the legal attendance requirements have been met at age 15, roughly the same proportion of first-borns is found in both schools, when the ratio of the first- to the later-borns becomes slightly greater than two to one. It seems clear that birth-order influences on schooling are present in England and are just as sharp as they are here.

Schachter (*14*) reported data from colleges and certain professional schools in the United States which show that at the graduate level, also, the first-born is overrepresented. This overrepresentation holds not only for the ratio of all first-born to all later-born, but also for families of any given size.

Several studies (*18*) in the psychological journals show that birth-order linkage to college attendance goes back at least to the '20's. Bender (*19*) reported some data in 1928 which show that the first-born were clearly in excess at Dartmouth at that time. His focus was on something other than the relation of birth order to college attendance; consequently, he missed the significance of this aspect of his data. In this he was like all others who reported birth-order data for college students, until Schachter, in 1963, (*14*) finally noted the connection between order of birth and going to college.

The evidence is of course not all in. The reports are fairly numerous by now, and they are consistent in

their findings. Since the evidence is congruent with what has been consistently found for various degrees of eminence for nearly 100 years, and also with what has recently been found concerning the linkage of verbal aptitude and birth order among the very bright, it seems a fairly safe assumption that there is a kind of academic primogeniture operating at the college level.

Birth Order and Personality

Alfred Adler believed that order of birth was influential in the channeling of the socially very significant power drives. The first-born, he said (*20*), is a "power-hungry conservative." The foregoing data suggest that the later-born may come out poorly in competition for position in our technological society, but it does not necessarily follow that industrial or professional achievement derives from a hunger for power. As to the allegation that the first-born is a conservative, I have been unable to find convincing evidence on the college campus. I have found at Santa Barbara that the first-born is somewhat more likely to say he attends church services than is the later-born, but this bit of evidence is about all I have found linking the first-born with conservatism. None of the measures of liberalism-conservatism I have tried out thus far show consistent trends related to birth order.

Sears, Maccoby, and Levin (*21*) came to the conclusion that the first-born shows greater "conscience" development than does the later-born. They thought that the differences they found in children were probably due to differences in handling of the first-born by parents, that the first-born had more metes and bounds set to his behavior and was more likely to be punished for transgressions. The father, it was noted, often participated in the disciplining of the first-born, a practice he did not usually continue with the later children. Dean (*22*) found the first-born to be more cooperative and more given to curiosity, the later-born to be more pugnacious and also more affectionate. This latter finding—that the later born are more affectionate—may have a sequel in a recent report by Schachter (*23*) that first-born were not so well liked as later-born by their fraternity brothers in the University of Minnesota.

Koch (*24*) found in her study of 5- and 6-year-old boys and girls from two-child families that the sex of their siblings together with birth order could influence their social behavior. For instance, a boy who is junior to a sister close to him in age (within 30 months, say) will often be rather "sissy" in comparison with a boy who has an older brother. The boy with the not-much-older sister will more commonly admit to liking to play with girls and with dolls than will boys reared in other sibling relationships. Recently I have found some similar evidence among college students. Male students with older sisters close to their own age were significantly less masculine on two measures of masculinity-femininity than were other males from two-child families.

Schachter (*25*) in 1959 concluded from a series of studies conducted over several years that the first-born is more driven by "affiliative needs" than is the later-born, especially when danger threatens. If the first-born feels that danger or pain lurks in the offing, he wants to share his anxiety by being with others; the later-born shows considerably less need to be with other people under similar circumstances. In this sense, the first born is more dependent on others. These generalizations of Schachter's derive largely from studies of undergraduates at the University of Minnesota.

Capra and Dittes (*15*) have reported that among Yale undergraduates first-borns were more likely to volunteer for a psychological experiment than were later-borns. I have also found, in a study recently concluded (May, 1965), that first-born males showed up for voluntary experimental testing in somewhat greater proportion than did later-borns. The differences among the female undergraduates were in the same direction but were not statistically significant. It may be that there is a sex factor here; it is also plausible that the nature of the experiment influences the ratio of volunteers. More research is certainly necessary to determine the significant parameters, if any, relating to birth order and volunteering for experimentation. If first-born do tend, even though only under certain circumstances, to offer themselves as subjects with greater alacrity, this would have great significance for those who base research on samples drawn from college students, especially where the first-born is already considerably overrepresented. Social scientists, in particular, who often use college populations in their studies, would have to control another parameter in their experimental designs.

