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ABSTRACT

This paper presents data gathered from three countries. Samples of students of high-school age from Japan (N-1700), India (N-1446) and Illinois (N-9582) completed the High School Mathematics Test, and, at the same time, responded to a questionnaire designed to measure various demographic and psychological variables. This paper reports not only on mathematics achievement for the three samples, but also examines the relationship of mathematics achievement with nine "background" variables, namely, students' gender, age, amount of instruction in mathematics, amount of discussion about school work with parents, frequency of reading during leisure time, self-evaluation of reading ability, level of test anxiety, attributions for success and failure, and the importance accorded the test. Results indicate differences among the samples in mathematics achievement, and, in addition, difference among them in the relative influence exerted by the background variables on students' achievement in mathematics. (Author)

Mathematics Productivity and Educational Influences for Secondary Students in Japan, India and the United States

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Abstract

This paper presents data gathered from three countries. Samples of students of high-school age from Japan (n = 1700), India (n = 1446) and Illinois (n = 9582) completed the High School Mathematics Test, and, at the same time, responded to a questionnaire designed to measure various demographic and psychological variables. This paper reports not only on mathematics achievement for the three samples, but also examines the relationship of mathematics achievement with nine "background" variables, namely, students' gender, age, amount of instruction in mathematics, amount of discussion about school work with parents, frequency of reading during leisure time, self evaluation of reading ability, level of test anxiety, attributions for success and failure, and the importance accorded the test. Results indicate differences among the samples in mathematics achievement, and, in addition, differences among them in the relative influence exerted by the background variables on students' achievement in mathematics.

Mathematics Productivity and Educational Influences for Secondary Students in Japan, India and the United States

Concerns have been expressed about a decline in the quality of education in the United States. From the mid-to-late 1960's and through the 1970's, the mean scores of students taking the Scholastic Aptitude Test have declined (Lerner, 1982). These findings are confirmed by a study at the University of Minnesota spanning 50 years. The same standardized tests were administered to samples of students from the same schools in 1928 and 1978. Again, the results indicate a substantial decline in mean test scores over time (Lerner, 1982). On an international level, study of achievement scores in mathematics indicates that achievement of American students lags behind those of students in other countries. Stevenson, Stigler, Lee and Kitamura (1983) report that American students fall further behind Asian students in mathematics the longer they are in school.

This paper reports on data collected from a cross-national comparison of mathematics achievement among representative samples of students from Japan and India and a random sample of students from Illinois. The purpose is to examine the relationship of achievement in mathematics with a selection of demographic and psychological variables for the students in Japan, India and Illinois. Thus, the paper not only provides information about the relative performance of students from three countries, but also attempts to delineate for each country the variables which exert the greatest influence on achievement in mathematics. The choice of variables included in the analyses are described in the following paragraphs.

Walberg and his associates (Walberg, 1984a; Walberg, 1984b; Walberg and Shanahan, 1983; Walberg, Harnisch & Tsai, in press; Horn & Walberg, 1984) have identified 9 factors associated closely with academic learning in students: students' age, ability and motivation; the quality and quantity of instruction; the psychological environment of the classroom; the peer group outside school: the home environment; and exposure to mass media, particularly television. These factors emerged from quantitative syntheses of research findings in small-scale experimental and correlational studies as well as regression analyses of large-scale educational surveys on a national level. Most of the syntheses showed more than 90 percent positive results; the average influence (effect size or correlation) was about .39 with a standard deviation of .30. The results may be systematically biased upwards to an unknown extent by the tendency for more significant results to be reported; by outcome measures that closely reflect lessons learned by favored treatment groups, and by the enthusiasm accorded to treatment groups. The results also may be underestimated in a number of ways: the failure of treatments to be implemented validly; the failure of outcome measures, particularly standardized tests, to reflect the curriculum and lessons taught; the unreliability of measurements; and other sources which may attenuate the observed effects (Cook & Campbell, 1979).

National surveys of high school students show a positive association between learning and the nine factors when they are statistically controlled for one another in multiple regressions (except the amount of television receiving viewing which is negative). In 9 studies totaling about 16,000 students (tested in mathematics, science, social studies, and reading) collected by the National Assessment of Educational Progress (NAEP), there are consistently positive associations (with the exception of television) between achievement and the eight remaining factors. Specifically, 91 percent of the 83 correlations and 64 regression weights in the 9 studies were in the expected direction (Walberg, 1984b). In addition, these associations were replicated in a multivariate study of the mathematics and reading scores of about 24,000 seniors who participated in the High School and Beyond study (Walberg & Shanahan, 1983). The largest correlation in the national surveys, .73, was between mathematics achievement and the number of mathematics courses taken by 17-year-olds (Walsh, Anderson & Harris, 1982). A subsequent study of an NAEP sample of 17-year-olds and their achievement in mathematics showed a fairly close replication of that correlation, .63 (Horn & Walberg, 1983).

