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ABSTRACT

Results of the National Assessment of Educational Progress are examined in the context of male and female differences. Considered are the first four years, beginning in 1969 and ending in 1973. Data were gathered in the learning areas of science, citizenship and writing the first year; reading and literature the second year; social studies and music the third year; mathematics and science, for the second time, the fourth year, or 1972-73. In other words, change data were first reported in science and appeared in print in March 1975. Focusing only on sex differences, the results throughout the four age levels present questions and cause speculation about the educative process, the methods, time allotment and emphasis. Some may conclude that learning opportunities are not equal for both boys and girls in the majority of schools. Some may conclude that interst is lower among boys than girls, or the reverse, in a particular learning area. The experience of the reader will facilitate in interpretation of the findings presented here. (Author/BJG)

NATIONAL ASSESSMENT OF EDUCATIONAL PROGRESS

MALE-FEMALE ACHIEVEMENT IN EIGHT LEARNING AREAS

A Compilation of

Selected Assessment Results

Education Commission of the States

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MALE-FEMALE ACHIEVEMENT IN EIGHT LEARNING AREAS

A Compilation of

Selected Assessment Results

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Department of Utilization/Applications

NATIONAL ASSESSMENT OF EDUCATIONAL PROGRESS

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FOREWORD

The National Assessment of Educational Progress (NAEP) is an information-gathering project which surveys the educational attainments of 9-year-olds, 13-year-olds, 17-year-olds and adults (ages 26—35) in 10 learning areas: art, career and occupational development, citizenship, literature, mathematics, music, reading, science, social studies and writing. Different learning areas are assessed every year, and all areas are periodically reassessed in order to measure educational change.

Each assessment is the product of several years work by a great many educators, scholars and lay persons from all over the country. Initially, these people design objectives for each area, proposing specific goals that they feel Americans should be achieving in the course of their education. After careful reviews, these objectives are then given to exercise (item) writers, whose task it is to create measurement tools appropriate to the objectives.

When the exercises have passed extensive reviews by subject-matter specialists and measurement experts, they are administered to probability samples from various age levels. The people who compose these samples are chosen in such a way that the results of their assessment can be generalized to an entire national population. That is, on the basis of the performance of about 2,500 9-year-olds on a given exercise, we can generalize about the probable performance of all 9-year-olds in the nation.

Goals of the Assessment

National Assessment provides information to educational decision makers and practitioners that can be used to identify educational problem areas, to establish educational priorities and to determine the national progress in education. To do so, NAEP must remain flexible enough to accommodate possible extensions, refinements and modifications. The following goals have been established for the project by the National Assessment Policy Committee, the Analysis Advisory Committee and the NAEP staff.

Goal I: To measure change in the educational attainments of young Americans.

Goal II: To make available on a continuing basis comprehensive data on the educational attainments of young Americans.

Goal III: To utilize the capabilities of National Assessment to conduct special interest "probes" into selected areas of educational attainment.

Goal IV: To provide data, analyses and reports understandable to, interpretable by and responsive to the needs of a variety of audiences.

Goal V: To encourage and facilitate interpretive studies of NAEP data, thereby generating implications useful to educational practitioners and decision makers.

Goal VI: To facilitate the use of NAEP technology at state and local levels when appropriate.

Goal VII: To continue to develop, test and refine the technologies necessary

for gathering and analyzing NAEP achievement data.

Goal VIII: To conduct an ongoing program of research and operational studies necessary for the resolution of problems and refinement of the NAEP model. (Implicit in this goal is the conduct of research to support previously mentioned goals.)

The National Assessment of Educational Progress also publishes a general information yearbook that describes all major aspects of the Assessment's operation. The reader who desires more detailed information about how NAEP defines its groups, prepares and scores its exercises, designs its samples and analyzes and reports its results should consult the *General Information Yearbook, Report 03/04-GIY.*

INTRODUCTION

What follows is an attempt to look at the National Assessment of Educational Progress findings as they relate to male and female differences. We are considering the first four years, beginning in 1969 and ending in 1973. Data were gathered in the learning areas of science, citizenship and writing the first year; reading and literature the second year; social studies and music the third year; mathematics and science, for the second time, the fourth year, or 1972–73. In other words, change data were first reported in science and appeared in print in March 1975.

These compiled findings focus only on sex differences. The results throughout the four age levels present questions and cause speculation about the educative process, the methods, time allotment and emphasis. Some may conclude that learning opportunities are not equal for both boys and girls in the majority of schools. Some may conclude that interest is lower among boys than girls, or the reverse, in a particular learning area. The experience of the reader will facilitate interpretation of the findings presented here.

READING 1970–71

Almost every research study that compares the reading competence of boys and girls has noted that girls generally read better than boys. This assessment of the American population of 9-, 13- and 17-year-olds supports those findings conclusively. At all three school-age levels, girls read better than boys, with only a few exceptions. Among young adults, however, American males read as well as females. On only a few exercises did males at all four age levels read considerably better than females.

Females not only surpassed males in most reading skills, they generally also read faster. Among 9- and 13-year-olds, more girls than boys read two assigned passages in the reading assessment at rates of 200 or more words per minute. Among 17-year-olds and adults, nearly equal percentages of males and females read both passages in excess of 200 words a minute.

If females had the lead in the rate categories, males appeared to have better recall of details. For example, although 42% of the girls at age 17 read the first passage at 200—299 words per minute compared to only 34% of the boys, 78% of the boys and only 62% of the girls who had read the passage at 200—299 words per minute answered four or five out of the five comprehension questions correctly after reading the passage. Those comprehension questions were almost all recall of details.

Table 1 shows the percentages of males and females who had "good" (i.e., four or more correct) comprehension after reading each passage. Table 2 shows the percentages of males and females when the results for both passages are combined.

As Tables 1 and 2 show, males did as well as or better than females in more than two-thirds of the rate categories when each of the passages is examined separately. When examined together, males equaled or outclassed the girls in recall of details in more than 80% of the categories.

Male superiority, however, ends there. Out of hundreds of exercises, males surpassed females in only 22 of them. Eight of those exercises called for the reading of signs, charts, graphs, maps, etc. (Theme 2); five exercises involved identifying and recalling significant facts from a passage (Theme 5); four dealt with drawing inferences (Theme 7); two were concerned with organization (Theme 6); and one exercise was from each of three skill areas: understanding and following written directions (Theme 3), using reference materials (Theme 4) and critical reading (Theme 8). On no exercise from Theme 1 dealing with vocabulary did males at any age level read better than females. Therefore, although school-age males were generally below females in all reading skills, their weakest skills area in relation to females appears to be vocabulary, and their strongest areas seem to be interpreting graphic materials, extracting and recalling details and drawing inferences.

An examination of differences in the sex category reveals that when males read better than females, they often did so at more than one age level. In addition, when males read *better* than females at only one of the four age levels, they usually read at least *as well* as females at one or more of the other age levels on the same exercise. For example, 17-year-old males were better than females in indi-

TABLE 1. Percentages of Males and Females With Four or More Correct Responses Within Each Rate (Words Per Minute) Category

Age	Sex	Percent by Rate Category				All Rate Categories Combined
		<100	100-199	200-299	>300	
			Passage 1			
9	M	60%	79%	68%	49%	70%
	F	65	83	79	84	77
13	M	22*	40*	61*	46	43*
	F	12	35	45	49	37
17	M	54*	69*	78*	65*	71*
	F	45	63	62	62	62
Ad	M	32	75*	79*	52	71*
	F	54	66	70	64	67
			Passage 2			
9	M	32*	40*	26*	5	34*
	F	24	34	20	18	29
13	M	30*	38*	43*	25*	38*
	F	22	33	36	26	32
17	M	13	30*	35*	29	30*
	F	29	30	36	33	32
Ad	M	16	44*	51*	56*	45*
	F	35	40	49	27	42

*Indicates where males are about the same as or better than females in recall of details.

TABLE 2. Percentages of Males and Females With Four or More Correct Responses on Both Passages Who Read Both Passages Within the Same Rate (Words Per Minute) Category

Age	Sex	Percent by Rate Category				All Rate Categories Combined
		<100	100-199	200-299	>300	
9	M	21%*	48%*	57%*	17%	33%*
	F	15	36	27	53	28
13	M	15*	19*	31*	17*	20*
	F	4	17	20	17	16
17	M	13*	21*	36*	26	26*
	F	6	21	28	29	25
Ad	M	6	38*	46*	26*	38*
	F	36	33	47	21	35

*Indicates where males are about the same as or better than females in recall of details.

cating which of four street signs told where a person should ride a bicycle (R20501), and both 9- and 13-year-old boys did as well as girls on that exercise. Similarly, on an unreleased exercise requiring respondents to interpret symbols on a map, males were superior at the 17-year-old and adult levels and about the same as females at the 13-year-old level. While we cannot say that the differences between black and white reading success are due to racial differences, it does appear that differences in reading performance of males and females really are related to sex differences because they occur across age levels.

Those 22 exercises on which boys read better than girls were not evenly distributed across age levels, however. The fewest exercises for an age level occurred at the 9-year-old level. The largest number of exercises occurred at the young adult level. Table 3 indicates the number of exercises within each theme at each age level. The reader should be aware that vertical totals in Table 3 do not represent the number of *different* exercises for each theme. For example, 3 of the 11 notations under Theme 2 where males read better than females were the same exercise administered at the 17-year-old and young adult levels. Similarly, the notations under Theme 8 represent the same exercise; on that one exercise, males at every age level did better than females.

There are certain characteristics in those 22 exercises that are worth noting. Most of them involve reading signs, forms and charts or are concerned with male-oriented activities. Males, for example, did best on Theme 2, which involved reading signs, charts and forms. On those kinds of exercises, males usually read better than or as well as females.

TABLE 3. Number of Exercises Where Males Performed Better Than Females

Age	Themes								Totals
	1	2	3	4	5	6	7	8	
9		1			1	1		1	4
13					1	1	3	1	6
17		6			1		1	1	9
Adult		4	1	1	4		2	1	13

But males did not surpass females on every exercise of that type. For example, Exercise R214 — a map-reading exercise — had five parts. Girls read better than boys on part 1 and part 3 at both the 9- and the 13-year-old levels; boys and girls were about equal at those age levels on parts 2, 4 and 5. Male 17-year-olds were better on part 5 but were equal to females on the other four parts. Nearly equal percentages of males and females had all five parts correct. Thus, one can point out that more male than female 17-year-olds responded correctly to one part of a map-reading exercise, but one cannot say that males were generally better map readers than females. The same is true of the ability of males to read such things as street signs, charts, cereal boxes or traffic tickets. Nevertheless, when males did read better than females it was usually on that type of material.

Male success on one particular exercise (R23602) seems to be due partly to their male-oriented experience. The exercise required the respondents to identify two different amounts of liability coverage noted on an automobile insurance policy. Male 13-year-olds, 17-year-olds and adults answered the first part as well as females did. The question was asked directly: "What is the maximum amount for which this policy covers medical bills?" The answer, $1,000.00, was listed on the facsimile of the policy. But on the second question — "What is the maximum amount this policy would pay in case you injured another person?" — the answer was not as obvious. There was no category that said "In Case You Injure Another Person." The reader needed to know that the proper heading for that category was "Bodily Injury Liability." While 84% of the 13-year-olds had answered the first question correctly, only 8% of them did so on the second question. On the second question the national percentage increased from 8% for 13-year-olds to 19% for 17-year-olds and 43% for adults. As the national percentage increased, so did the relative performance of males. Among the 13-year-olds, boys did about as well as girls; at age 17, boys were better than girls; and at the young adult level, men were clearly superior on this exercise. Greater male experience — especially adult males — with automobile insurance forms of this kind probably accounts for some of their impressive success on this exercise.

A number of other exercises on which males did notably well also dealt with what appear to be male-oriented activities: driving a sports car, hunting and fishing and reading a newspaper advertisement for a job. Although 9-year-old girls did better than boys in identi-

fying reasons why a sports car can turn corners easier than a passenger car (R50201), males were significantly better at the other three age levels. Also, in responding to the sign — HORSEPOWER without HORSE SENSE is FATAL (R81401) — males were considerably better than females at all four age levels.

Two unreleased exercises (U52901 and U52902) asked the respondents to interpret a list of regulations for fishing in a particular state. On one part, adult men read better than women, and boys read as well as girls at ages 13 and 17. On the second part of the exercise, females were better at age 13, males and females were similar at age 17 and adult males did better than adult females. One might suspect that men would do better than women and better than younger males because of their closer interest in hunting and fishing activities. However, only 47% of the 13-year-olds and adults in the nation responded correctly to that part of the exercise while 56% of the 17-year-olds did so. Since 17-year-olds were not better than adults on the first part of that exercise, it seems impossible to suggest reasons for their superiority on that point.

Familiarity with content may not in itself account for males doing better than females on certain exercises. One unreleased exercise (U53606) concerned a female-oriented job. On that exercise, 13- and 17-year-old girls were better than boys on detail questions concerning the name of the company, job qualifications and salary. On those same details, adult males did about as well as females. But on one question that asked how to apply for the job, 13- and 17-year-old boys did about as well as girls, and men did better than women. Perhaps it was not familiarity with the content as much as it was familiarity with the procedures for applying for a job that enabled males to do so well on this exercise. As with many other findings in this study, more exact explanations are not readily available.

These examples of male superiority obviously do not suggest that school-age males *generally* read as well as or better than females. As indicated, the instances where boys were clearly superior are few indeed. Girls have always been better readers than boys during the school years and probably will continue to be so.

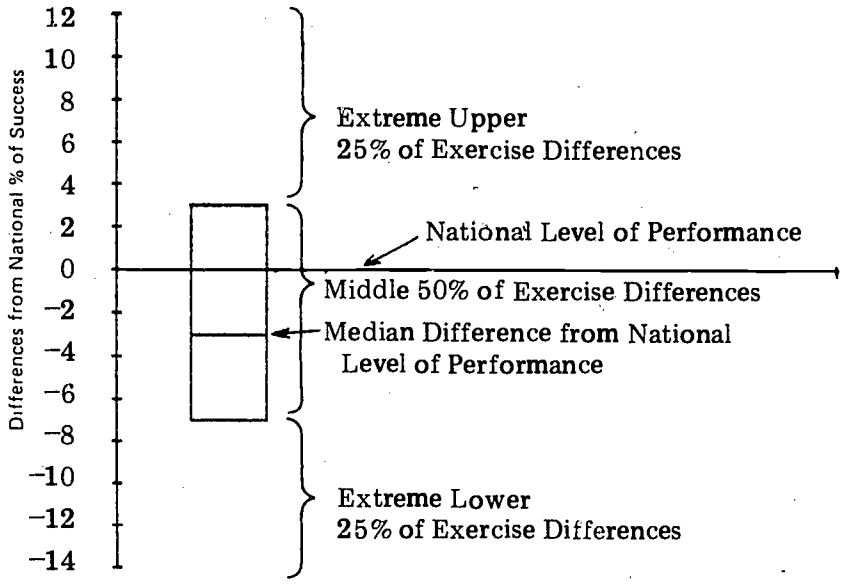
Reasons for female superiority have been posited and described in numerous reports and articles and need not be repeated here. One additional speculation might be offered here, though, regarding the absence of female reading superiority at the adult level. Adult women generally did not perform significantly better than men on the reading exercises. There are no doubt numerous reasons why women lose their reading advantage after school, among which are probably the factors of interest, male-oriented or female-oriented reading materials and sex bias in jobs and other activities. Moreover, since the majority of higher-level jobs — where reading is an important and frequently used skill — belong to men, women generally do not have the opportunity to employ reading skills that men do. The need for females to read decreases while it increases for males. With the advent and growth of women's liberation movements, however, more and more females are becoming less content with traditional roles. The expectations and achievements of women have been changing. The future assessments of reading may find that the superiority women have over men in reading during the school years may very well continue throughout the adult years.

In a given set of exercises (e.g., all attitude exercises), a group's achievement can be summarized conveniently by examining its differences from national percentages of success. For example, if 70% of the nation's 9-year-olds correctly answer a given exercise while 73% of the 9-year-olds in the Northeast correctly answer the same exercise, the Northeast difference is +3.

If we wish to discuss Northeast performance across a number of exercises, the single most useful number is the median difference. However, a more complete picture of a group's typical performance emerges from examination of the entire range of differences or, more conveniently, the middle 50% of the exercise differences. The group summary exhibit in this chapter depicts not only the median differences for each group, but the range including the middle 50% of the exercise differences as well.

Exhibit A presents a sample plot of group differences at age 9. Differences on all 15 exercises range from +12 to -14, but since only the middle half of the differences are shown, the bar is plotted from only +3 to -7. The median difference, -3, is indicated by the heavy line.

EXHIBIT A. How Differences From the National Percentages of Success Are Reported: Sample Graph



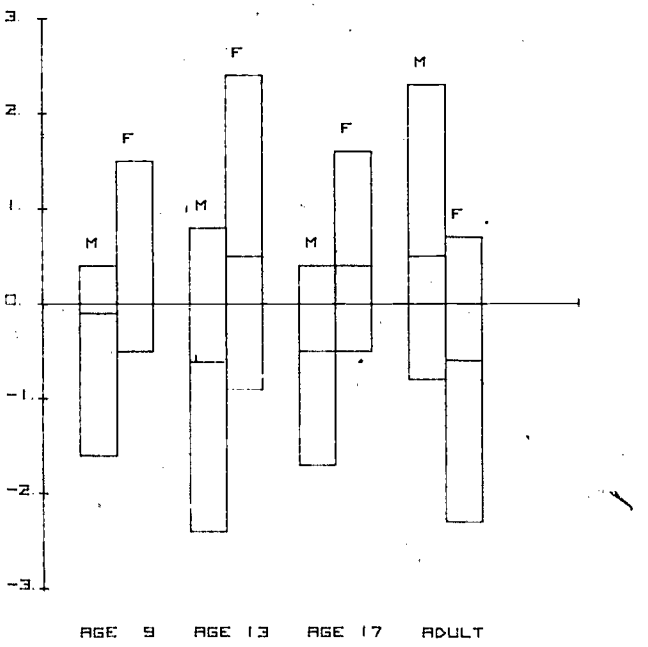
Skills

Although skill development has always been a major objective in the school curriculum, recent criticism of social studies teaching suggests perhaps that social studies programs have, in practice, not been directed sufficiently toward the attainment of this goal. For years the social studies were overly concerned with the accumulation of descriptive facts, often obsolete, irrelevant or forgotten before students had either digested or applied them. Beginning in the mid-sixties, the "new" social studies, sensitive to this criticism, began to stress the teaching of basic thinking skills, and the orientation of curriculum materials and teaching strategy began to shift.