It seems a reasonable hypothesis that birth-order effects are seldom unitary, but are mixtures involving other family aspects, such as the sex of the siblings and their difference in age. It has already been mentioned that a boy whose only sibling is an older sister, especially a close-up older sister, tends to be somewhat more effeminate than a boy with an older brother. I have found at Santa Barbara that on self-rating tests a girl from a two-child family tends to check more disparaging adjectives about herself if she has an older brother than if she has an older sister. The same girl with an older brother tends to check more unfavorable adjectives about her sibling and about their father than does the second-born of two sisters. What lends interest to this datum is that there are more girls here who have older brothers than who have older sisters. One may conjecture that such a girl's academic motivation might be at the expense of self-esteem and esteem for her brother and father. In any event, there is some tentative evidence that the junior member of either sex in the two-child family has some unfortunate attitudinal residuals if the older sibling is of the opposite sex.

There have been many studies of the relation of mental disorder to birth order. Since the data reported tend to be confusing and generally rather contradictory, they will not be introduced here, except for those of Schooler (*26*), who has done two studies on birth order and schizophrenia. He found that females who were among the younger in large families, that is, of five or more children, were overrepresented in his two samples of schizophrenics. Schooler believes that the difference in incidence is probably social in origin rather than biological, but he does not attempt to explain the presumed social genesis. In students at the University of California I have been unable to find any relation between birth order or family size and maladjustment, as measured by such a standard device as the Minnesota Multiphasic Personality Inventory. There are differences, to be sure, in the way certain items in this test are answered by first-borns as compared with later-borns, but generally these differentiating items bear no relation to symptoms of a neurotic or psychotic nature. This is not to say that personality

differences do not obtain, as both family size and birth order are varied, for they do; but the differences in this admittedly parochial population seem not to be related to deviant adjustment to any significant degree.

An Attempt at a Synthesis

In England and in the United States, there appears to be an indubitable relation of birth order to the achievement of eminence, however it has been defined. The dice are loaded in favor of the first-born. There is also some evidence that in the *quite bright* segment of our population the first-born are not only present in greater numbers, but are also somewhat more verbally able. The first-born is overrepresented among college populations, and there is some indication that the more selective the college, the greater the overrepresentation. It seems reasonable to believe that the aptitude data and the college attendance figures must be interrelated, and it seems equally reasonable that both sets of data are linked, quite possibly in a causal way, to the numerous data on eminence that have been presented.

Cattell observed (*3*) that the preeminence of the first-born was "probably due to social rather than to physiological causes." In my opinion the most prominent of the presumed social "causes" is likely to be the differential parental treatment accorded children of different ordinal positions, to greater "conscience" development, greater dependence on adult norms, and higher expectations of achievement falling to the lot of the first-born. I have already mentioned the report of Sears *et al.* (*21*) that parents tend to be stricter with the first-born child. Lasko (*27*) noted that later-born children tend to be treated in a more relaxed, permissive way. This difference in rearing practices may explain why Dean (*22*) found the first-born to be more dependent upon adults and the later-born more physically aggressive—that is, less hampered by social restraint. She also reported that the first-born showed more curiosity—that is, he asked more questions—and that he sought adult attention more frequently. Finally, one further difference which sets the first-born apart is that he is the only child who has access for an indeterminate period of time to parental interaction which he does not have to share with a sibling.

The foregoing data suggest fairly strongly, I think, why the first-born may do better in school. His curiosity, dependence upon adults, and greater conscience development doubtless make him respond more affirmatively to the teacher and to the school. He should thus more frequently win the teacher's approval, which should serve to augment further his tendencies to do that which is expected of him as a student. If this inference is correct, it is easy to understand why the colleges attract such a high proportion of the first-born.

Schachter argues (*14*) that the greater predilection of the first-born for college explains his greater eminence: His superior educational attainments make the achievement of eminence easier for him when he competes for place and position with the less well-trained later-born. This would appear to be unquestionable today, at least as regards eminence in science and technology. I would suspect, however, that in creative writing, sculpture, painting, music—the arts generally—the dependence on college training is not nearly so marked. I would also suspect that a century ago it was easier to achieve eminence, however defined, without having gone to college. Still, the greater incidence of the first-born among the eminent must have somewhere its origin: Educational attainment cannot be discounted as an important source of the observed differences in eminence among the birth orders.

The intellectual superiority of the first-born noted by Terman, by Altus, and by Nichols among the very bright segment of the population deserves further comment. Hunt (*28*), who has summarized the literature on the development of intelligence, leaves room to believe that the child can increase his intelligence by hard intellectual work. If the first-born, by virtue of his different treatment in the home, takes to school more readily, works harder, persists longer (as the college attendance figures attest), then it might be expected that he may well increase his intellectual stature in the process. The first-born who arrives at college has given himself a boost, as it were, by hard tugging at his intellectual bootstraps.