Five of the nine independent variables studied in this paper are related to Walberg's nine factors. They are students' age, the number of courses taken in the subject area, the frequency with which students discussed school work with their parents, the frequency of reading books during leisure periods, and a self-evaluation by students of their reading ability. Walberg's work demonstrates that higher scores are associated with older students. As noted already, there is a strong and positive relationship between mathematics achievement and the number of mathematics courses taken. The other variables, discussions about school with parents, amount of voluntary reading and self-evaluation of reading ability, may be considered as aspects of the home environment. Walberg (1984b) argues that what he describes as "the alternable curriculum of the home" is twice as predictive of academic learning as the socio-economic status of the family. Walberg includes in this home curriculum parent-child discussions about school events a'.d the encouragement of reading during hours of leisure.

The sixth variable whose relationship to mathematics achievement is investigated in this paper is level of test anxiety, that is, the debilitating effect of anxiety on performance in educational tests (Hill, 1980, 1984; Atkinson, 1980; Harnisch, Hill & Fyans, 1980). Numerous studies have demonstrated this effect. For example, a major testing project in Illinois instituted by the State Board of Education (Fyans, 1979) included measures of test anxiety. Students were drawn at random from 300 schools throughout the state at grades 4, 8 and 11. Level of test anxiety correlated with academic performance in reading and mathematics for the three ethnic groups (Blacks, white, Hispanic), both male and female, and for all ages. Correlations increased across the three grade levels so that by the eleventh grade, test anxiety correlated -.60 with performance on achievement tests. Similarly, Willig, Harnisch, Hill and Maehr (1983) have demonstrated negative correlations between test anxiety and performance for low-income students from white, Black and Hispanic groups.

Longitudinal studies provide further evidence. Hill and Sarason (1966) compared the performance on achievement tests of the 10 percent most anxious students and the 10 percent least anxious students in the 5th, and then in the 6th grades. They found that the highly anxious group was about a year behind the school district average on standardized reading and mathematics achievement tests, while the low anxious group was a year ahead. In addition, the high-anxiety students were twice as likely to be held back and repeat a grade than the low-anxiety students.

The seventh variable, like level of test anxiety, is concerned with students' psychological response to academic situations, in particular, their attributions for success and failure. The guiding principle of attribution theory is that people search to understand why a personal event, especially unexpected success or failure, has occurred (Weiner, 1979, 1980, 1984; Heider, 1958). In the theory there are four perceived causes of success and failure at achievement tasks: ability or lack of ability; effort or lack of effort, being given an easy task or an overly difficult one, and having good luck or bad luck. Attributions influence the expectation of future success or failure. For example, students who attribute their success at tests to high ability expect that they will do well on future tests. On the other hand, students who attribute success to factors such as good luck will not expect to do well in future. Similarly, failure attributed to factors such as a lack of ability will lower expectations more than failure attributed to a factor over which a student has some control, such as the amount of effort expended.

Attributions also influence the affective response to success and failure. For example, students who attribute failure to a lack of ability, a factor over which they have little control, may become depressed, not only because of the immediate failure, but also because of the expectations of future failure. On the other hand, a sense of pride can be the result of success attributed to superior ability. Weiner's research suggests that students who attribute success to a stable, internal factor such as ability and who attribute failure to factors over which they have control, such as the amount of effort expended, will perform well on achievement tests. Conversely, students who attribute success to external factors such as an easy task or good luck and who attribute failure to a stable, internal factor, such as lack of ability, will perform badly on achievement tests.

It is important to point out that there are dangers in attempting to interpret psychological measures in cross-cultural situations. Such interpretations are appropriate when there has been extensive testing of the measures within the different cultures to ensure that the measures are understood in a similar manner in each of them. In this paper, then, there is no attempt to interpret the pattern of attributions in India in relation to that of the American or Japanese samples.

The final two variables included in the paper are gender and the level of importance students attached to the mathematics test they took. It was anticipated that there would be no gender differences either on the test scores or on the relationship between the scores and the selected variables for the American sample. However, it appeared possible that gender differences would emerge in the samples from Japan and India. The variable, importance accorded to the test, was included as a check of the seriousness with which the students responded to the test and the questionnaire.