Among the important questions considered in this assessment is whether or not young Americans have mastered some of the basic thinking skills considered crucial by the subject-matter experts. Have the changes suggested by the experts filtered down to the schools and students themselves? In attempting to answer some of the questions, a variety of skills were probed. For the purposes of analysis, these were divided into two topics: obtaining information and interpreting information. Clearly there is a great deal of overlap between and among basic skill competencies, and these divisions should be considered no more than an organizing framework. The topics are further divided into subtopics directed at the following questions: Are young Americans able to raise questions and seek answers related to a variety of issues? Can they identify sources most suitable to solve a particular problem or to find particular information, and use standard reference sources and aids to locate information? Do they use basic problem-solving techniques of the social sciences? Can they interpret maps, graphs and tables effectively? Are they able to use nontraditional sources of information to draw conclusions? The National Assessment of Educational Progress has explored these skill competencies in a variety of exercises, providing some baseline data for future comparison and at least some tentative answers for the present.

As Exhibit 1 indicates, females tend to perform slightly better than males through the high school years. Among young adults a reversal occurs. Males perform slightly above the nation, and females perform slightly below national levels.

EXHIBIT 1. Skill Performance: Male-Female Results Compared to National Results



□ - National level of performance
— - Median difference

Among 13-year-olds, a comparison of the results for males and females points to one clear pattern of difference. Males scored considerably lower than females on all the exercises involving the use of a book index or card catalogue.

Seventeen-year-old males performed better than females on four out of seven exercises involving map- and graph-reading skills. Two involved reading and interpreting graphs. On Exercise RSI21, a bar-graph interpretation, almost 5 percentage points separated their performance. The results on a pictograph, RSI25, were even more disparate. Forty-seven percent of the males answered correctly compared to 37% of the females. On two very similar exercises involving the use of an outline map and a table (RSI26, USI27), between 10—12 percentage points again separated the male-female results. Females did better on two exercises (RSI32 and RSI33) involving the interpretation of songs. Forty-eight percent of the females understood the main message in the song "Walk a Mile in My Shoes," compared to only 39% for males. Forty-five percent of the females understood "Carefully Taught," compared to 34% for 17-year-old males.

As at age 17, the greatest difference in the performance of males and females occurs within the subtopic of interpreting graphs, maps and tables. Male performance was better than that of females on all seven of these exercises. On one exercise, RSI26, 19 percentage points separate their performance levels. In this exercise involving both the use of a map and table, the males answered correctly 44% of the time; only 25% of the females, on the other hand, could do as well.

Knowledge

Traditionally the goals of social studies education have been linked to civics and some simpler aspects of history and geography. However, the legitimate range of topics in the social studies is no longer so clearly defined. Economics, sociology, psychology, anthropology, philosophy and political science have now joined history, geography and civics as part of the curriculum. "Mini" and "maxi" courses concentrating on specific concerns and interests of students have become increasingly popular across the country. Names, dates and facts are no longer "sacred cows" to be carefully transferred in some magic pedagogical process from textbooks to students' minds. The emphasis is shifting from covering the whole field and memorizing the important facts, to learning how to use varieties of information to make decisions and better understand the processes of change.

While most Americans would agree that the social studies includes an intelligent understanding of social conditions, problems and processes, beyond this vague consensus it is difficult to get much agreement on just what young Americans should know. However, National Assessment has made every effort to establish a broad representational base with the four knowledge-area topics in the social studies assessment. These include: economics, geography, history and political science. Because each of these topics could easily be subject of an assessment in itself, it would be presumptuous to think we have fully covered these fields. We have, however, provided useful data within all of them.

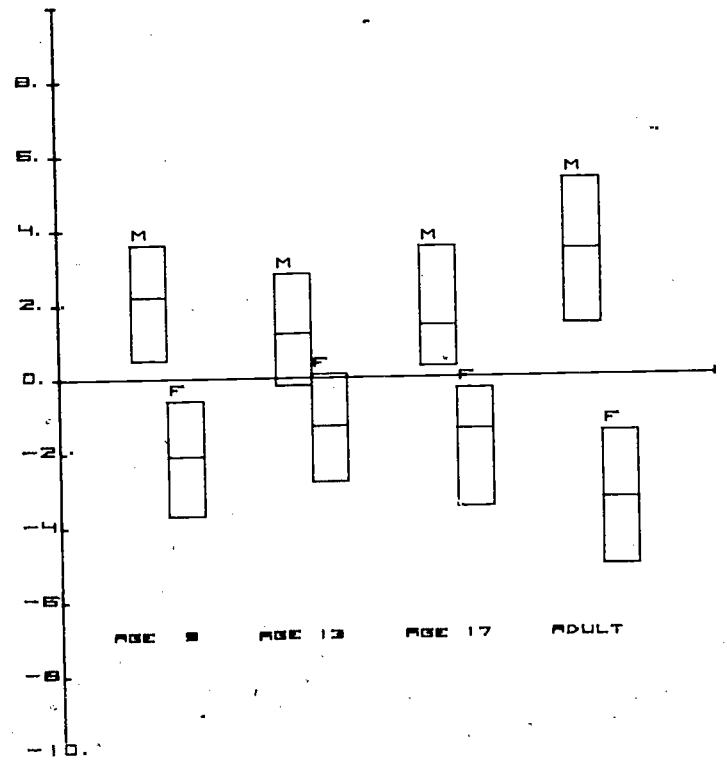
Male-Female Performance

Exhibit 2 indicates that males perform better in knowledge exercises at all age levels. Female performance levels come closest to that of males at age 13 on these exercises; however, the pattern still remains clear. The greatest disparity between male and female performance occurs at the adult level.

Among 13-year-olds, male performance was generally better than female performance in the knowledge area. This is particularly true for geography questions.

Likewise, 17-year-old males generally did better than their female counterparts on geography items. For example, on one exercise

EXHIBIT 2. Knowledge Performance: Male-Female Results Compared to National Results



□ - National level of performance
— - Median difference

involving the use of latitude and longitude tables and some understanding of the relationship of the equator to climatic conditions (RKG09), 45% of the males — compared to 23% of the females at this age — responded correctly. On another exercise involving a map of rainfall zones (RKG14), 66% of the males — compared to 54% of the females — responded correctly.

Attitudes

What young people learn about freedom, equality, justice, respect and cooperation is ultimately the key to the future of a democratic society. The debate still rages as to how and what attitudes should be learned or transmitted. Some would insist that learning comes only experientially in this area and that the heart of value education does not lie in the subject matter of social studies courses, no matter how well they are organized and developed. Others hold that values can and should be taught with the aid of instructional materials that can guarantee appropriate outcomes. No matter what camp educators belong to, however, there is agreement that attitudes are difficult to measure accurately.

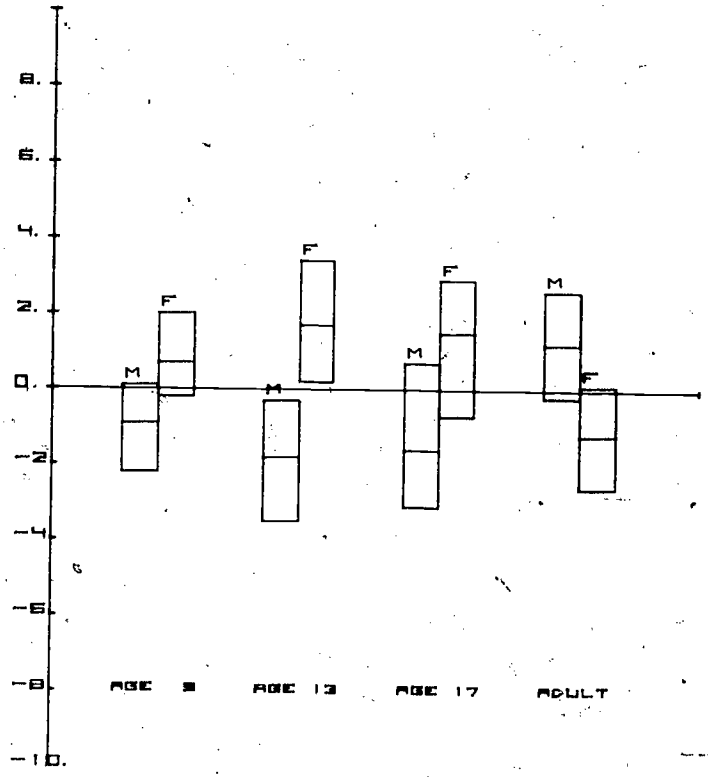
National Assessment's survey of attitudes does not resolve this debate; however, it does provide some indicators of the national value consensus at four age levels. The attitudes area has been divided into two basic topics. The first concentrates on the commitment to the rights guaranteed in the First Amendment, which are basic to the freedom and

fulfillment of all people in our society. Respondents are required to make value judgments about a variety of situations in which the freedoms of speech, press, religion, petition and assembly are involved. The exercises are geared to measure attitudes toward these rights and not knowledge of them. The questions purposefully ask whether or not individuals SHOULD be allowed to do certain things, not whether, in fact, they can by law do them.

The second topic covered in the attitudes area deals with commitments that are more individual in nature yet no less important to the functioning of a democratic society. They center on the conflict between the worth of the individual on the one hand, and a value system, to a large part shaped by the demands of modern industrial society, in which status, achievement, productivity, efficiency and institutional permanence are extolled. This topic deals with attitudes toward participation in school and the community, sensitivity to the needs and feelings of others, respect for the views of others and belief in the rule of law.

Exhibit 3 indicates that females perform better than males on attitudinal exercises at ages 9, 13 and 17; however, by young adult this pattern abruptly switches and males perform better than females.

EXHIBIT 3. Attitude Performance: Male-Female Results Compared to National Results



0 - National level of performance
— - Median difference

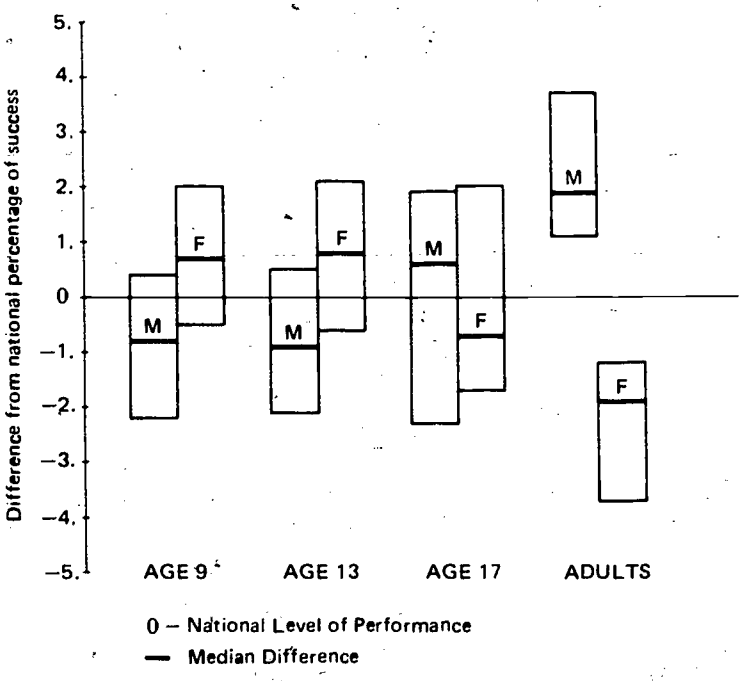
Among the exercises for 13-year-olds on which females performed better than males were three that involved a commitment to social participation and a strong positive self-image. One of these is not released but involves voting behavior (UAB03). The other two involve the participation of young people in school and community affairs. One exercise, RAB02, asks if teenagers should be involved in making decisions about what courses would be offered in school. The other, Exercise RAR02, asks if teenagers should be able to write letters to elected government officials or express their views on political issues. Almost 10 percentage points separated male-female scores on these two exercises.

Among the exercises for 17-year-olds on which males performed better than females were five involving attitudes toward the First Amendment rights of freedom of religion (RAR07), press and speech (RAR08, UAR09) and the right to picket either a police station (RAR12B) or rock festival (RAR12A). In comparison, females at age 17 did particularly well in comparison to males on exercises involving the belief in the worth of the individual. Results for females on 12 of the 15 exercises in this topic were above those of the males. Exercises on which the differences were unusually large include: *Vandalism: Crime or Prank?* (RAB20), *Political Obligation to Minority Groups* (RAB17) and *Community Control* (RAB04). Between 8 and 14 percentage points separated male-female performance on these exercises.

Male adults tended to perform best on exercises measuring attitudes toward First Amendment rights: male scores were from 7 to 16 percentage points above those of females on exercises involving religious freedom (UAR06, RAR07), the freedom to picket (RAR12A and B) and the right of assembly (RAR11). Females did considerably better on three exercises involving participation in the decision-making process (RAB02, UAB03, RAB04) and two involving respect for the rights and views of others (RAB16, UAB14).

In items concerning attitudes toward underlying values of American society, knowledge of the role and function of government, knowledge of and attitudes toward constitutional rights and knowledge of the electoral process and the role of political parties, females tended to perform better than males at ages 9 and 13. At age 17, the pattern reversed, males tending to perform slightly above the national level. Among young adults, the reversal became even more evident. On more than three-fourths of all the exercises, the males were above the national levels of performance; the females were below (see Exhibit 4).

EXHIBIT 4. Political Knowledge and Attitudes: Male-Female Performance Compared to National Performance



Sex differences in citizenship achievement vary somewhat from one exercise to another, males doing better in some cases and females doing better in others. The variation is greater for adults than for the younger age levels. This can be seen in Exhibit 5, which shows the approximate difference between males and females for every result. The darkened bars above zero, for example, represent results on which the percent correct for males is higher (by the amount shown in the margin) than the percent for females. The darkened bars below zero show results on which females did better.

In the exercise that yields the largest sex difference (A61-1), men exceed women by 28%, and they fall 22% below women on another exercise (I-53-3). It is important to note that a difference *between sexes* is approximately twice that between a given sex and the national value since the latter includes both sexes.

Exhibit 6 shows, by age, the median sex difference for all citizenship results. The relationship between Exhibits 5 and 6 is that the first plots the *distribution* of differences and the second plots the *median* of that

EXHIBIT 5. Difference in Percent Correct Between Males and Females for Each Exercise Result (Bar length indicates number of results at a given difference level.)

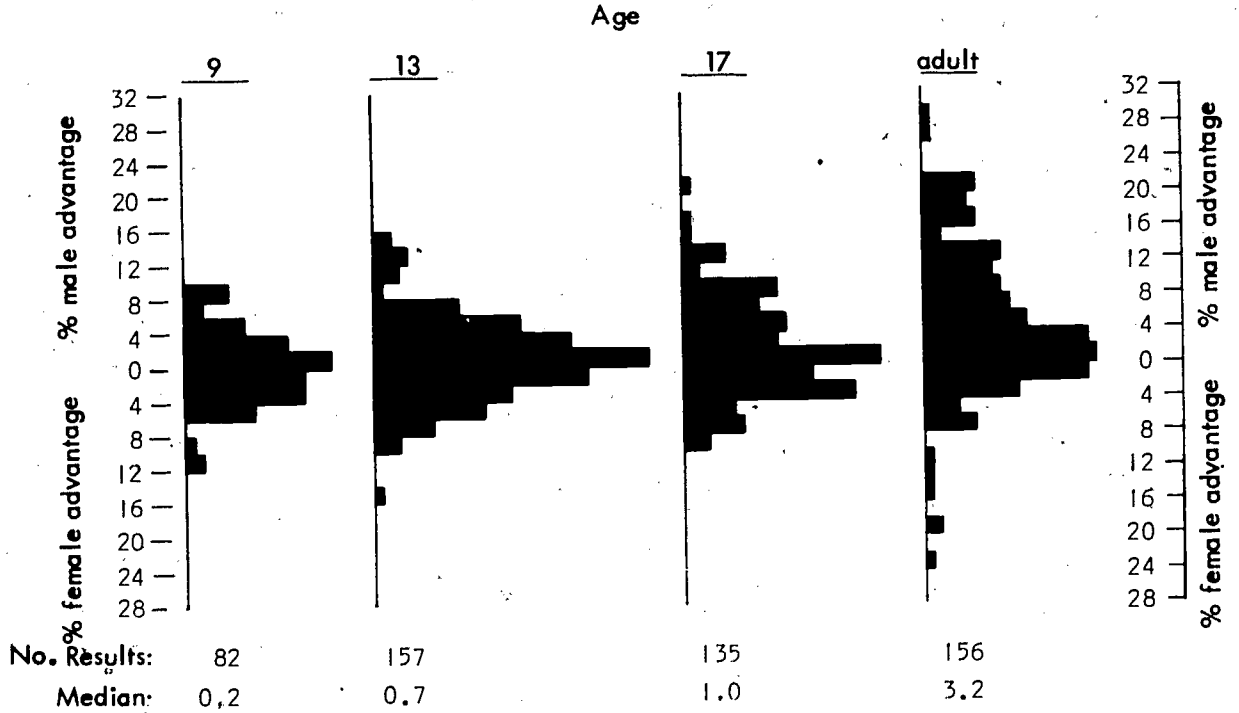
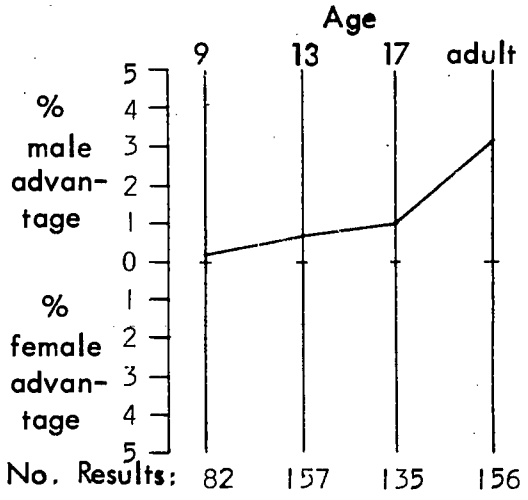


EXHIBIT 6. Median Sex Differences for All Citizenship Results



distribution. The results will generally be discussed in reference to graphs of median differences (as in Exhibit 6), although individual exercise results (or result clusters) that differ substantially from the median also will be described.