Finally, one must grapple with this problem: If differential treatment of the first-born by his parents makes him a better prospect for higher aptitude, for college training, and for eminence, why does it affect relatively few of the total available first-borns? McClelland (*29*), who has given two decades to research on motivation and achievement, has generalized his findings on optimal home influences thus: " . . . what is desirable . . . is a stress on meeting certain achievement standards between the ages of six and eight." The child is given, he continues, training in independence and mastery, and he is held in warm regard by both parents, who are ambitious for him but not too dominating, and who have a strong, positive attitude toward education.

Not many parents would fill this bill of particulars in all details. Even when they do, their offspring must have an initial aptitude for learning that places them in the upper half of the total pool of children, if the parental impetus toward achievement is to have the desired result. It seems to me that the preceding considerations impose sufficient restrictions to ensure that only a minor portion even of the relatively fortunate first-born will attain a college degree. And to the extent that aptitude and eminence are a product, even partially, of the educational process, they would tend to vary with education.

In conclusion, the viewpoint embodied in this paper may be fairly summarized by a single sentence: Ordinal position at birth has been shown to be related to significant social parameters, though the reasons behind the relations are as yet unknown or at best dimly apprehended.

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Elementary Science: A New Scheme of Instruction

The processes of scientific inquiry are stressed in a program now being tested.

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For the past several years, a set of materials called *Science—A Process Approach* has been under development and testing as a means of teaching science in the elementary grades (*1, 2*). At present, these materials comprise 14 booklets, parts 1 (A and B) through 7 (A and B), each part containing descriptions of about 25 science exercises, and an additional booklet, *Commentary for Teachers*. The exercises of part 1 are intended for kindergarten children, the others for children of successive grades through the sixth. Each exercise is addressed to the teacher and describes the activities to be conducted with and by the children. For each exercise there is given a set of objectives, a rationale, new vocabulary to be introduced, and a list of materials needed. In addition, a section on appraisal suggests the kind of additional questioning that may be used by the teacher to satisfy herself that the desired learning has occurred.

The development of these materials has been carried out under the direction of the Commission on Science Education of the American Association for the Advancement of Science, with support from the National Science Foundation. The major developmental work has been conducted by groups of scientists and educators assembled for "writing sessions" during the summer months of 1963, 1964, and 1965. At present, the materials are being tried out in 14 school systems, and additionally in 20 individual schools, in various parts of the country. Assessment of pupils' achievement following their participation in each exercise is an integral feature of the evaluation (*3*).

The most striking characteristic of these materials is that they are intended to teach children the *processes* of science rather than what may be called science content. That is, they are directed toward developing fundamental skills required in scientific activities. The performances in which these skills are applied involve objects and events of the natural world; the children do, therefore, acquire information from various sciences as they proceed. The goal, however, is not an accumulation of knowledge about any particular domain, such as physics, biology, or chemistry, but competence in the use of processes that are basic to all science.

The exercises of parts 1–4 concern the processes called Observation, Classification, Communication, Number Relations, Measurement, Space/Time Relations, Prediction, and Inference. A variety of content is used to support the learning of these skills. For example, observation exercises deal with colors, shapes, textures, and sounds, and involve such objects and events as magnets, plants, weather changes, rolling balls, animals in motion, seeds, and growing organisms. The exercises in each process grow increasingly complex, making use of what the child has learned before. For example, an early classification exercise treats the single-stage classification of sets of common objects (red-blue, rough-smooth). Successive exercises introduce more complicated classification problems, and an exercise in part 4 deals with a multistage classification schema applicable to collections of plants, animals, and other objects.

In parts 5, 6, and 7 the exercises deal with the most highly integrated processes called Formulating Hypotheses, Making Operational Definitions, Controlling and Manipulating Variables, Experimenting, Formulating Models, and Interpreting Data. These more complex activities clearly build upon the simpler skills and knowledge acquired in parts 1–4. The exercises have a greater number of specific prerequisites which can readily be identified as having been taught in earlier lessons. Although process rather than content remains the focus of attention, the exercises in parts 5–7 cover a range of important topics from physical science, earth science, life science, and behavioral science. In the current edition, there is a trend toward grouping "blocks" of lessons dealing with particular science content. Quite possibly, this trend will be further emphasized in later editions.

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