In summary, this paper reports not only on achievement by students from Japan, India and Illinois on a mathematics test, but also examines the relationship of mathematics achievement with nine demographic and psychological variables, namely, gender, age, amount of instruction in mathematics, frequency of discussion about school work with parents, frequency of leisure reading, self-evaluation of reading ability, level of test anxiety, attributions for success and failure, and the importance accorded the mathematics test. Like other national and cross-national investigations, the measurement of factors of interest is incomplete and may not be strictly comparable in the three countries. Nonetheless, a large-scale, cross-national investigation offers valuable comparative information and insight into differences among the countries in the factors most closely associated with achievement in mathematics.

Sample

The sample from India is a representative sample of 1,446 students from the State of Andhra Pradesh collected by staff of the Andhra University. The Japanese group is a nationally representative sample of 1,700 students tested by staff of the Nippon Electric Company as a part of a collaborative study with the University of Illinois. The U.S. group is a random sample of 9,582 students in high schools throughout Illinois tested by the State Board of Education. Table 1 shows the distribution of the three samples by age, sex, and other variables included in the analyses, and the mean and standard deviation of the mathematics score for each group.

Measures

Achievement in mathematics was measured by the High School Mathematics Test which was developed by the Educational Testing Service. The 60 items on the test concern algebra, geometry, modern mathematics, data interpretation, and probability. The internal consistency reliability (Cronbach's coefficient alpha) of the test is .87 for the Illinois sample. Students also completed a background questionnaire which measured, among other items, the level of mathematics completed, frequency of leisure reading, self-evaluation of reading ability, frequency of discussion of schooling with parents, and perceptions of the importance of the test, amount of test anxiety, and reasons for success and failure on academic tasks.

Japanese scholars translated and checked items both on the mathematics test and on the questionnaire. Because of educational and cultural differences between Japan and the United States, the meaning and content of several questionnaire items were changed deliberately as indicated on Table 1. One item was greatly changed. Because Illinois schools generally allow mathematics courses as electives, the number of semesters of mathematics completed was taken as the index level of mathematics. Japan, on the other hand, has a nationally prescribed sequence of mathematics in the high school curriculum, so students' estimates of items covered in their mathematics classes were obtained as an index. In India, both the mathematics test and the questionnaire were given in their English form. The one item on the questionnaire which was modified to suit the Indian situation concerned students' socio-economic background.

Analysis

Means, standard deviations, and correlations for the three countries were computed and are shown in Tables 1, 2a and 2b. In addition, the achievement scores were regressed on the explanatory variables and this is shown in Table 3. Figure 1 shows the mathematics achievement in percentiles for the three samples at the three respective age levels: 15-year-olds, 16-year-olds, and those aged 17 or older. Figure 2 shows box plots of mathematics achievement by groups differing in their attributions to success and failure for the sample from India.

Results and Discussion

As noted, Table 1 provides information about the composition of the three samples and corresponding scores on the mathematics test. In the samples from Japan and India, the male students performed better than their female counterparts. This was not the case for the Illinois sample. The marked difference in the number of male (81%) and female (19%) students in the Indian sample should be noted. This imbalance is indicative of the relatively small number of girls attending high school in India (Arnove, 1984).

The variable age provides an indication of the high performance of the Japanese students who outperform their counterparts in Illinois and India at all age levels. In fact, the lowest mean score for the Japanese (34.35 out of a possible 60 for 15-year-olds) is better than the highest mean score for any age group in the samples from Illinois or India. In addition, the students from India on the average perform better than the Illinois students at all age levels. The samples show dissimilar trends across age. There appears to be a positive linear trend in the Japanese sample, with scores increasing as students' age increases. For the Illinois sample, on the other hand, it is the 16-year-old students who perform best, while there appears to be a negative trend for the sample from India. Here it is the youngest students who score best on the test and the oldest students who have the lowest scores.

The third variable, the amount of time students spend discussing school work with their parents, appears to exert litle effect on mathematics achievement for the Japanese or the Indian sample, while there appears to be a positive trend for the Illinois sample. Here, the students who claimed they talked a lot with their parents performed better on the test than the students who indicated that they rarely discussed their school work with their parents. There were differences among the samples in relation to the next variable, too, the frequency with which students chose to read books other than those assigned in class. Japanese students who indicated that they did read additional books performed better than Japanese students who indicated little additional reading. This was not the case for the students from Illinois or India. It is interesting to note the differences in the proportions of students in the four levels for the three samples. Few Japanese students (less than 8% of the sample) claimed to read a lot, whereas over 50% of the Indian sample indicated extensive reading. The Illinois sample was somewhere in the middle range, with 19% of the sample indicating that they frequently read additional books.