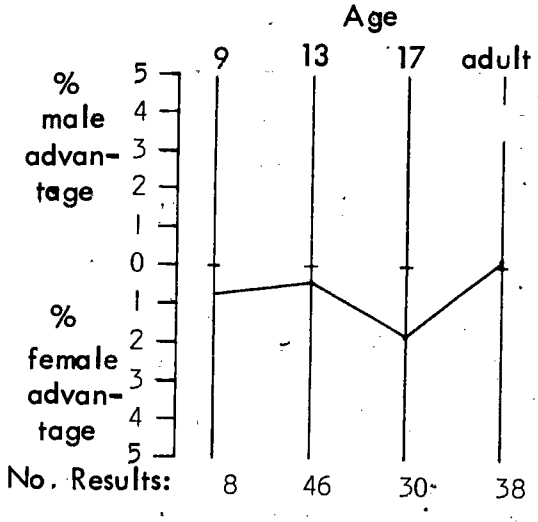
In Exhibit 6-it can be seen that boys and girls achieve about equally well at age 9, but a slight male advantage appears at age 13 and increases gradually with age. For adults the median male advantage over females across all measures is just over 3%. Although the trend toward a male advantage for older age levels is consistent and statistically reliable, from many practical perspectives men and women did about equally well on the average. Although small but statistically significant group differences are discussed at times in this report, the doubtful practical importance of small differences should be kept in mind.

Results by Goal

Goal A: Show Concern for the Well-Being of Others

Although the median sex difference for Goal A is negligible (see Exhibit 7), there are sex differences for exercises concerned with racial and religious discrimination. Females were

EXHIBIT 7. Median Sex Differences for Goal A



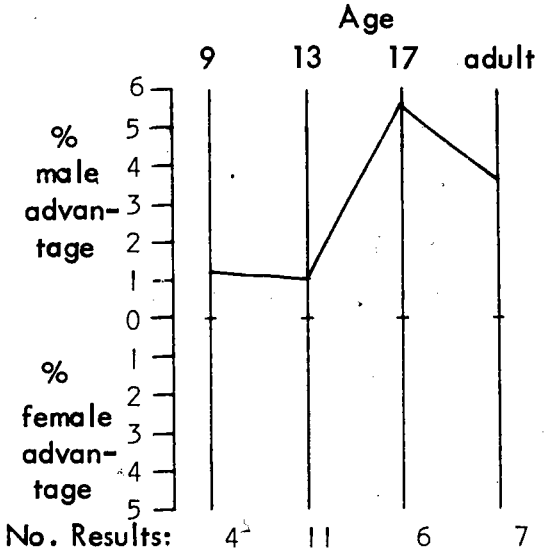
slightly more willing to associate with persons of different races in a variety of public situations, whereas males were slightly more *aware* of religious and racial discrimination.

Of the Goal A exercises on which the sexes achieved about equally, most concern knowledge of how to use community services to help others with specific needs and other questions about individual help not related to race or religion.

Goal B: Support Rights and Freedoms of All Individuals

Although differences at ages 9 and 13 are very slight on Goal B, males did better at ages 17 and adult by about 5% (Exhibit 8). Most of these exercises concern free speech and due process of law and measure both knowledge and attitudes.

EXHIBIT 8. Median Sex Differences for Goal B



Goal C: Recognize the Value of Just Law

Boys at ages 9 and 13 did slightly better than girls on Goal C, but there was no increase in advantage with age. On specific exercises, men tended to know more specific facts about law (C53) while women did as well as men in explaining why just laws and rules are needed (C2). (See Exhibit 9.)

Goal D: Know the Main Structure and Functions of Government

Goal D results favor males generally and show a substantial increase in this sex difference with age. From a negligible advantage at age 9, the median difference favoring males becomes almost 11% for adults (Exhibit 10).

EXHIBIT 9. Median Sex Differences for Goal C

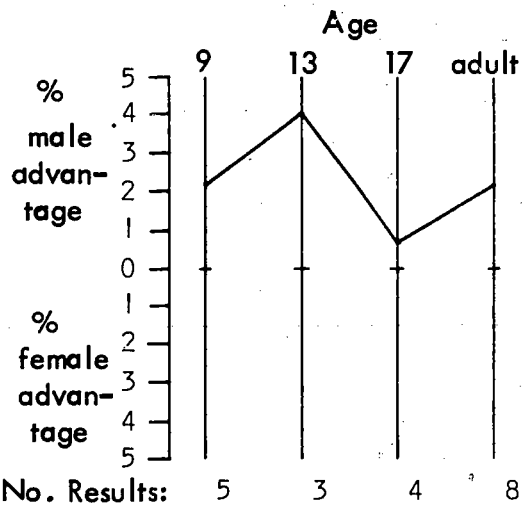
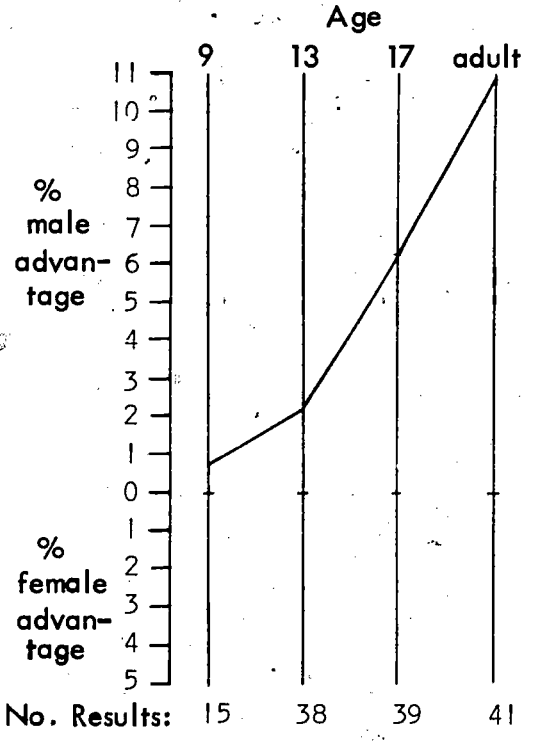
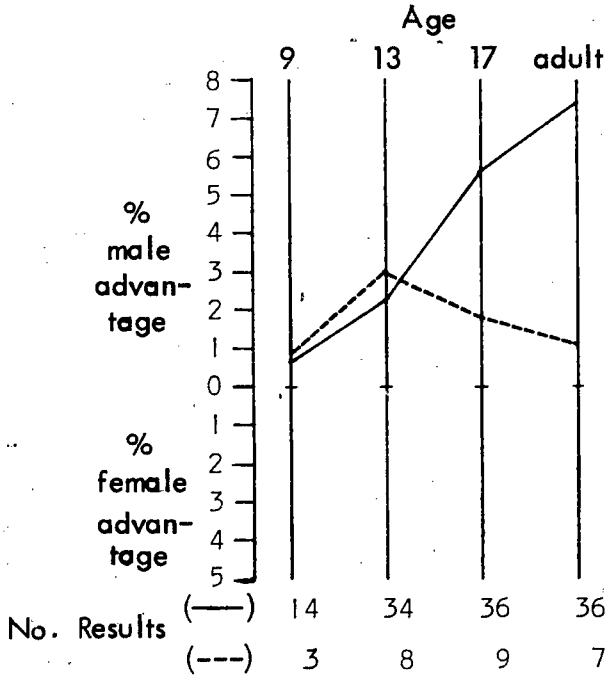


EXHIBIT 10. Median Sex Differences for Goal D



Sex differences for Goal D, and closely related exercises for other goals, vary according to the type of knowledge assessed. Exhibit 11 shows median sex differences separately for all exercises concerned with knowledge of specific facts about government and for all

EXHIBIT 11. Median Sex Differences for All Exercises Assessing Knowledge of Specific Facts About Government (——), and All Exercises Assessing Understanding of Basic Principles of Democracy and Government (----)



exercises concerned with understanding the basic principles of democracy and government.

On those exercises that assessed knowledge of specific facts about government, there was a male advantage increasing with age in a pattern very similar to that for Goal D as a whole (compare Exhibits 11 and 10). On exercises dealing with the broad principles of democracy, law and government, the same pattern emerged for ages 9 and 13, but for ages 17 and adult, the sex difference diminished instead of increasing.

Goal E: Participate in Effective Civic Action

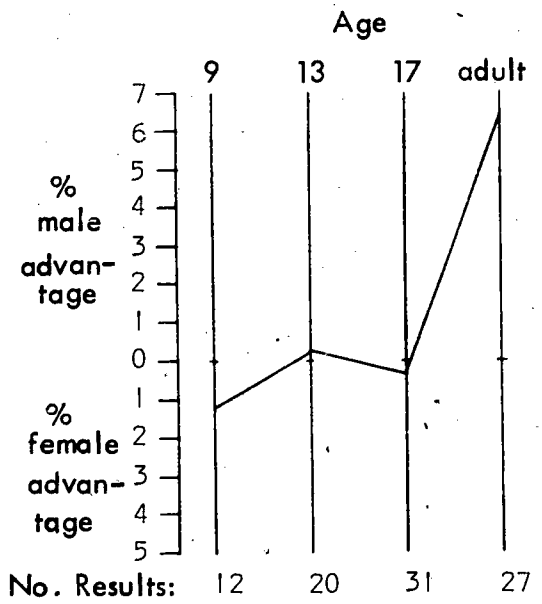
At the school ages, males and females did about equally well overall on Goal E. The median for adult men, however, is over 6% higher than for women. When Goal E is broken down, more interesting differences appear. Women surpassed men by 3% to 5% in taking civic action through organizations. On the other hand, men exceeded women by 4% to 6% in communicating their views to officials or to the public. Adult and 17-year-old males also knew more ways to try to influence government decisions than did females, and they felt more capable of doing so (see Exhibit 12).

In group tasks where cooperation among several peers was necessary for success, more boys than girls at ages 9 and 13 disrupted the task or broke the rules. No such difference was found at age 17, nor did the sexes differ at any age in how often they contributed positively to the group effort.

Goal F: Understand Problems of International Relations

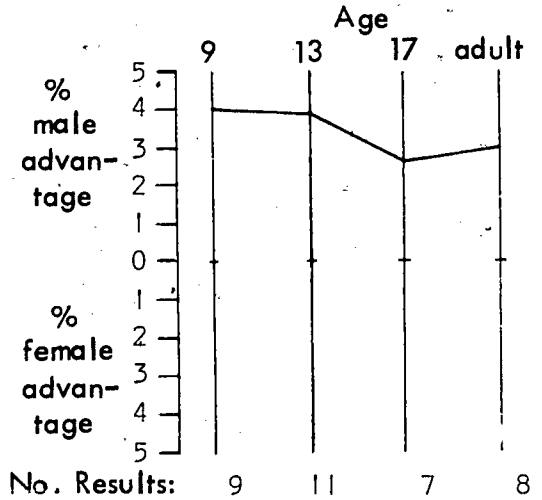
Males showed a 3% to 4% advantage over females on Goal F across the four ages. The difference varies according to type of exercise and age, however. Among 13-year-olds and

EXHIBIT 12. Median Sex Differences for Goal E



adults, males knew more about current wars and world turmoil while females were at least as successful as males at suggesting ways to seek peace. But at age 17, this pattern is not evident; in fact, 11% more males than females named three ways to avoid war, while females knew as much about current wars as males (see Exhibit 13).

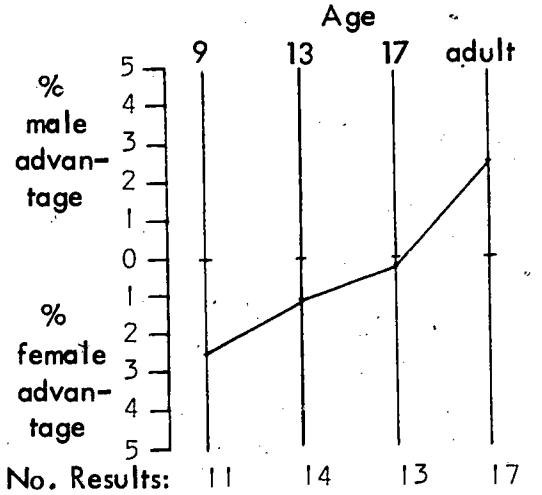
EXHIBIT 13. Median Sex Differences for Goal F



Goal G: Approach Civic Decisions Rationally

Male and female achievements were nearly equal for Goal G, although there is a slight tendency for the median difference to favor females at age 9 and males at the adult level (Exhibit 14). Results do not confirm the stereotype of the rational male versus the emotional woman. At age 13, the two results favoring girls by about 5% involve explaining the rational advantages of allowing different viewpoints to be expressed (G10, G56). Men recognized urban problems, the purpose of unions and the implications of automation more often than women.

EXHIBIT 14. Median Sex Differences for Goal G



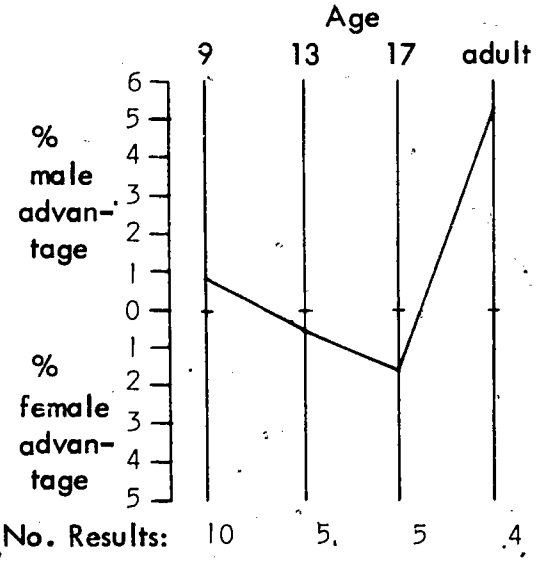
Goal H: Take Responsibility for Own Development

Sex differences on Goal H were quite small at the school ages, as shown in Exhibit 15. At the adult level, more men than women were continuing their education in some way, which accounts for the difference in the Goal H medians.

Goal I: Help and Respect Their Own Families

There is a dramatic median advantage of 16% for adult women on Goal I, which is compat-

EXHIBIT 15. Median Sex Differences for Goal H



ible with the cultural role expectations for adult women with families. This difference is based on six results, all assessing parents' involvement in their children's education. Five of these differences favor women, by margins of 13% to 22%. At age 9, the median Goal I difference indicates that about 5% more girls than boys help with the care of younger brothers and sisters and work several hours a week around the home. It should be noted that for all results concerning care of children in the family, percentages are calculated starting only with those respondents whose families have children in the appropriate age range (see Exhibit 16).

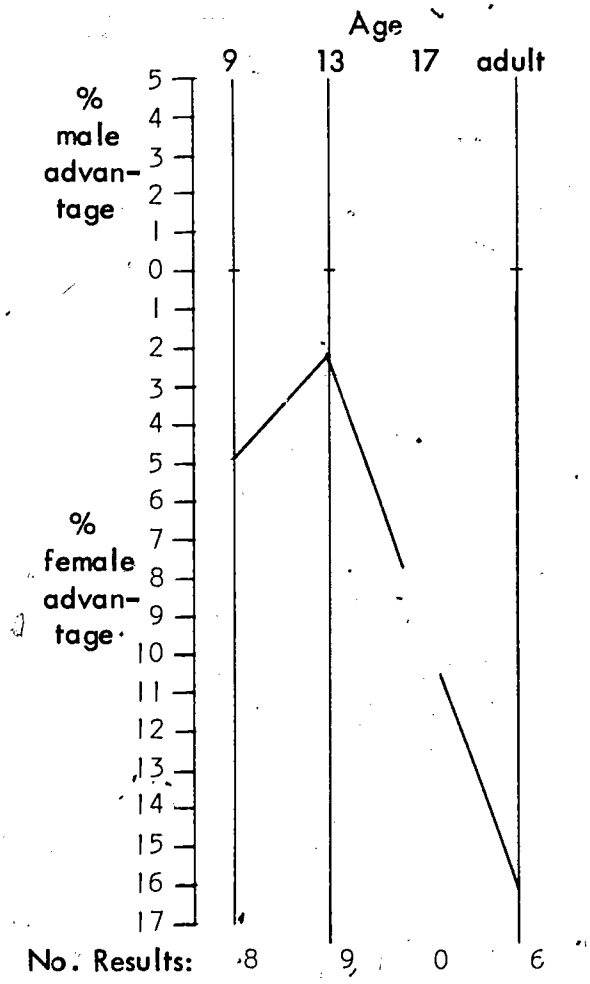
Child rearing probably demands more time than any other citizenship achievement reported, a fact that should be taken into account in appraising the total set of sex differences for citizenship results.