Both the Japanese and the Illinois samples showed increases in mathematics score with more positive self-evaluations of reading ability. For the Japanese sample, there were similarities to students' response to the last variable, the frequency of reading additional books. This was not surprising because the wording of this variable in the Japanese questionnaire closely resembled that used for frequency of reading. For the samples from Illinois and India, the bulk of the students (68% and 56%, respectively) indicated that they thought they read as well as most other students. The two samples differed, however, in the relationship of reading self-evaluation to scores on the mathematics test. Illinois students who rated their reading highly performed better on the test than students who did not think they read well. On the other hand, it was the "middle" group of Indian students, those who considered they read as well as most other students, who scored best on the test.

The variable, level of test anxiety, or, alternatively, level of test comfort, measured students' degree of anxiety when they were put under testing conditions. For the Japanese and Illinois samples, as test comfort increased, that is, as students indicated they felt more relaxed before and during tests, their mathematics scores improved. In both cases, the bulk of the students rated themselves at the "more anxious" end of the scale which was a composite of students' responses to seven questions about their feelings of anxiety in testing situations. The sample from India responded differently, with 67% of the students claiming to be relaxed during testing, that is, in the three levels at the "quite relaxed" end of the scale. The corresponding mathematics scores for India, however, show no distinct pattern. In fact, the group scoring highest were the students labeled as "quite anxious," although they comprised only 1% of the sample.

The wording of the variable, the importance accorded to the mathematics test, differed for the Japanese sample, and, in addition, gave the students only two options, whereas the students from Illinois and India were given three options from which to choose. For both the Illinois and Japanese samples, higher scores on the mathematics test are associated with students rating the test as important. In the sample from India, however, there appears to be a slightly negative trend operating, with the students who claimed they did not consider the test important doing better than the students who gave a high rating to the importance of the test.

The final variable included in Table 1 is the number of mathematics courses taken by the students. As noted earlier, the format differed somewhat for the Japanese students. For them, the great majority (97%) indicated that most or many of the problems they encountered on the mathematics test had been dealt with in their school courses. For the Illinois sample, 68% indicated that they had taken two or three mathematics courses in high school. For both samples, students who indicated that they had taken a larger number of mathematics courses performed better than students who had taken few courses.

For the sample from India, 48% of the students indicated that they had taken only one or no mathematics courses in high school. This was an unexpected finding in light of governmental policy in India which makes mathematics education compulsory in the first ten years of school (Kapur, 1978; Giri, 1978). The anomaly may be explained in terms of the structure of the Indian educational system. All the students in the sample were attending junior colleges, somewhat akin to senior high schools in the United States. Thus, although the students may have had few or no mathematics courses at the junior college level, they would have had training in mathematics in the years preceding their entry into junior college at about age 15. It is possible, then, that these data regarding prior mathematical experience of students in India may be misleading. In an attempt to interpret the variable more clearly, the Indian students' responses were dichotomized. That is, for the correlations and multiple regression analyses, students were divided into two groups: those who had taken no mathematics courses versus those who had taken at least one mathematics course.

Figure 1 shows, for students aged 15, 16 and 17 years or older, selected percentiles (25, 50, 75, 90, 95, and 99) on mathematics achievement for the three samples. Again, the performance by the Japanese students is evident, particularly for the two older age groups. Consider, for example, the performance of students at the 90th percentile. For the 15-year-old age group, students at the 90th percentile (indicated by the letter C on the figure) scored 24 for the Illinois sample, 43 for the Japanese sample, and 48 for the sample from India. For the 16-year-old age group, students scored 33 for the Illinois sample, 52 for the Japanese sample, and 46 for the sample from India. For the 17-year-old and older age group, the scores for Illinois, Japan and India were 25, 55, and 44, respectively. The sample from India performed best at the 15-year-old age level, outperforming both the Japanese and the Illinois students. The sample from Illinois performed at a lower level for every age group.

The correlations between the variables are presented in Tables 2a and 2b, Table 2a showing correlations for both Japanese students (the lower left triangle) and students from Illinois (the upper right triangle), and Table 2b showing the correlations for the students from India (lower left triangle) and repeating the correlations for the Illinois students (the upper right triangle). The correlations in both tables confirm a number of trends reported from information provided in Table 1. For the Japanese and Illinois samples, there are significant correlations between mathematics achievement and the number of mathematics courses taken (r = .51 for Illinois, r = .23 for Japan). That is, students with a more extensive mathematical background performed better on the test than students with less mathematical background. Male students in Japan and India performed better than their female counterparts (r = .32 for Japan, r = .16 for India). For the Japanese sample, there was a positive relationship between age and mathematics achievement (r = .32), while there was a negative relationship between these two variables for the sample from India (r = -.12).

There was a positive correlation between self-evaluation of reading ability and mathematics achievement for students from Illinois (r = .27) and Japan (r = .11). Similarly, students from Illinoa and Japan showed positive correlations between level of test comfort and mathematics achievement (r = .28 for Illinois, r = .14 for Japan). Also, there were positive correlations between the importance accorded the test and mathematics achievement for students from Illinois (r = .28) and from Japan (r = .14), but there was a negative correlation between these two variables for the sample from India (r = -.11). The students from Illinois were the only ones to show a positive correlation between the amount of students' discussion about school with their parents and mathematics achievement (r = .12).

Figure 2 shows box plots of mathematics achievement by attribution group for the sample from India. Box plots of mathematics achievement for the Illinois and Japanese samples have been presented and discussed already in an article by Harnisch and Ryan (1985). A box plot provides a graphical representation of the location of the 25th, 50th, and 75th percentile score with the range of values plus the mean value. The box represents the middle 50 percent of the values while the whisker or tails extending from the box represent the lower and upper quartile values. Values of 0 on the box and whisker plot indicate the probability occurrences as 1 chance out of 20, while an asterisk indicates the probability of occurrence as 1 chance out of 200.

In Figure 2, each box represents the mathematics achievement of a group of students who attribute their success on academic tasks to a common factor and who attribute failure to another common factor. The numbers from 1 to 16 in the legend (in the right hand corner of the figure) indicate the perceived causes of success and failure for each group. For example, students in Group 8 attribute their success to the possession of effort and their failure to the difficulty of the task they are given. The number of students in each group and their respective means and standard deviations are listed below the figure.

Note that the majority of students (n = 779) fall into Group 6, that is, they attribute success to the expenditure of effort and they attribute failure to a lack of effort. In terms of attribution theory (Weiner, 1980, 1984), these students are attributing both success and failure to a factor over which they have control, namely, the amount of effort they expend on a task. This should enhance their expectation of future success ("If I wish hard enough, I will succeed on the tasks I am given") and reduce their feelings of shame when they fail ("I would have done better if I had worked harder"). The misgivings noted earlier about interpreting data gathered in cultures which differ from that of the United States should be kept in mind. It may be that Indian students' conceptions of ability, effort, luck and difficulty of a task are dissimilar to those held by students in the United States.

Student-level regressions for mathematics achievement as explained by the variables in the correlation matrices (see Tables 2a and 2b) are shown in Table 3. The regressions account for 8% of the variance in mathematics achievement in India, 23% of the variance in Japan, and 34% of the variance in Illinois. When controlled for the other variables, students' level of mathematics, that is, the number of courses in mathematics they had taken, is the most consistent predictor of achievement across the three samples. In Japan, the major factors predicting achievement were male status, age level, level of mathematics, importance accorded the test, and test comfort. A similar pattern of factors emerged for the Illinois sample, with the exception of male status which did not make a significant contribution to achievement. In India, the positive factors associated with achievement were male status and level of mathematics, while the negative factors were age level and importance accorded the test.

These results are not consistent across all samples. However, the analyses do show level of mathematics to be significant for each of the samples. This finding lends support to Walberg's (1984b) inclusion of quantity of instruction as a major variable affecting academic achievement. What goes on inside classroom is also of interest. Research has shown that methods of teaching and learning used within mathematics classrooms affect achievement. A number of instructional methods have proven consistently effective in improving performance. Some, such as the use of instructional cues, reinforcement and corrective feedback produce large average effects (greater than one standard deviation) on achievement tests, while others, such as the use of open classrooms, produce moderate effects on measures of cooperativeness among student's, independence and creativity (Walberg, 1984a). Given these findings, future cross-cultural research studies may be enhanced by the inclusion of items assessing instructional techniques used in classrooms.

The regression analyses have shown differences among the three samples in the relative influences of the eight variables on achievement in mathematics. One of the differences, the significant of male status in India and Japan but not in Illinois, is relatively easy to understand. Education for females lags behind that for males in both countries (Vogel, 1979; Naik, 1979). However, differences among the three samples for other variables which measure social patterns or psychological orientations are more difficult to interpret. Test comfort provides a good example. Students from India responded to this variable in a very different fashion from that of students in Japan or Illinois. The majority of Indian students claimed that they were relaxed under testing conditions, and, in addition, there was no significant relationship between their level of test comfort and their achievement in mathematics. No simple explanation for this situation is apparent. Of the three samples, the greatest variation in mathematics achievement was explained with the Illinois sample. This result may be accounted for in terms of the selection of the variables which was guided by research conducted in the United States. These variables may have particular relevance for an American sample and there may be other variables in Japan and India which exert a stronger influence on mathematics achievement.