Other Results

Knowledge of Civic Issues and Problems

Knowledge of civic issues and problems such as war, discrimination and urban crowding was assessed as part of several goals. The median sex differences for all such results

EXHIBIT 16. Median Sex Differences for Goal I

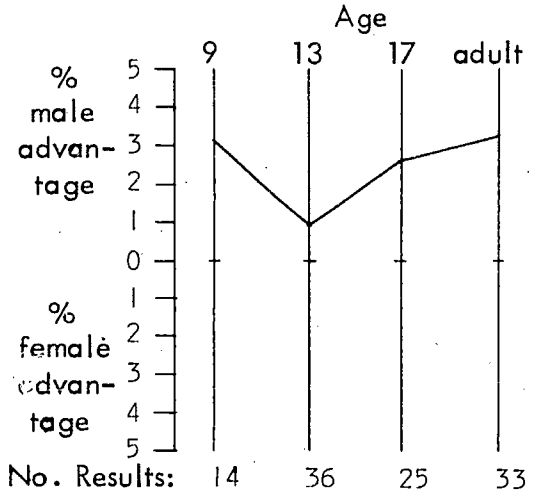


combined appear in Exhibit 17. There is a male advantage of about 3% for all ages except age 13 where the difference dips to 1%.

Summary of Sex Differences

The citizenship achievements of the two sexes often differ by 5% and, in a few instances, by more than 20%. The differences follow diverse patterns for different citizenship goals and types of achievement, often varying considerably across ages. The median sex differences favor males at most ages for four goals (B, C, D, F) in which most objectives concern knowledge of law, government and

EXHIBIT 17. Median Sex Differences for All Exercises Assessing Knowledge of Civic Issues and Problems



international problems and support of individual rights. Women exceeded men substantially in Goal I, which mainly concerns care of family in educational ways. For the other four goals, there is no consistent sex difference across ages.

How well are Americans able to compute?

To provide data on Americans' skills and knowledge in mathematics, the National Assessment of Educational Progress conducted an assessment in mathematics during the 1972–73 school year. Ability in computation was only one of the many mathematical areas assessed.

Neither sex has a clear advantage in computational ability since results for males and females varied at the different age levels. Male and female overall performance differed by only 1 percentage point at ages 9 and 17; girls had approximately a 3-percentage-point advantage at age 13, while for adults, males outperformed females by about 4 percentage points.

Table 4 shows the number of exercises on which each sex had a higher percentage of success. Females performed noticeably better than males at age 13 while males had a similar advantage at the adult level. Differences in performance for 9- and 17-year-olds are not nearly so marked; females show a slight advantage at age 9 while males have a small edge at age 17.

At all ages, males generally did better than females on the more difficult exercises and on word problems. Females tended to do better on "pure computation" exercises demanding the application of a specific mathematical process. For example, 9-year-old males did better than females on such exercises as the difference between a rocket target and the actual landing point, apportioning an equal number of dog biscuits over a number of days and determining how many words a girl missed on four spelling tests. Nine-year-old females, on the other hand, were more successful with exercises on adding, subtracting and multiplying with one-place regrouping. Males at the three older age levels had a higher performance level on the exercises involving difference in air temperatures and time required for a car to travel a certain distance. Females had an advantage in decimal subtraction and multiplication at ages 13 and 17 and in decimal addition at all three of the older age levels. There were, of course, some exceptions to these generalizations at every age level.

TABLE 4. Number of Exercises on Which Males and Females Were More Successful

	Age 9	Age 13	Age 17	Adult
Number of exercises administered	33	37	33	18
Number of exercises on which more males answered correctly	13	6	18	14
Number of exercises on which more females answered correctly	20	31	15	4

The National Assessment of Educational Progress was designed to allow comparisons of performance among a number of different population groups. For example, at every age level the performance of males on the science exercises may be compared with that of females. Do boys and girls perform equally well on science exercises? If not, do differences appear for all science exercises, or only for certain kinds of exercises?

To find answers to these questions, we first consider, for every science exercise, the difference between the percentage of success for males and that for females.

The distributions of differences for all exercises, at ages 9, 13, 17 and adult, are presented in Exhibit 18. In this exhibit, the length of each bar represents the number of science exercises that show a given difference between percentage correct for males and females. A difference of *plus* 7% indicates that 7% more males than females got the correct answer. A difference of *minus* 7% means that 7% fewer males than females got the correct answer.

A striking feature of the distributions in Exhibit 18 is the large spread of male-female differences for adults, ranging from one exercise on which the correct answer is given by 35% more men than women to another exercise on which the difference is in favor of women by 25%. In sharp contrast, age 9 sex differences spread much less, ranging from an exercise on which boys do 8% better than girls to one where girls do 5% better than boys.

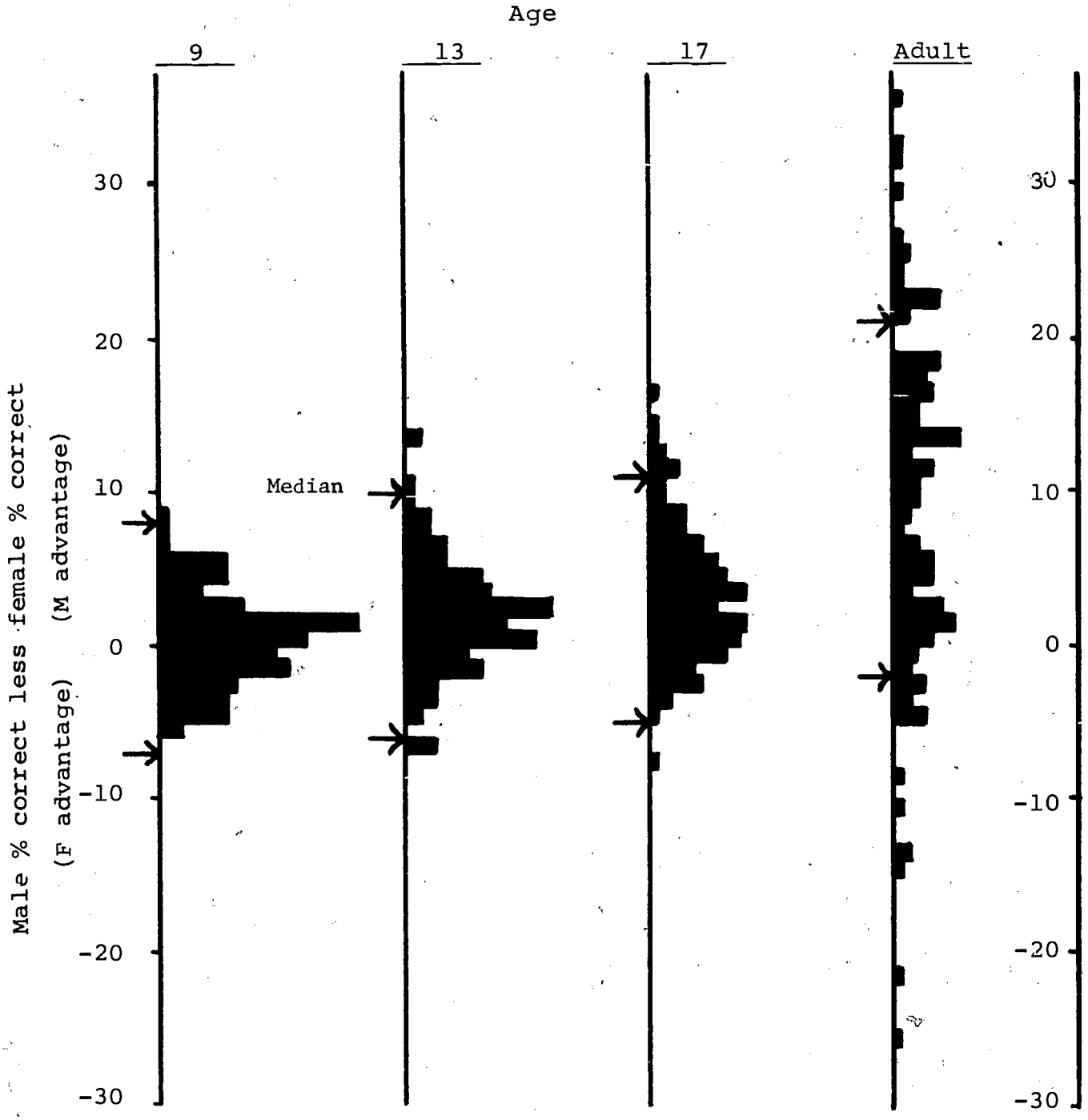
For adults, it is clear that performance on a number of science exercises is decisively better for males than for females, while for a number of other science exercises, females perform much better than males. At ages 13 and 17, the range of sex differences is considerably smaller than for adults but still slightly greater than at age 9.

The median male-female difference for all science exercises is shown on Exhibit 18 for each age level. These medians show a progressive increase with age — 0.5% at age 9, 1.7% at age 13, 3.0% at age 17 and 9.7% for adults. With increasing age, then, there is an increasing tendency for males to perform better than females on science exercises.

The arrows in Exhibit 18 show the cutting points beyond which exercises are worth individual discussion as atypical exercises. These exercises will be discussed individually later, where we find that the exercises on which male performance is atypically superior are, without exception, physical science exercises. For exercises assessing knowledge of biological science, the typical male-female difference is small. On some biological science exercises, performance of females is better than that for males.

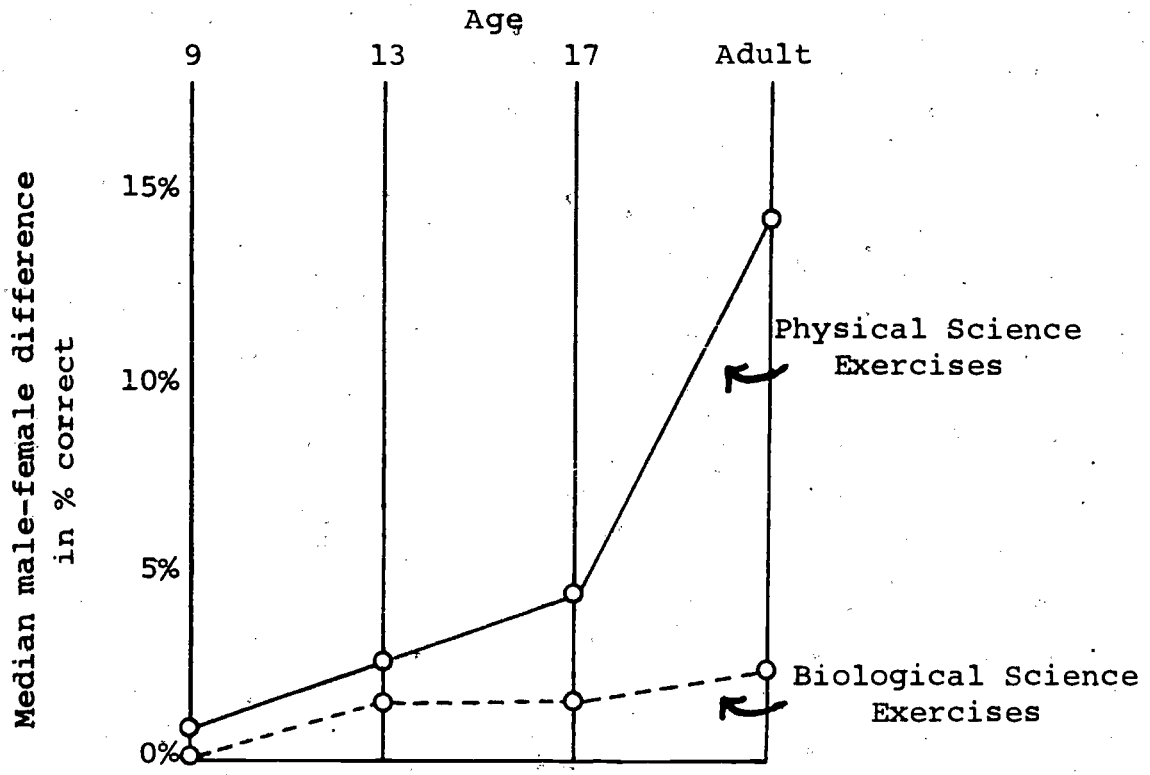
The relation between age and the male-female difference on typical physical or biological science exercises is shown in Exhibit 19. For biological science exercises, the median sex difference remains small at all four age levels, rising from 0.1% at age 9 to 2.3% for adults. The median sex difference for physical science exercises, on the other hand, rises from a modest 0.8% at age 9 to 14.2% for young adults. These results suggest that the increasing tendency with age for males to perform better than females on all science exercises is largely accounted for by the exercises in physical science. At every age studied, males and females perform more nearly alike on

EXHIBIT 18. Male-Female Differences in Percentage Correct for All Science Exercises at Four Age Levels



	9	13	17	Adult
No. of Exercises	145	122	124	119
Median difference	0.5%	1.7%	3.0%	9.7%

EXHIBIT 19. Median Male-Female Differences for Physical and Biological Science Exercises at Four Age Levels



exercises that assess knowledge of biological science.

Among the biological science exercises at each age, one or more are designed to assess knowledge of human birth or reproduction. For example, one exercise (Exercise 101 at age 9 and Exercise 201 at age 13) asks, "Where does a human baby come from?" Another exercise (Exercise 330 at age 17 and Exercise 416 for adults) asks, "On the average, in human females, the egg is released how many days after menstruation begins?" Also appearing at age 17 (Exercise 325) and at the adult level (Exercise 420) is the question "What is the function of the placenta in a pregnant human female?" For these and other similar but unreleased exercises, it is of interest to look at male-female performance differences.

Table 5 displays these male-female differences.

The table shows that for two exercises, one at age 13 and one at age 17, boys get the correct answer more often than girls. For three exercises, one at age 9, one at age 13 and one at age 17, there is no sex difference in performance. For eight exercises, two at age 17 and six at the adult level, the percentage correct for females is higher than that for males. It is noteworthy that all of the adult exercises relating to human reproduction show a performance difference in favor of women. Even on exercises referring to elements of the reproductive system in the human male, women give the correct answer more often than men.

TABLE 5. Male-Female Difference in Percent Correct for Every Exercise Relating to Human Birth or Reproduction (Negative Differences Imply Females More Often Correct)

Age			
9 (1 exercise)	13 (2 exercises)	17 (4 exercises)	Adult (6 exercises)
0%	2%	5%	- 2%
	0%	0%	- 2%
		-3%	- 4%
		-8%	-13%
			-15%
			-25%

Male-female differences can also be analyzed in terms of the objectives the exercises were designed to assess. When this is done, we find that exercises for Objective I (Know Fundamental Facts and Principles of Science) and Objective II (Possess the Abilities and Skills Needed to Engage in the Processes of Science) yield median sex differences indicating a male advantage at all four ages. At every age, the difference in favor of males is at least slightly greater for the typical exercise that assesses Objective II than for the typical exercise that assesses Objective I.

At age 9, the median difference in performance between boys and girls over all 145 science exercises is 0.5%. This is negligibly different from 0%. Also, as seen in Exhibit 18, the boy-girl differences are approximately symmetric about zero. We recognize that such differences are subject to sampling error, and that nonzero differences may be the consequence of sampling fluctuations. Thus, even with no general tendency for boys to perform better or worse than girls, some observed differences would be positive and some would be negative, clustered more or less tightly around zero. The actual distribution for age 9 in Exhibit 18 closely resembles the distribution to be expected if there were no systematic sex differences in performance.

Nevertheless, one science exercise at age 9 is atypical, in the sense that the boy-girl difference in performance is more distinct from the median difference for all exercises than we expect, based solely upon sampling variability. This is released Exercise 120, on which 76% of the boys give the right answer compared with 68% of the girls. The exercise requires knowledge that a moving block striking a stationary block from the left will cause the latter to move to the right.

At age 13, the median difference between boys and girls, over all 122 science exercises, is 1.7%. For 90 of these exercises, or 74% of the total number, boys perform better than girls.

From Exhibit 18, it may be seen that performance of boys exceeds that of girls by at least 10%, the upper cutting point for male-female differences, for three exercises. Of these three exercises, one has been released (214) and two remain unreleased so that they may be administered again to 13-year-olds when science is reassessed. Exercise 214 asks where a two-pound weight must be hung on the left side of a (pictured) beam to make the beam balance when a four-pound weight has been hung on the right side of the beam. Among boys, 61% give the correct response, while 48% of the girls answer correctly.

Both unreleased exercises for which the observed sex difference is at least 10% also are apparatus exercises; respondents are to find the correct answers by performing experiments in elementary physics. At age 13, then, exercises on which boys most clearly perform better than girls are exercises that pertain to simple experiments in physics.

Another four exercises at age 13, all unreleased, are atypical, showing about 6% (the lower cutting point for differences) higher performance by girls. Perhaps these exercises only appear atypical due to unusually large sampling error.

For 17-year-olds, the distribution of sex differences over the 124 science exercises is similar to that for 13-year-olds (Exhibit 18). The median difference is higher at age 17, 3.0%, and for a greater proportion of exercises (78%), boys perform better than girls.

For nine exercises, the difference between percent of success for boys and girls is at least 11%. Two of the exercises that show a male-female difference of at least 11% were released, and seven remain unreleased for readministration. The released exercises are: 320, which asks how long it will take for a boat travelling at five miles per hour down a river that flows at five miles per hour to reach a point 10 miles downstream (males, 61% correct; females, 47% correct); and 341, an apparatus item requiring placing a weight on a beam so as to balance the beam (males, 82% correct; females, 68% correct).

All seven unreleased exercises that display male-female differences of at least 11% at age 17 involve tasks similar to those of the released exercises in that the correct answer is more likely to be known by a person with knowledge of physics. Four of them require the completion of a simple physics experiment. As at age 13, then, those exercises on which 17-year-old males outperform females are physical science exercises.

At age 17, one exercise atypically displays a sizable difference in favor of females. For this unreleased exercise, which taps knowledge of the reproductive system in the human female, 39% of the 17-year-old males and 47% of the females give the correct answer.

Many more exercises at the adult level show atypical sex differences than do exercises at the younger ages. The median difference in percent of success for males versus females is 9.7%. For 82% of the 119 science exercises, male performance exceeded performance of females. However, several science exercises at the adult level are associated with a much higher level of success for women than for men.