Much has been written about the educational system in Japan and the consistently good performance of Japanese students on mathematics tests (Harnisch & Sato, 1984; Harnisch & Ryan, 1985; Harnisch, Walberg, Tsai, Sato, & Fyans, in press; Vogel, 1979). However, relatively little is known in this country about secondary education in India. The literature points to enormous problems encountered by educators in their attempts to provide education to the vast population of India (Naik, 1979; UNESCO, 1980; Kapur, 1979; Giri, 1978; Arnove, 1984). For example, less than 5% of thoes who start first grade reach higher education, where over two-thirds drop out (Arnove, 1984). Also, there is a large diversity in the quality of secondary schooling. This fact was borne out by the data gathered in this study: school-level analyses of mathematics achievement show marked differences among the 36 schools. In spite of these obstacles, the Indian government, in an effort to industrialize its economy, has put considerable emphasis on educating students in the fields of science and mathematics. The result has been the training of large numbers of scientists and technicians. In fact, Arnove (1984) reports that India has the third largest pool of scientists and technicians in the world, exceeded only by the United States and the Soviet Union.

In conclusion, this paper has provided data on mathematics achievement and a test of the productivity model using samples of students from India, Japan and Illinois. The purpose was to examine the relationship of achievement in mathematics with selected demographic and psychological variables. Superior mathematics achievement was noted for the Japanese sample, particularly for students aged 16 or older. The achievement pattern for the sample from India was strikingly high at the 15-year-old age level. The Illinois sample performed consistently lower than Japan or India at each age level. Relationships between mathematics achievement and the selected variables differed from country to country. However, level of mathematics instruction was found to be associated consistently with higher mathematics achievement in all three samples. In closing, it should be noted that the measurement of factors explaining mathematics achievement may not be strictly comparable from country to country. The variables included in this study may have been more appropriate for students from Illinois. Nonetheless, a large-scale, cross-national study can provide valuable descriptive information about relative achievement in mathematics and the influence of "background" factors on that achievement.

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Table 1. Sample Proportions, Mathematics Achievement Means, and Standard Deviations by Response Options on Selected Variables for High School Students from Japan (n=1,700), Illinois (n=9,582), and India (n=1,446)

Variable	Japan			Illinois			India		
	Proportion*	Mean	S.D.	Proportion*	Mean	S.D.	Prop.*	Mean	S.D.
Sex									
Male	.58	42.08	9.37	.50	19.88	9.55	.81	32.90	10.25
Female	.42	36.17	7.73	.50	19.32	8.54	.19	28.65	8.81
Age									
15	.27	34.35	6.79	.07	16.72	7.72	.24	33.48	10.10
16	.36	40.73	8.91	.80	20.49	9.22	.49	32.26	10.13
17 or older	.37	42.58	9.34	.13	15.87	7.34	.27	30.20	9.92
Discussion of school with parents									
Never or hardly at all	.27	40.90	8.94	.20	17.51	8.25	.12	31.59	11.37
Once or twice a month	.31	39.22	9.57	.17	18.61	8.56	.12	32.07	9.49
Once or twice a week	.32	39.13	9.09	.32	20.23	9.08	.25	33.16	9.97
Just about every day	.10	39.05	8.80	.31	20.90	9.53	.51	31.67	10.05
Frequency of reading additional books									
Never or hardly at all	.40	38.39	8.82	.28	18.67	8.60	.06	28.89	11.06
Once or twice a month	.33	38.88	9.48	.34	19.63	8.79	.12	30.91	10.87
Once or twice a week	.19	41.72	8.90	.20	20.10	9.55	.30	34.28	9.59
Just about every day	.08	43.72	8.79	.19	20.42	9.58	.52	31.35	9.96
Reading self-evaluation									
I read less than others (Japan)/ I read worse than most (Ill.&Ind.)	.65	38.89	9.12	.09	15.97	6.94	.13	30.47	9.82
I read as much as others (Japan)/ I read as well as most (Ill.&Ind.)	.30	40.71	9.37	.68	18.65	8.27	.56	33.33	9.69
I read more than others (Japan)/ I read better than most (Ill.&Ind.)	.05	42.54	8.25	.23	23.92	10.48	.30	30.85	10.83
Test Comfort Scale									
0 - Quite anxious	.15	37.61	8.47	.13	16.60	7.04	.01	37.50	12.97
1	.19	39.12	9.33	.14	17.05	7.49	.01	34.44	9.03
2	.18	39.86	9.00	.17	18.53	8.07	.04	32.89	9.60
3	.16	39.38	9.45	.15	19.27	8.47	.10	33.78	9.98
4	.14	38.68	9.56	.13	19.68	8.69	.18	32.44	10.45
5	.13	42.32	8.66	.11	21.40	9.62	.23	31.51	10.15
6	.03	41.96	8.28	.11	23.06	10.30	.23	32.53	9.67
7 - Quite relaxed	.01	48.32	7.77	.05	26.95	11.39	.21	33.62	9.89