The total number of adults to whom a given exercise was administered is smaller than the comparable numbers for 9-, 13- or 17-year-olds. Typically, an exercise was administered to more than 2,000 respondents at the younger ages but only to about 850 adults. Consequently, at the adult level, a larger observed male-female difference is required in order that we be confident that the observed difference represents other than a sampling departure from the overall median difference. At the adult level, we give special attention only to exercises for which the observed male-female difference is in favor of males by 21% or more, or in favor of females by at least 2%.

For 17 of the adult science exercises, at least 21% more males than females gave a correct answer. For another 17 exercises, performance of females was at least 2% better than performance of males.

Of the 17 exercises for which males show a decisive advantage, 6 were released and are listed by exercise number in Table 6. Of the 17 exercises for which females performed at least 2% better than males, 10 were released and are also listed in Table 6.

As for exercises at ages 13 and 17, the adult exercises for which success of men is most decisively superior to success of women are those assessing knowledge of electronics and physics. Exercise 413, for which 33% more males than females got the right answer, requires knowledge that most of the chemical energy of gasoline burned in a car is converted to heat. Exercise 408, with a male-female difference of 32%, is the same as Exercise 323 at age 17 and asks about the purpose of a fuse in an electrical circuit. Exercise 415, with a sex difference of 31%, is identical to Exercise 320, administered at age 17. One must determine the time it will take a motorboat traveling five miles per hour on a river flowing five miles per hour to reach a point 10 miles downstream. Exercise 410 (26% difference) is correctly answered by indicating that an electric current involves the movement of electrons in a copper wire. Exercise 438

TABLE 6. Released Exercises at the Adult Level With Atypical Sex Differences

Exercise No.	% Correct Males	% Correct Females	% Difference
413	77	44	33
408	81	49	32
415	71	40	31
410	76	50	26
438	83	61	22
430	33	11	22
407	67	69	-2
412	58	61	-3
402	89	93	-4
404	77	81	-4
405	69	73	-4
406	67	72	-5
441	43	54	-11
416	49	62	-13
418	41	62	-21
420	31	56	-25

(22%) is the same as Exercise 341 at age 17, an apparatus exercise that requires placing a weight on a balance beam so as to balance the beam. Exercise 430 requires knowledge that if two light waves are traveling in a vacuum, the wave with the higher frequency will have the shorter wavelength (22% male-female difference).

The exercises that are atypical in favor of women are very different from these physical science exercises. Exercise 420 asks the function of the placenta in a pregnant human female (to carry nourishment to the baby); 56% of females gave the right answer, compared with 31% of males. Exercise 416 requires knowledge that, on the average, an egg is released in human females 14 days after menstruation begins; the sex difference is 13% in favor of females.

On Exercise 406, 5% more women than men state that adrenaline acts as a stimulant to the heart. Women perform better than men by 4% on an exercise (405) assessing knowledge of the effects of sterilization in human males and on an exercise (404) requiring knowledge that whooping cough cannot be inherited.

Women outperform men by 4% in displaying knowledge that the sex of a human baby is determined by chromosomes (Exercise 402) and by 3% in indicating that transplant surgery might be most successful if the donor is an identical twin (412). More women than men (2% more) also recognized that, in mammals, sperm are produced by the testes (407).

Both of the remaining exercises (441 and 418) on which women did better than men offer special problems of interpretation. For Exercise 441, an apparatus exercise administered to young adults, performance of women (54%) is almost 11% higher than that for men (43%). The apparatus consists of a pendulum — a weight on the end of a string. Given a watch with sweep second hand, the task is to find how long it takes for the weight to swing back and forth 10 times. When a respondent interpreted "back and forth" as a swing only to the left or to the right, something that was not uncommon, the answer was scored incorrect. When this same task was administered to 17-year-olds (Exercise 344) and to 13-year-olds (Exercise 237), boys performed better than girls, by 9% in each case. Misinterpretation of "back and forth" may have played a substantial part in this anomaly.

Exercise 418, on which the difference between correct response for women and men is 21%, also presents special problems of interpretation; groups that generally perform well on other science exercises tend to give a wrong answer to this one. The respondent is told that a five-pound rock is dropped from a cliff 500 feet high. The longer the rock falls, the greater is its: acceleration, potential energy, speed, total energy or volume? "Acceleration" and "potential energy" are both popular answers among groups of respondents who perform well on other physical science exercises. Both of these answers are wrong. The correct answer is "speed," the answer supplied by 62% of women and by 41% of men.

The content of the unreleased adult exercises that display atypical male-female differences resembles that for the released exercises. All 10 of the unreleased exercises on which men succeed at least 21% more often than women tap knowledge of physics. Of the 7 unreleased exercises on which women succeed at least 2% more often than men, one asks a question concerning the fertilization of an egg in a human female, and another concerns the development of the human embryo; two require familiarity with human diseases, one refers explicitly to knowledge of recipes and clothing design and the other two are more general science exercises, one from biology and one from astronomy.

Physical Science Versus Biological Science

At each age level, exercises have been classified on the basis of their content into classes of "physical science" or "biological science."

(Some exercises at each age assess general science facts, principles or attitudes; they could not be classified either as physical or biological science and are not considered further in this section.) Comparisons of the distributions of male-female performance differences at each of the four age levels appear in Exhibits 20 to 23.

Exhibit 20 shows that, at age 9, sex differences are distributed nearly symmetrically about zero for both physical science exercises and biological science exercises. This finding is consistent with the general result that 9-year-old boys and girls perform about equally well on the National Assessment science exercises.

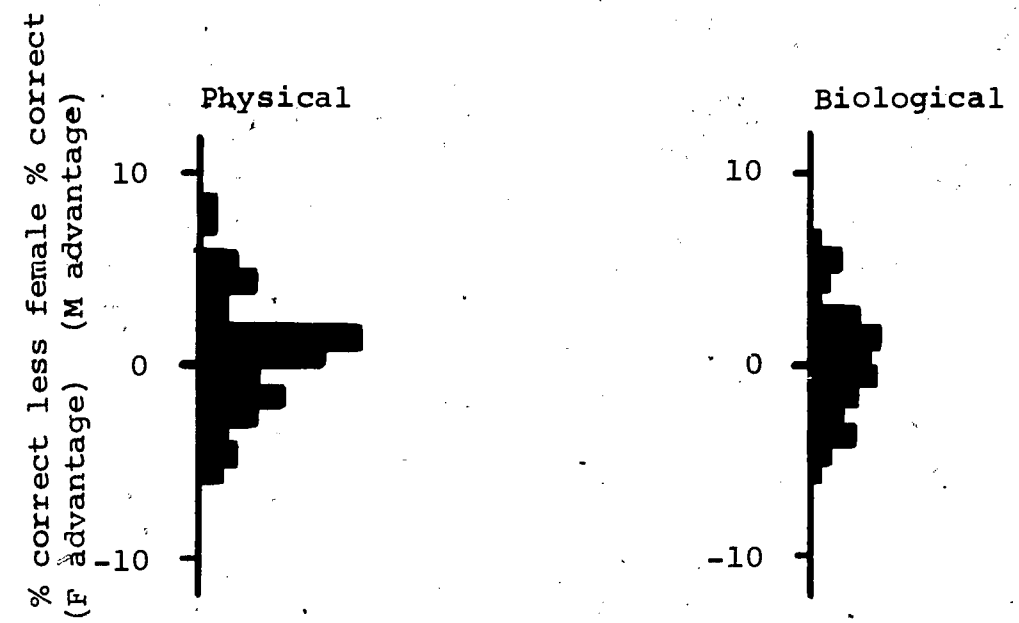
Exhibit 21 shows the comparable distributions for age 13. Sex differences for physical and biological science items display similar distributions. However, as noted earlier, the only exercises on which boys perform at least 9% better than girls are physical science exercises.

Results for age 17 are shown in Exhibit 22. At this age, it is clear that all exercises on which boys perform much better than girls are physical science exercises. The results provide no evidence for any systematic sex difference on biological science exercises.

For adults, the effects noted for 17-year-olds are accentuated (Exhibit 23). The vast majority of exercises for which men perform much better than women are exercises assessing knowledge of physical science.

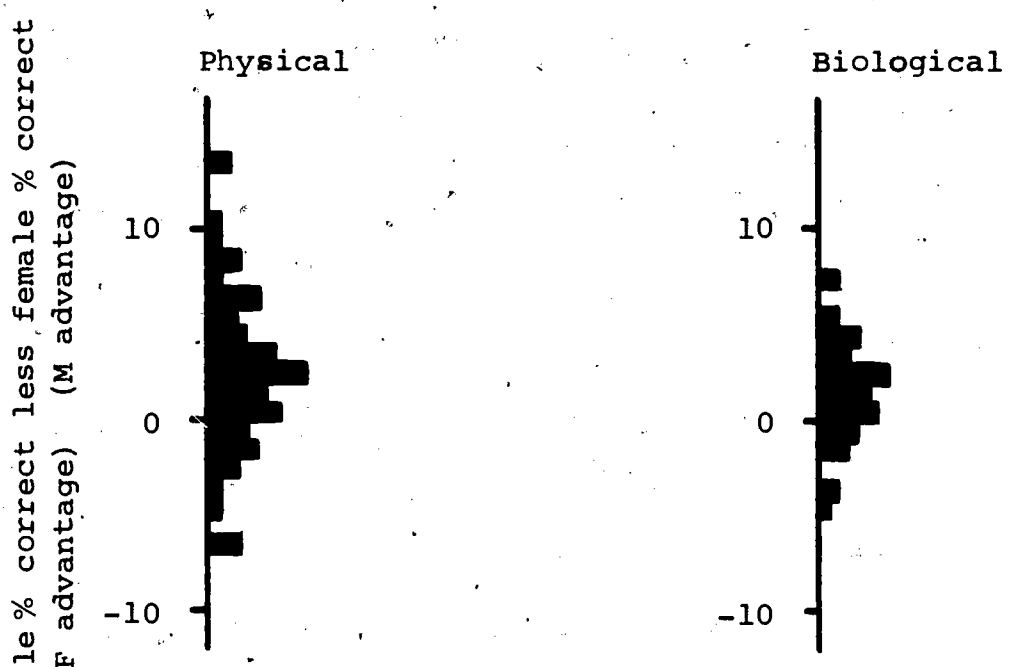
The pattern over-age of medians for physical and biological science exercises is shown in Exhibit 19, which clearly shows that the advantage of males over females on physical science exercises increases with age. This finding is consistent with an expectation one might have based upon knowledge of a different choice of science curriculum by boys and girls in high school. Boys and girls alike tend to be exposed to physical and biological science topics in elementary grades. In high school, science courses — physics, chemistry, biology, etc. — more often are elective courses. Boys more frequently than girls choose to elect courses in physics and chemistry. The differential exposure of boys to a physical science curriculum might explain the advantage of boys and young men over girls and young women on the typical exercise that assesses physical science.

EXHIBIT 20. Male-Female Differences for Physical and Biological Science Exercises -- Age 9



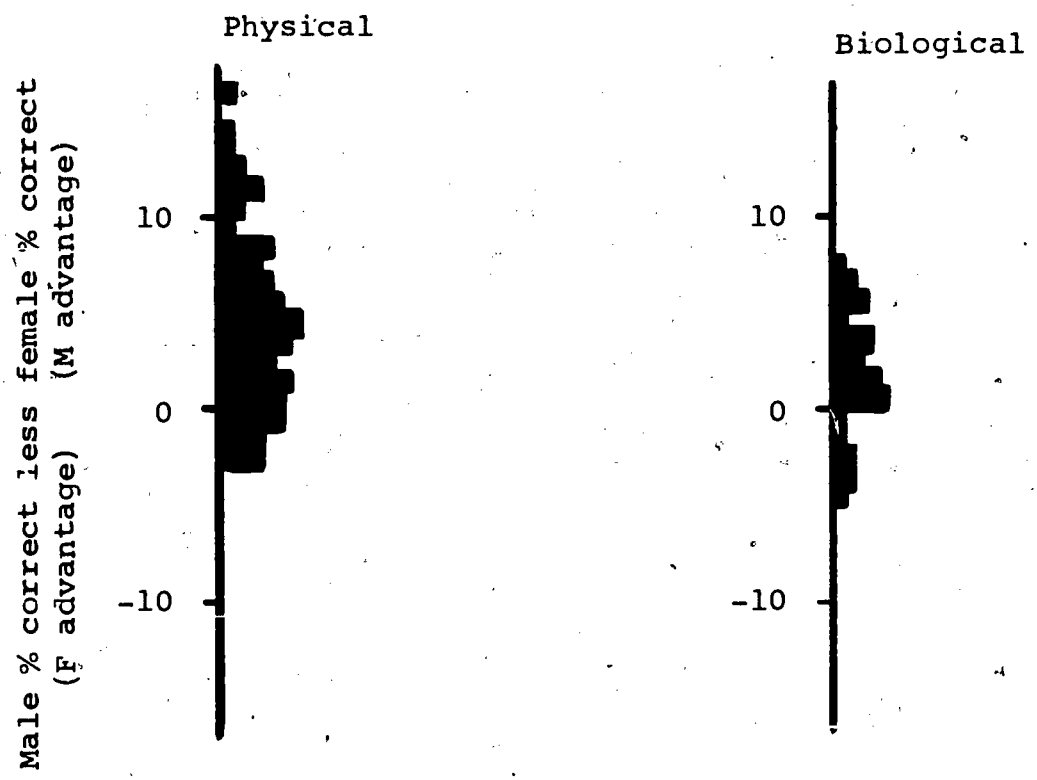
	Physical	Biological
No. of Exercises	78	48
Median difference	0.8%	0.1%

EXHIBIT 21. Male-Female Differences for Physical and Biological Science Exercises -- Age 13



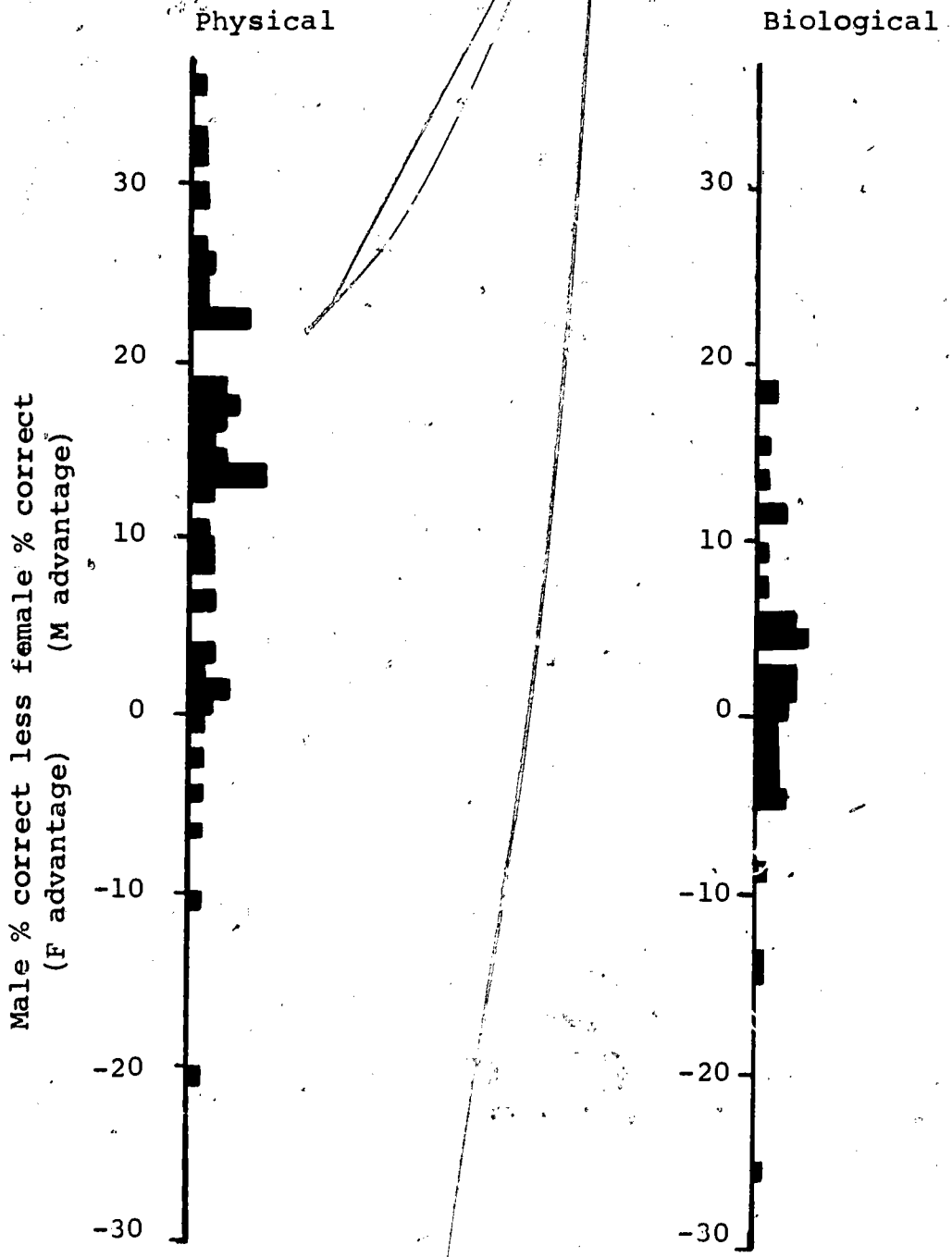
	Physical	Biological
No. of Exercises	67	39
Median difference	2.4%	1.5%

EXHIBIT 22. Male-Female Differences for Physical and Biological Science Exercises -- Age 17



	Physical	Biological
No. of Exercises	78	33
Median difference	4.2%	1.6%

EXHIBIT 23. Male-Female Differences for Physical and Biological Science Exercises -- Young Adults



	Physical	Biological
No. of Exercises	63	44
Median difference	14.2%	2.3%

Science Objectives and Other Ways to Classify Exercises

The finding of differential performance by males and females for physical science versus biological science exercises suggests that other ways to classify science exercises also may be sensitive to sex differences. One obvious way is by the science objective for which each exercise was designed.

Most of the science exercises written for each age level were intended to assess Objective I. Fewer exercises were administered for Objective II. (These include the apparatus exercises at ages 13, 17 and adult.) Still fewer exercises assessed Objectives III and IV. Table 7 shows the number of exercises at each age level prepared for each objective. Table 8 shows the median male-female differences for each set of exercises at the four age levels.

Such small numbers of exercises for Objectives III and IV were administered as to make an evaluation of sex differences for those groups of exercises unrewarding. Larger numbers of exercises for Objectives I and II were administered at every age.

At all four ages, the median male-female difference is positive (greater than zero) both for exercises assessing Objective I and for exercises assessing Objective II. However, at each age, the median male-female difference is greater for Objective II (Possess the Abilities and Skills Needed to Engage in the Processes of Science) than for Objective I (Know the Fundamental Facts and Principles of Science), although the differences between objectives are small except at age 17.

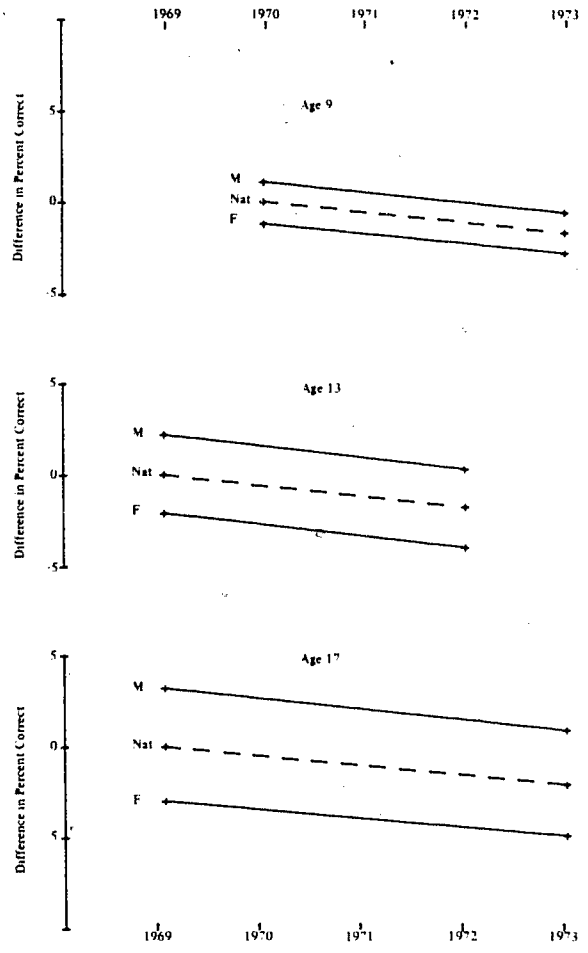
TABLE 7. Number of Exercises for Each Objective at Four Age Levels

	Age			
Objective	9	13	17	Adult
1	96	75	89	85
2	29	31	24	24
3	11	8	6	5
4	9	8	5	5
All exercises	145	122	124	119

TABLE 8. Median Male-Female Differences in Percentage Correct by Objective at Four Age Levels

	Age			
Objective	9	13	17	Adult
1	.3	2.0	2.6	9.4
2	1.0	2.4	5.2	9.5
3	1.6	-.5	.9	11.7
4	-1.2	.5	.2	5.5
All exercises	.5	1.7	3.0	9.7

EXHIBIT 24. Average Changes in Performance for Males and Females at Ages 9, 13 and 17



The percentages of males and females that answered a typical science question correctly declined at all three age levels. Furthermore, the gap between males and females remained constant. The performance of 9-year-old boys is, on the whole, 2 to 3% above that of girls. The average performance of 13-year-old boys is still 4% above that of girls. At age 17, average male performance is 6% above that of females.

KEY:

M – Male
F – Female

The median male-female difference favors females at all ages, and this advantage becomes more apparent at the higher age levels. Exercises having male-female differences departing atypically from the median differences occur at all age levels.

Differences Within Age Levels

A male-female difference on an exercise is obtained by subtracting the female percentage of success from the male percentage of success. Therefore, a positive difference indicates a male advantage and a negative difference indicates a female advantage for a given exercise. Exhibit 25 gives the distribution of male-female differences for all administered exercises at each age level. Each interval represents one percentage unit; for example, the first interval above 0 represents any exercise that has a male-female difference between 0.00% and 0.99%. Small departures from the median differences may be atypical in some cases, and large departures may not be atypical. This is due to the varying magnitude of the standard errors. Exercises written for Objective IV, most of which asked respondents to give a report of activities, are recorded to the left of the vertical line. Exercises written for Objectives I, II and III, which asked respondents to do something, are recorded to the right of the vertical line.

There is no apparent difference between males and females in what they do and what they say they do regarding writing behaviors. Both types of exercises tend to distribute around the median in about the same way. The dispersion of exercises is about the same at all age levels except for several extreme exercises.

Table 9 lists the exercises for which the male-female differences[1] are atypical, i.e., each departs from the median difference at that age level by at least 1.96 times its standard error.[2]

Age 9

The median male-female difference is -1.3%. Typically, therefore, slightly over 1% more females than males perform acceptably.

Of the 23 exercises administered, 3 show atypical departures from the median difference. When asked to indicate, from a list, which of several types of writing they had done for fun (R108), 3% more males than females said they had written at least one of the things listed. The remaining 2 atypical exercises are unreleased. Males performed better than females when asked to write about a kite. More females, however, wrote acceptable cheerful messages.

Age 13

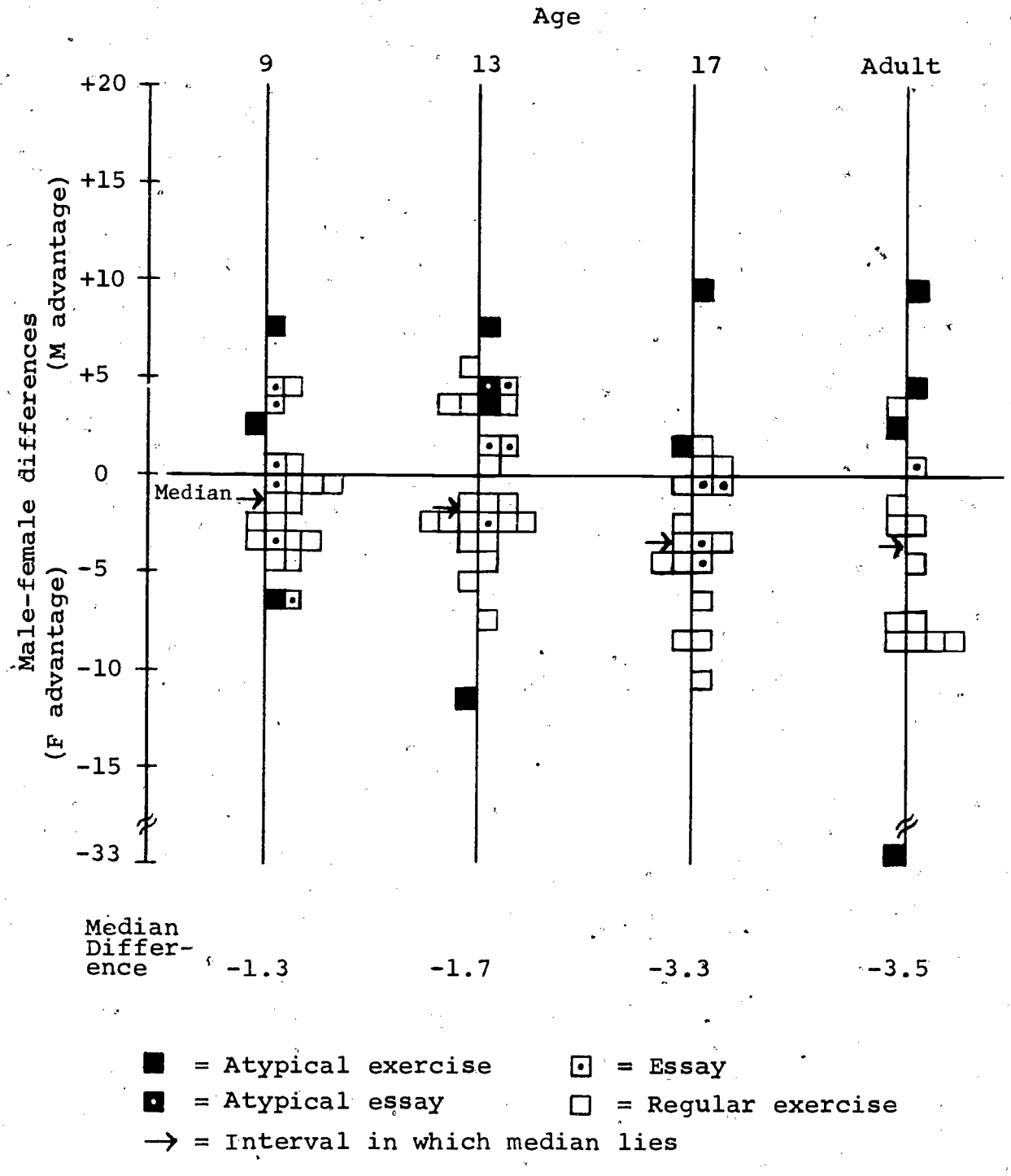
The median male-female difference is -1.7%. Typically, therefore, nearly 2% more females than males perform acceptably.

Four of the 26 exercises show atypical departures from the median difference. Males were able to write an acceptable letter, containing certain essential information, ordering a pair of seahorses (R204) more often than females

[1] These differences have been rounded to the nearest whole percent.

[2] A difference as large as 1.96 times its standard error is expected by chance about 5 times in 100.

EXHIBIT 25. Male-Female Differences by Age*



Exercises assigned to Objective IV are on the left of the vertical line for each age; exercises assigned to Objectives I, II and III are on the right.

TABLE 9. Atypical Male-Female Difference (Total Atypical Exercises = 13, Where 4 Expected by Chance)

Exercise Number	Male % Success	Female % Success	Difference (M % - F %)	Exercise Content* and Objective
		Age 9		
U604	33.3	25.6	8	----- (1)
R108	94.7	92.2	3	Written for fun? (4)
(Median difference)			(-1.3)	
U601	82.8	89.7	-7	----- (1)
		Age 13		
R204	49.1	41.5	8	Order seahorses (2)
R212	51.1	46.5	5	"Pen pal" (1)
U705	14.3	10.6	4	----- (2)
(Median difference)			(-1.7)	
U707	72.2	83.4	-11	----- (4)
		Age 17		
U801	57.1	47.3	10	----- (1)
R307	84.4	82.7	2	Written outside school? (4)
(Median difference)			(-3.3)	
		Adult		
R402	43.2	33.3	10	Describe accident (1)
U903	37.9	33.3	5	----- (2)
R406	98.8	96.2	3	Read during week? (4)
(Median difference)			(-3.5)	
U905	48.1	81.6	-33	----- (4)

**Content phrase ending with ? indicates Objective IV exercise; phrase in quotes indicates an essay; dashes indicate unreleased exercises.*

by 8%. When asked to write a friendly and newsy letter to a pen pal in another country (R212), 5% more males than females wrote middle quality essays or better. Two atypical exercises are unreleased, 1 showing more males than females able to perform a task related to business writing. More females than males gave acceptable responses when reporting a certain type of letter-writing activity.

Age 17

The median male-female difference is -3.3%. Typically, therefore, slightly over 3% more females than males perform acceptably.

Of the 19 exercises, 2 show atypical male-female differences. When asked to indicate, from a list, which of several types of writing they had done outside of school (R307), 2% more males than females said they had written at least one of the things listed. This is consistent with the results for the similar exercise administered at age 9, but the male advantage has decreased by about 1 percentage point. One atypical exercise is unreleased. Males performed better than females when asked to write a message involving two boys.

Adults

The median male-female difference is -3.5%. Typically, therefore, between 3% and 4% more females than males perform acceptably.

Four of the 16 exercises show atypical male-female differences. When asked to fill out a report of an automobile accident as depicted in a diagram (R402), 10% more males than females did so in an acceptable manner. When asked which of several categories of written material (varying from books and magazines to business letters and recipes) they had read during the past week (R406), 3% more males than females said they had read more than one category. Two atypical exercises are unreleased. More males than females acceptably performed a letter-writing task involving a male friend. More females than males gave an acceptable response when reporting a certain type of writing behavior.

Overlap Tasks

None of the tasks that were administered at more than one age level show atypical male-female differences at all the age levels at which they were administered. The occurrences of atypical differences form no particular pattern. Table 10 lists the overlap tasks that show at least one atypical difference. A specific exercise that departs from the median difference for its age level by at least 1.96 times its standard error is marked with one asterisk (*).

Classes of Exercises

On the basis of content or the type of task required, exercises were sorted into classes. The two major classes are:

Self-Report Exercises

These exercises were designed to learn something about respondents' attitudes about writing. All were classified under Objective IV, Appreciate the Value of Writing. They asked such things as whether respondents had written notes or letters, or which of a list of things — poems, words to songs, etc. — they had written other than as school assignments.

Performance Exercises

These exercises required that respondents perform some writing task or show knowledge about some aspect of writing. The performance exercises were divided into two additional groups.

Nonessay performance exercises. These exercises required respondents to do such things as fill out an application form, address an envelope, write a note or order containing certain information or to show knowledge indicating an awareness of the need for or importance of writing.

TABLE 10. Overlap Tasks Showing at Least One Atypical Difference

Overlap Task	Age	Exercise Number	Difference (M%-F%)	Exercise Content and Objective
4	17	R303	-10	Describe accident (1)
	Adult	R402	10*	
6	13	R204	8*	Order seahorses (2)
	17	R305	1	
	Adult	R405	-4	
9	9	R108	3*	Written outside
	13	R209	-3	school? (4)
	17	R307	2*	
b	13	U703	-1	
	17	U801	10*	------ (1)
e	13	U707	-11*	------ (4)
	17	U806	-9	
	Adult	U905	-34*	

Essay and letter-writing exercises. Respondents were asked to write about some topic, such as a forest fire or an admired person, or to write a letter to a hypothetical pen pal or road commissioner. All responses to this type of exercise were scored for overall writing quality. All but two of them were classified under Objective III; the two exceptions, classified under Objective I, were the letters. These letters were scored for overall quality, rather than whether they contained certain specific information.

When exercises are classified in these ways, the number of exercises for any one class becomes quite small (two self-report exercises at age 9; one letter for adults), and care must be taken not to overgeneralize about them.

Table 11 shows the median differences by age for these classes of exercises. Comparison of performance medians with the self-report medians shows small differences at ages 9 and 17, and slightly larger ones for 13-year-olds and young adults, where a greater-than-usual female advantage appears on self-report exercises. The median differences for essays depart from the results for nonessay performance exercises, boys doing as well as or even slightly better than girls on essays, except at age 17. When the responses for essays at all four ages are combined, there is no difference at all in performance.

Summary

The median male-female differences at the four age levels indicate that typical writing behavior favors females and that the female advantage increases with age. The largest increase in this advantage occurs between ages 13 and 17 (-1.7 to -3.3). Males and females typically do not differ in writing skills at ages

TABLE 11. Median Male-Female Differences for Various Classes of Exercises (Number of Exercises Shown in Parentheses)

	9	13	17	Adult	Ages
Self-report	-0.5 (2)	-2.5 (8)	-2.5 (5)	-5.0 (6)	-2.6 (21)
Performance	-1.3 (21)	-1.3 (18)	-3.3 (14)	-3.5 (10)	-1.7 (63)
Non-essay	-1.8 (15)	-1.8 (13)	-3.5 (10)	-4.5 (9)	-2.3 (47)
Essay	0.0 (6)	1.8 (5)	-2.0 (4)	0.5 (1)	0.0 (16)
All Exercises	-1.3 (23)	-1.7 (26)	-3.3 (19)	-3.5 (16)	-2.1 (84)

9 and 13 as much as they do at age 17 and the adult level. Even at these higher age levels, however, the female advantage is not shown on every exercise.

The female advantage disappears when one examines only essay exercises, with the exception of 17-year-olds. Over all four ages, there is no male-female median difference on essay exercises.

Of the 3 exercises that show atypical differences favoring females, 2 are identical at different ages, asking for a report about writing activity. The third exercise required respondents to perform a writing task. Seven of the 10 exercises that show atypical differences favoring males have some type of masculine content. Either males are mentioned in the exercise, or the exercise involves activities or interests generally considered masculine. Of the other 3 exercises, 2 asked what respondents had written outside of school; the other asked respondents what they read during the week. The common feature of these exercises was a request for a report of activities. All 7 exercises having masculine content requested respondents to do something.

Theme 1: Understanding Imaginative Language

Females consistently performed better than males at the three lower age levels, but at the adult level there was little difference between them.

On most exercises (13 of the 18) for 9-year-olds, females did better than males. This was especially noticeable on inference exercises, which required written responses, and form similarity questions. The female median difference was 1.5%, and the male median difference was -1.5% (see Exhibit 26).

On 20 of the 29 exercises for 13-year-olds, the percentage of success for females was above the national percentage. They did particularly well on the inference exercises, which required written responses. Males, with a -1.7% median difference, were generally below the females. But on some exercises — notably missing-line Exercise R103 and metaphor Exercises R114A and B — they did unusually well (see Exhibit 27).

Females consistently outperformed males at age 17. On 22 of the 27 exercises, they were above the national percentage of success and the males were below it. They did particularly well on the written part of the inference exercises and on form questions. Males did quite poorly on those items, relative to their usual performance. However, they did unusually well on metaphor Exercise R115B. The median difference for females was 1.3%, while for males it was -1.3% (refer to Exhibit 28).