Table 1 (cont'd)

Variable	Japan			Illinois			India		
	Proportion*	Mean	S.D.	Proportion*	Mean	S.D.	Prop.*	Mean	S.D.
Importance of test									
I didn't try to get a good score (Japan)/Not important at all (Ill.&Ind.)	.36	38.63	8.89	.24	17.05	7.24	.13	33.50	11.56
Important (Ill.&Ind.)				.58	19.09	8.47	.52	32.96	9.82
I tried to get a good score (Japan)/ Very important (Ill.&Ind.)	.64	41.51	9.44	.18	24.63	10.92	.35	30.59	9.88
Level of mathematics (Expressed as number of mathematics courses taken in high school for Ill. & Ind. & match to instruction for Japan)									
None				.02	14.53	4.53	.08	30.53	10.14
1				.29	14.41	4.78	.40	33.31	10.25
2				.35	17.82	7.16	.18	30.35	9.85
3				.30	25.87	9.45	.10	31.10	9.14
4 or more				.05	26.90	12.24	.25	32.40	10.34
Some part of the problems were not taught yet at school	.03	36.41	8.00						
A few problems were not taught yet at school	.51	37.78	8.21						
Most problems were taught at school	.46	42.07	9.70						

*Proportion may not add to 1.00 due to rounding.

Table 2a. Correlations Among the Selected Variables for Secondary Students from Japan (n=1,700) and Illinois (n=9,582)

Variable	1	2	3	4	5	6	7	8	9
1. Math achievement	1.00	-.08	.03	.51	.05	.27	.12	.27	.28
2. Age	.32	1.00	.08	-.02	.01	-.06	-.04	-.01	-.03
3. Male	.32	.14	1.00	.04	-.13	-.04	-.18	-.05	.18
4. Level of mathematics	.23	.40	.05	1.00	.02	.16	.13	.29	.19
5. Frequency of reading books	.17	.12	.14	.06	1.00	.25	.08	.05	.07
6. Reading self-evaluation	.11	.01	.06	-.01	.50	1.00	.09	.03	.24
7. Discussion of school with parents	-.05	-.09	-.10	-.04	.12	.11	1.00	.18	.11
8. Importance of test	.15	-.003	.09	.03	.05	.03	.09	1.00	.09
9. Test comfort scale	.14	.01	.17	-.05	.06	.10	-.01	.03	1.00

Correlations in the upper right triangle are for Illinois, while the lower left triangle contains the correlations for the Japanese sample.

Table 2b. Correlations Among the Selected Variables for Students from India (n=1,446) and Illinois (n=9,582)

Variable	1	2	3	4	5	6	7	8	9
1. Math achievement	1.00	-.08	.03	.51	.05	.27	.12	.27	.28
2. Age	-.12	1.00	.08	-.02	.01	-.06	-.04	-.01	-.03
3. Male	.16	.04	1.00	.04	-.13	-.04	-.18	-.05	.18
4. Level of mathematics	.05	.07	.07	1.00	.02	.16	.13	.29	.19
5. Frequency of reading books	.01	.01	.01	.09	1.00	.25	.08	.05	.07
6. Reading self-evaluation	-.03	.07	.04	.03	.13	1.00	.09	.03	.24
7. Discussion of school with parents	-.01	-.07	-.04	.02	.21	.06	1.00	.18	.11
8. Importance of test	-.11	-.05	-.04	.05	.09	-.03	.11	1.00	.09
9. Test comfort scale	.00	.05	-.04	.02	.14	.10	.10	.06	1.00

Correlations in the upper right triangle are for Illinois, while the lower left triangle contains the correlations for the sample from India.

Note: Correlations exceeding the absolute value of .06 are significant at an alpha equal to .05.

Table 3. Unstandardized Student-Level Regression Weights for Mathematics Achievement on Selected Variables with students from Japan (n=1,700), India (n=1,446) and Illinois (n=9,582).