Over the 21 exercises, adult males demonstrated an advantage over females 11 times. However, the difference between the sexes' median percentages is only .6%, so males cannot be said to have much of an advantage (see Exhibit 29).

Theme 2: Responding to Literature

The responses for Theme 2 were, for the most part, verbal and judgmental. Evaluations were not recorded as were those of other themes.

Theme 3: Recognizing Literary Works and Characters

The third theme includes most of the exercises written to satisfy the first of the three major literature objectives: Read Literature of Excellence. Five types of exercises assessed different kinds of recognition of literary works: the first presented the student with a picture from a well-known nursery rhyme, story or poem and asked him what work it illustrated; the second consisted of parodies of famous poems ("The Village Blacksmith," "The Charge of the Light Brigade" and "Sea Fever," for instance) and instructions to identify the source of the parody (these measured Objective IIB); the third type of exercise presented the respondent with an allusion to some literary work or figure and asked for identification of the allusion; the fourth presented people with a disguised myth or story pattern and asked for identification of its source; and the fifth consisted of straightforward questions about specific works and figures.

At each age level, females demonstrated a slight advantage over all the exercises taken together. However, on certain exercises there were very large differences between male and

EXHIBIT 26. Distribution of Group Differences for All Theme 1 Exercises -- Age 9

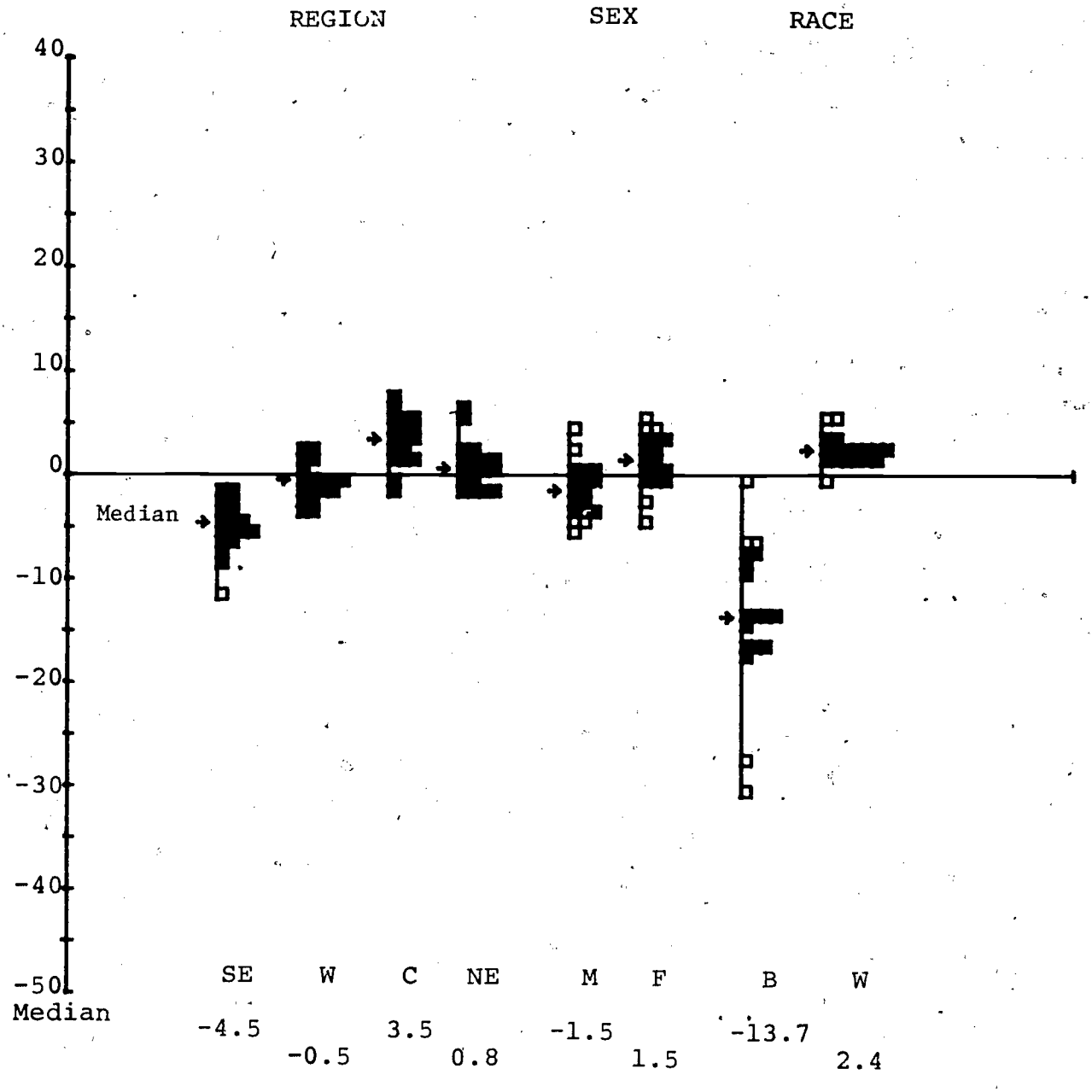


EXHIBIT 27. Distribution of Group Differences for All Theme 1 Exercises -- Age 13

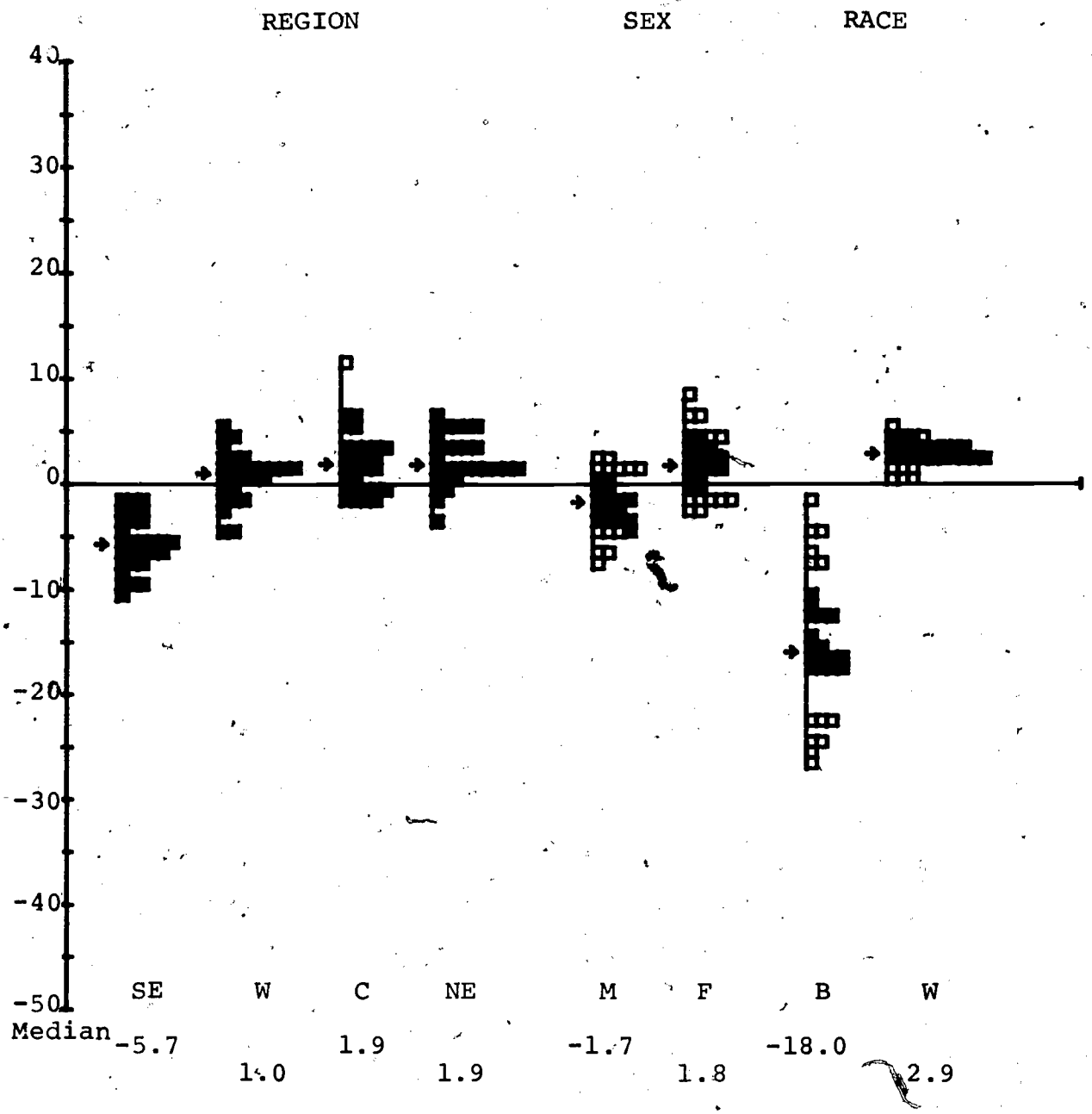


EXHIBIT 28. Distribution of Group Differences for All Theme 1 Exercises -- Age 17

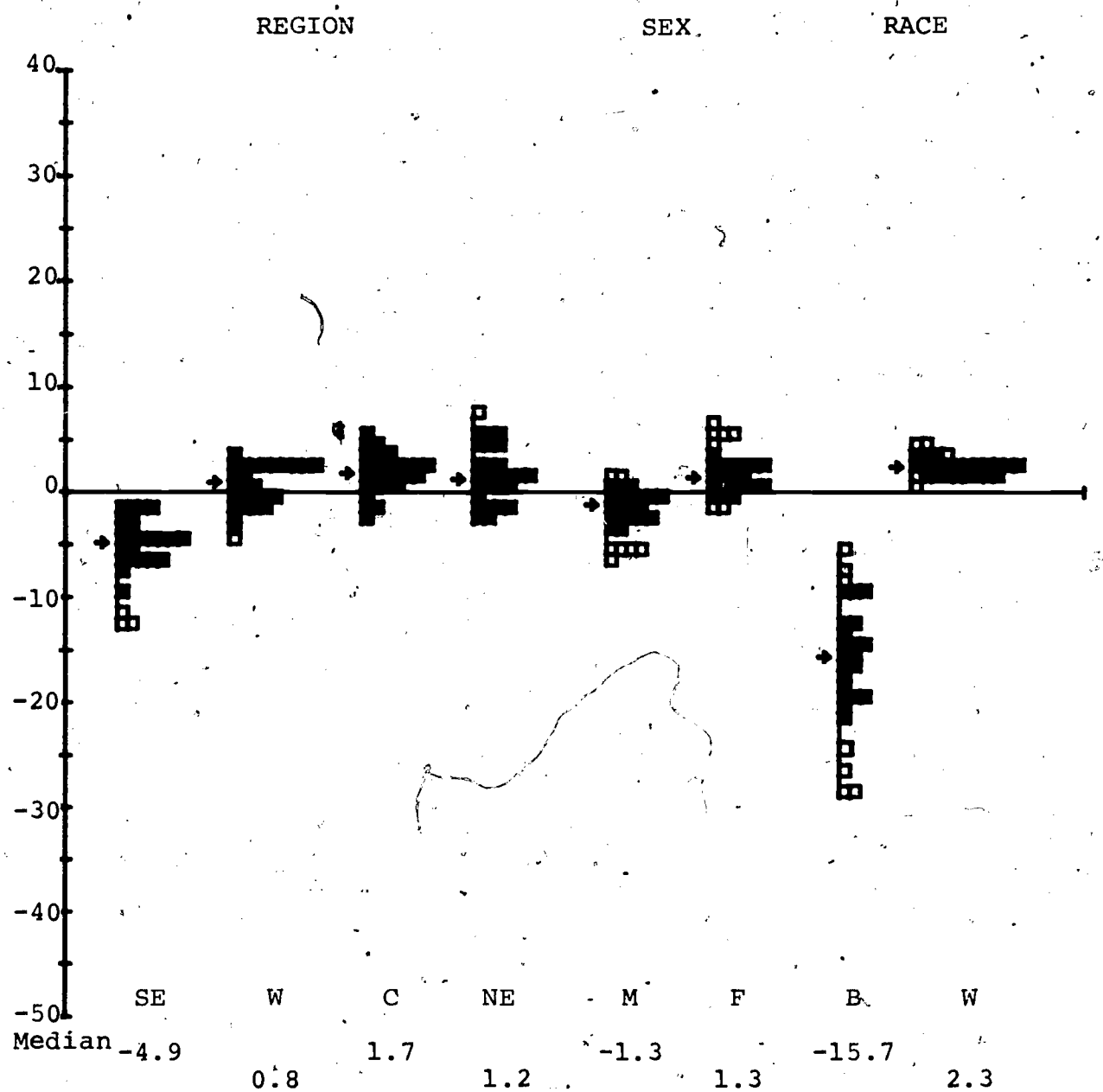
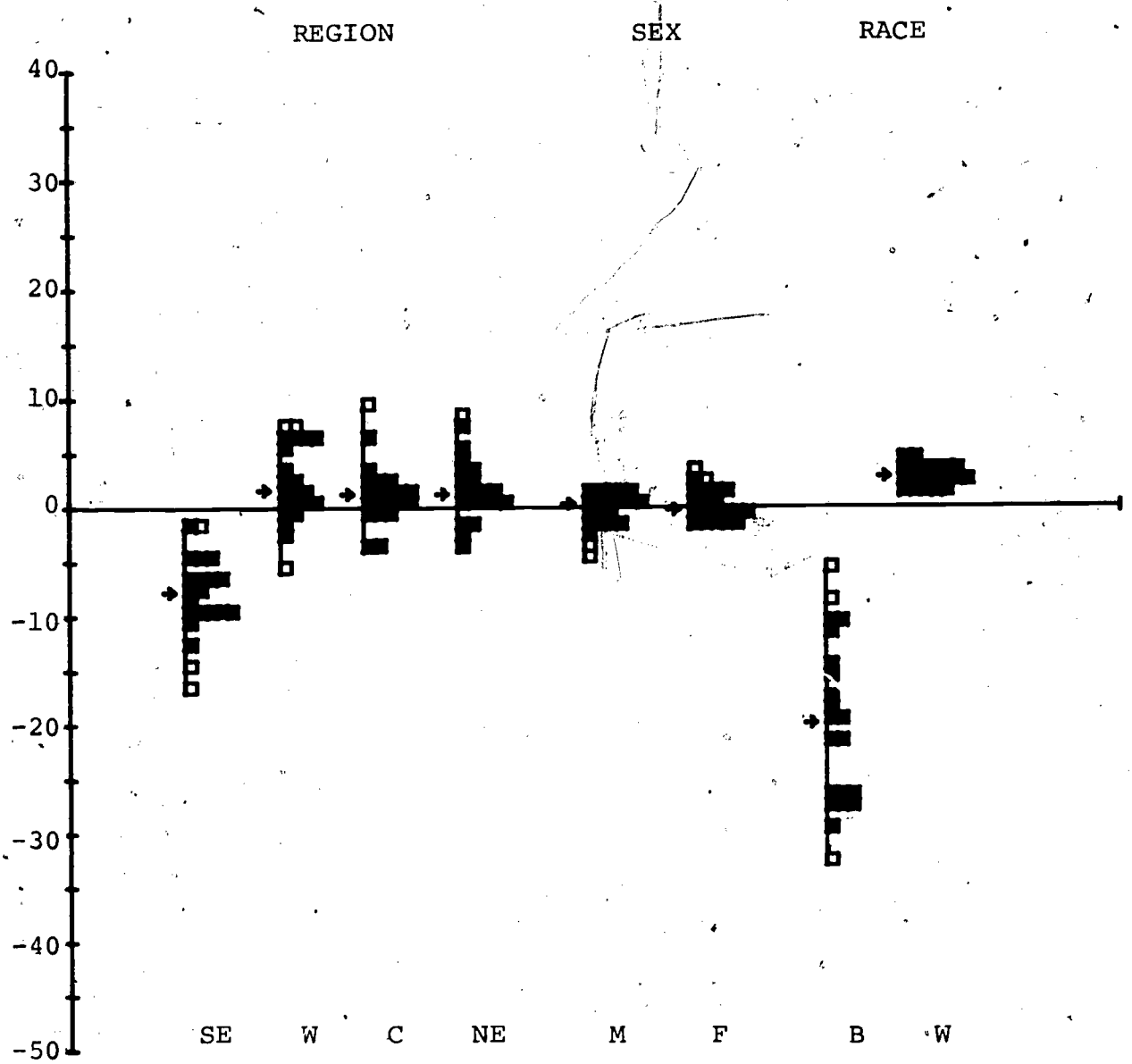


EXHIBIT 29. Distribution of Group Differences for All Theme 1 Exercises -- Adult



female performance. Nine percent more 9-year-old girls than boys recognized an illustration from *Winnie the Pooh*, for instance, and their advantage on *Alice in Wonderland* was even larger (10%). But on *Moby Dick* the 17-year-old males demonstrated a 12-point superiority and on Sherlock Holmes an 8-point advantage. In fact, our results over all the ages indicate a male advantage for masculine figures such as Robin Hood, Paul Bunyan, Daniel Boone, Samson and John Henry, along with better-than-average recognition of adventurous works such as *Moby Dick*, *Treasure Island* and *Gulliver's Travels*. Females outperformed males on poems, nursery rhymes and works such as *Charlotte's Web*, *Alice in Wonderland* and *Winnie the Pooh*. The sexes seem to have about equal success in recognizing Biblical figures.

Nine-year-old girls performed slightly better than the nation; boys, slightly worse. Nevertheless, the sexes excelled in different sorts of exercises. Relative to their usual performance, males did unusually well on exercises requiring identification of Robin Hood (U331G), Daniel Boone (R331I), the Trojan Horse (U333C), Paul Bunyan (R332G) and Thor (R332C). Girls did poorly on these same exercises but excelled on exercises requiring knowledge of *Alice in Wonderland* (R305), *Winnie the Pooh* (R303), *Charlotte's Web* (R306), nursery rhymes and fairy tales.

The median difference for 13-year-old males was 1 percentage point below the median difference for girls. As at age 9, the males did best on exercises requiring familiarity with masculine figures like John Henry (U329D), Samson (R328A), Galahad (R329C), Don Quixote (R307) and adventure stories like *Treasure Island* (U316). Females did relatively poorly on those exercises but excelled the males in exercises dealing with *Charlotte's Web*, *Alice in Wonderland*, *Winnie the Pooh* and Hansel & Gretel (U312).

For 17-year-olds, as at the other ages, the male median difference was negative (-.7%). But again males performed best on exercises dealing with masculine figures like John Henry (U329D), Mercury (U330D), Sherlock Holmes (R308), Samson (R328A), Don Quixote (R307) and Gulliver (U318). Females, while performing relatively poorly on such exercises, did exceptionally well identifying illustrations from *Alice in Wonderland* (R305) and *Winnie the Pooh* (R303) and Biblical figures like David (R330C), Job (R334) and Cain and Abel (U339).

The median difference for male adults was .6%. Relative to their usual performance, males excelled on exercises dealing with John Henry (U329D), Troy (R336), *Moby Dick* (R309) and Sherlock Holmes (R308).

Females did poorly on these exercises but did exceptionally well on questions about *Alice in Wonderland* (R305), Chicken Little (U328C), Adam (R328E) and Paul Revere (U319B).

Males performed best relative to the nation on Theme 3 at all age levels. The exercises in this theme required knowledge of specific facts, particularly the names of important literary works or characters. Other groups that performed best relative to the nation on Theme 3 were the Northeast (at ages 17 and adult) and the extreme-affluent suburb group (at ages 9, 13 and 17). This could indicate that the English curricula used in the Northeast and in the suburban schools place a good deal of emphasis upon factual knowledge; however, it could also reflect wider reading backgrounds for people in those groups.

Theme 4: A Survey of Reading Habits

Theme 4 contains two kinds of exercises. The first kind was designed to determine attitudes toward literary instruction, and the second kind was designed to discover what types of literature individuals read and how often they read. The national results indicate not only that a great majority of Americans read works of literature, but that the majority feels that it is important to read and to teach literature in school.

The male median difference for 9-year-olds was -1%. However, males performed atypically well on items surveying nonfiction reading habits, e.g., R404C, R404A, R404D and R404E.

The female median difference was 1%. Though the 9-year-old girls' response percentages were lower than the males' on the nonfiction questions just mentioned, their results were unusually high on questions about the frequency with which they read poetry and fiction, e.g., R407D, R406, R404A and R404B.

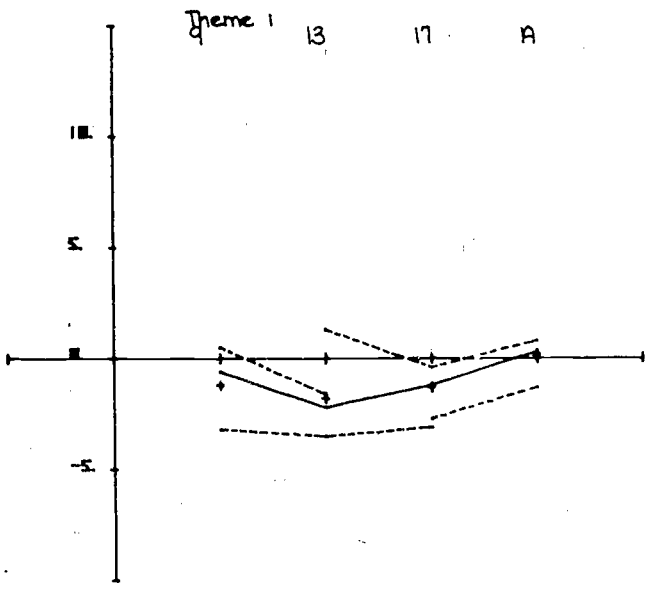
At age 13, the median difference for males was -2.5%; for females, 2.4%. Male differences were again atypically high on surveys of nonfiction reading habits. See, for instance, R405G (news magazines), R405D, R405F (editorials), R410C and R411C (biographies). Female effects were unusually high on items dealing with fiction, e.g., R410A, R411A, R405A. Females also displayed higher-than-usual differences on questions about the importance of literature (R401) and the number of times people reread works (R411G and F).

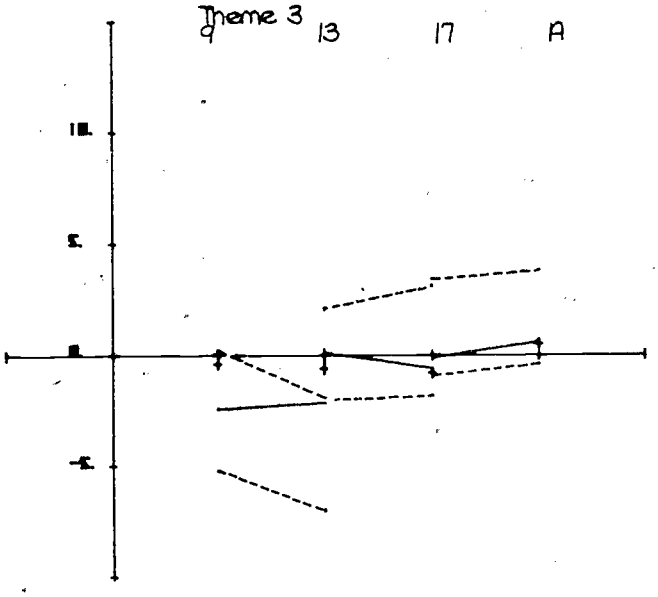
At age 17, the median difference for males was -2.1%. Their positive effects were unusually high on Exercises R411C (biographies), R410G (essays) and R410H (literary history). Females, with a median difference of 2.2%, showed their greater positive group effects on R410A, D and F (novel titles, play titles and poem titles) and R411A, B, E and H (dealing with novels, plays and rereading habits).

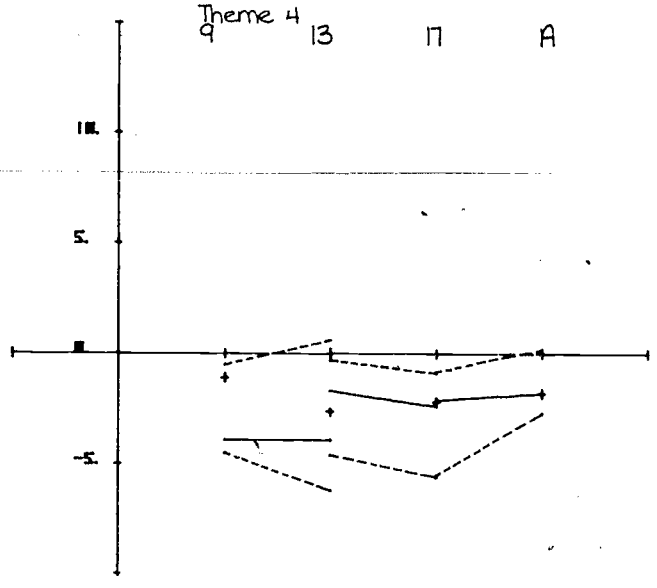
The adult male difference was -1.8%. Adult males did particularly well on the attitude questions R402 and R403. Females, with a median effect of 1.7%, had unusually high positive effects on R410A and R411A, both of which required verifiable titles of novels people had read.

The following graphs display several kinds of information about age-by-age results for Themes 1, 3 and 4. Theme 2 is not included because there were too few exercises in it for medians to be at all useful. The plotted points connected by solid lines represent the median differences (or effects) *for overlap exercises only* — that is, exercises administered at two age levels. Each of these lines displays only one age-to-age comparison: either age 9 results compared to age 13, age 13 compared to age 17 or age 17 compared to adult. If a line running from left to right slopes away from the $\emptyset$ line, the median difference for the older of two age levels is further from the national level of performance; if a line slopes toward the $\emptyset$ line, the median difference for the older of two age levels is closer to the national level of performance. The broken lines above and below each solid line depict the upper and lower quartiles (seventy-fifth percentile and twenty-fifth percentile). They enable the reader to see immediately the range covered by 50% of the overlap exercise effects and to determine the degree to which the slope of a line accurately reflects a trend from age to age. Finally, the crosses (+) depict for each age the median difference based upon *all* exercises administered at that age level in a theme. These points enable the reader to compare overlap median differences to median differences based on all exercises in a theme.

EXHIBIT 30. Age Comparisons for Males







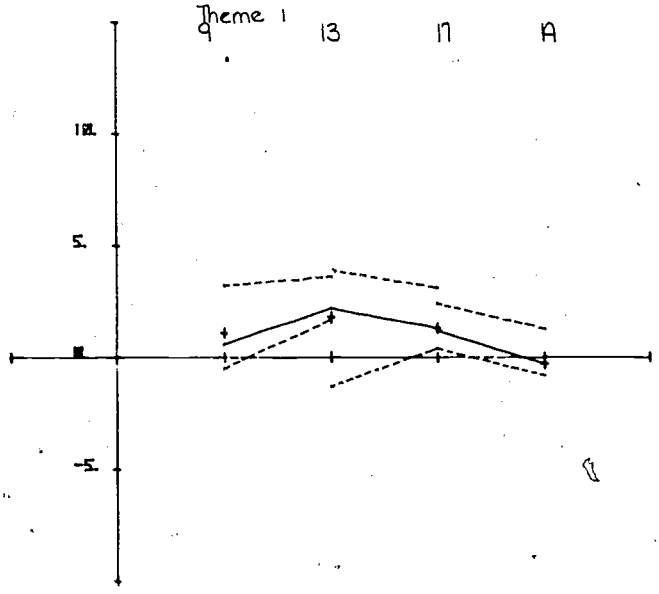
Males

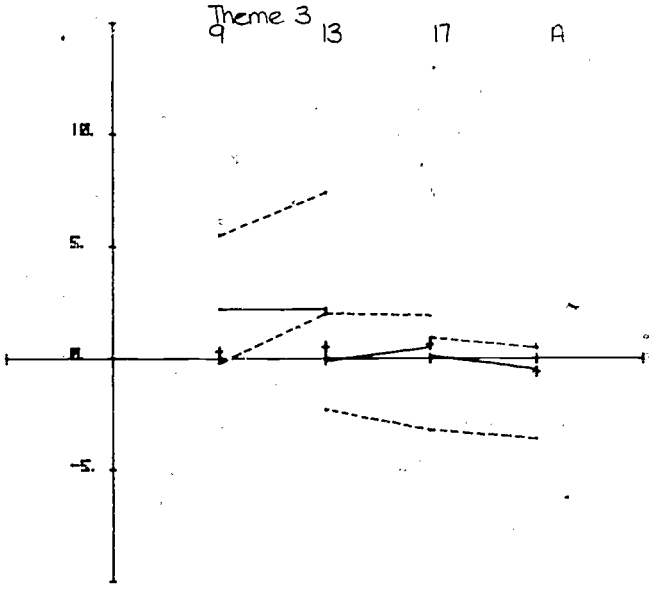
Nine-year-old boys do not differ as much from the national level of performance as 13-year-old boys do on the very same Theme 1 (Objective II) exercises. The variability in the effects is, however, greater at age 9 than at age 13. The same is true of age 13 results compared to those achieved by 17-year-olds. For this reason, it is safest to say that the 9—13 and 13—17 comparisons reveal little change. There does appear to be an improvement in standing (relative to the nation) between the age of 17 and achievement of adulthood, but this may simply reflect a decline in achievement among women, who comprise more than half the national population.

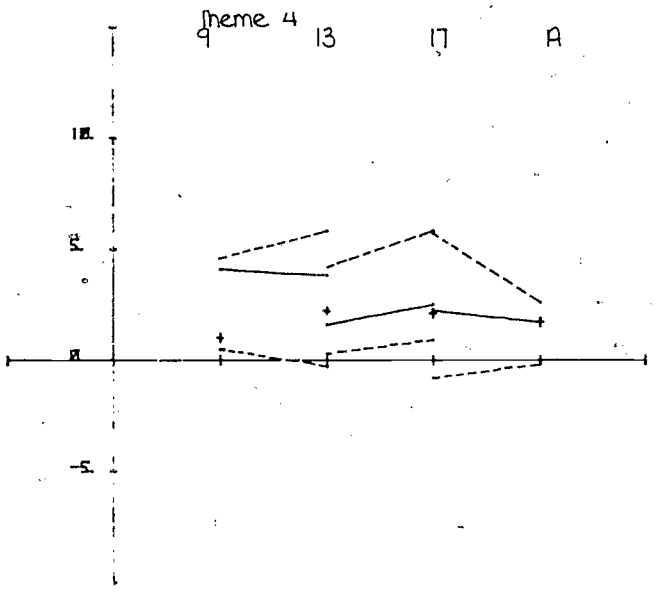
On Theme 3 overlap exercises, there was little change from age to age in median difference from the national level. However, the quartile lines indicate that a greater proportion of effects on 9—13 overlap exercises were below the national level at age 13.

Theme 4 results again reveal a shift in the distribution of 9—13 overlap effects at age 13; however, there is little evidence of any age-to-age trends. (Refer to Exhibit 30.)

EXHIBIT 31. Age Comparisons for Females







Females

As one might expect, the age trends for females mirror those for males. Thus, in Theme 1 (Objective II) there is a slight improvement from age 9 to age 13, very little 13–17 difference and an approach to the national level between age 17 and the adult level.

Theme 3 (Objective I) and Theme 4 (Objective III) median differences likewise reflect slight trends that are the reverse of those demonstrated by males. (See Exhibit 31.)

In the music assessment, females of all ages generally attained higher percentages of acceptable scores on the performance items than did their male counterparts. The differences, however, were not extremely large; on the average, less than 5 or 6 percentage points separated the male and female percentages for 9-year-olds, 13-year-olds and 17-year-olds, while a slightly larger difference separated adult females from adult males. The exercises that involved singing familiar songs like "America" and the round were the exercises upon which the greatest discrepancy between male and female scores appeared. On these exercises, as many as 20 or 30 points separated the male from the female percentages. On the other hand, sight-reading exercises, which proved to be difficult for everyone, tended to show the smallest discrepancy between male and female performance.

Males tend to play brass and percussion, while females tend to play woodwinds and strings. In general, the greatest number of instrumentalists at any age were from the group whose parents had some post-high-school education.

Females of all ages generally demonstrated more positive attitudes toward music than did their male counterparts. Males, it appears, are less interested in music and are less actively involved, especially in vocal performance.

Panelists attributed the less positive male attitudes to a number of factors, including the predominance of women in elementary music education, the failure to continue vocal instruction after the voice change, competition from athletic programs and an ambiguous cultural attitude toward males in the arts (see Table 12).

TABLE 12. Male-Female Differences for Music Attitude Exercises

Description	*Age*	*National Percentage*	*Male Difference*	*Female Difference*
5A				
Listen to music on TV at least weekly	9	91.7	0.0	0.0
	13	79.7	−3.2*	3.0*
	17	71.8	−1.0	1.0
	Adult	63.4	−2.7*	2.6*
Listen to music on radio at least weekly	9	81.4	−2.4*	2.4*
	13	92.2	−2.1*	1.9*
	17	97.6	−0.2	0.2
	Adult	92.2	1.0*	−1.0*
Listen to music on records/tapes at least weekly	9	68.3	−2.0*	2.0
	13	76.1	−5.3*	4.9*
	17	85.2	0.6	−0.6
	Adult	63.7	−4.0*	3.8*

Description	Age	National Percentage	Male Difference	Female Difference
5D				
Attend live musical programs at least monthly	13	23.2	1.0	−1.0
	17	27.7	1.2	−1.2
	Adult	13.6	0.5	−0.5
5E				
Like to listen to at least one kind of music	9	76.2	−2.8*	2.6*
	13	93.4	−1.4*	1.3*
	17	98.0	0.1	−0.1
	Adult	98.5	0.5*	−0.4*
5F				
Like to sing at least one kind of music	9	73.6	−3.2*	2.9*
	13	79.2	−8.9*	8.6*
	17	72.6	−11.2*	9.9*
	Adult	76.7	−8.2*	7.9*
5G				
Play at least one instrument	9	43.7	−4.2*	4.2*
	13	54.0	−4.8*	4.9*
	17	41.6	−2.5*	2.4*
	Adult	29.5	−3.1*	3.0*
5H				
Enjoy singing with a small group	13	75.8	−6.6*	7.0*
	17	80.8	−9.1*	8.9*
	Adult	82.8	−4.7*	4.6*
Enjoy singing with a large group	13	74.8	−5.6*	5.9*
	17	74.1	−11.3*	11.1*
	Adult	79.7	−6.8*	6.5*
Enjoy playing with a small instrumental group	13	60.1	1.8*	−1.9*
	17	66.9	3.0*	−3.0*
	Adult	59.0	0.0	0.0
Enjoy playing with a large instrumental group	13	64.2	−3.0*	3.2*
	17	57.0	−3.0*	3.0*
	Adult	52.0	−2.0	2.0
5I				
Belong to at least one vocal group	9	22.1	−6.3*	5.8*
	13	26.3	−9.4*	9.5*
	17	19.7	−8.6*	7.8*
	Adult	4.8	−1.5*	1.5*
Belong to at least one instrumental group	9	7.8	−0.7	0.6
	13	16.6	1.4	−1.4
	17	9.8	1.2	−1.0
	Adult	0.8	0.3	−0.3

CONCLUSION

The foregoing findings may be no surprise to the reader or researcher. The numbers do corroborate certain suppositions held.

The task still left to be done is that of probing into the reasons for declines or the causes of success. The step following is then to effect some change either in curriculum, methods, teacher preparation or even in philosophy and attitudes.

In every report such as this, there are background variables that color and slightly alter the results. At the same time, there is enough consistency to make the data valid.