Variable	Japan		India		Illinois	
	b-wt	t-value	b-wt	t-value	b-wt	t-value
1. Constant	21.46		34.14		-2.04	
2. Age	2.31	9.25	-1.88	-4.46	- .96	6.95
3. Male	4.51	10.74	4.82	6.23	.18	1.10
4. Level of mathematics	2.07	5.21	2.43*	2.26	4.16	46.54
5. Frequency of reading books	.01	2.73	- .53	-1.46	- .002	1.30
6. Reading self-evaluation	.81	2.08	- .15	- .32	2.58	17.22
7. Discussion of school with parents	- .004	.97	- .12	- .39	.002	1.82
8. Importance of test	2.24	5.36	-2.13	-4.63	1.70	13.64
9. Test comfort scale	.47	4.13	.21	1.08	.63	16.15
R-square	.23		.08		.34	

Note: All R-squares are significant at the .01 level; t-values greater than 1.97 and 2.59 respectively are significant at the .05 and .01 levels.

*Variable dichotomized on math courses taken, where 1 = one or more courses taken versus zero.

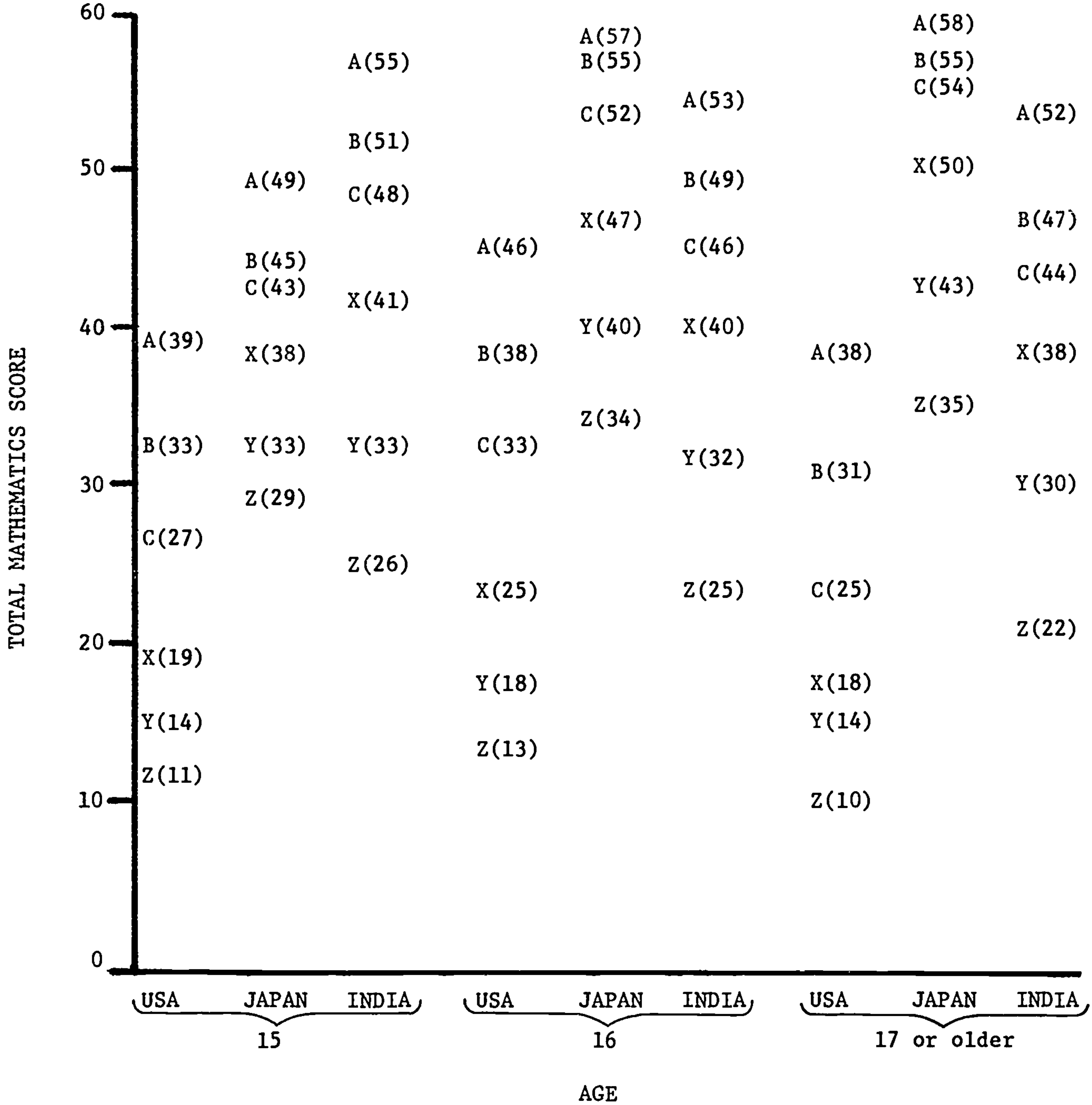
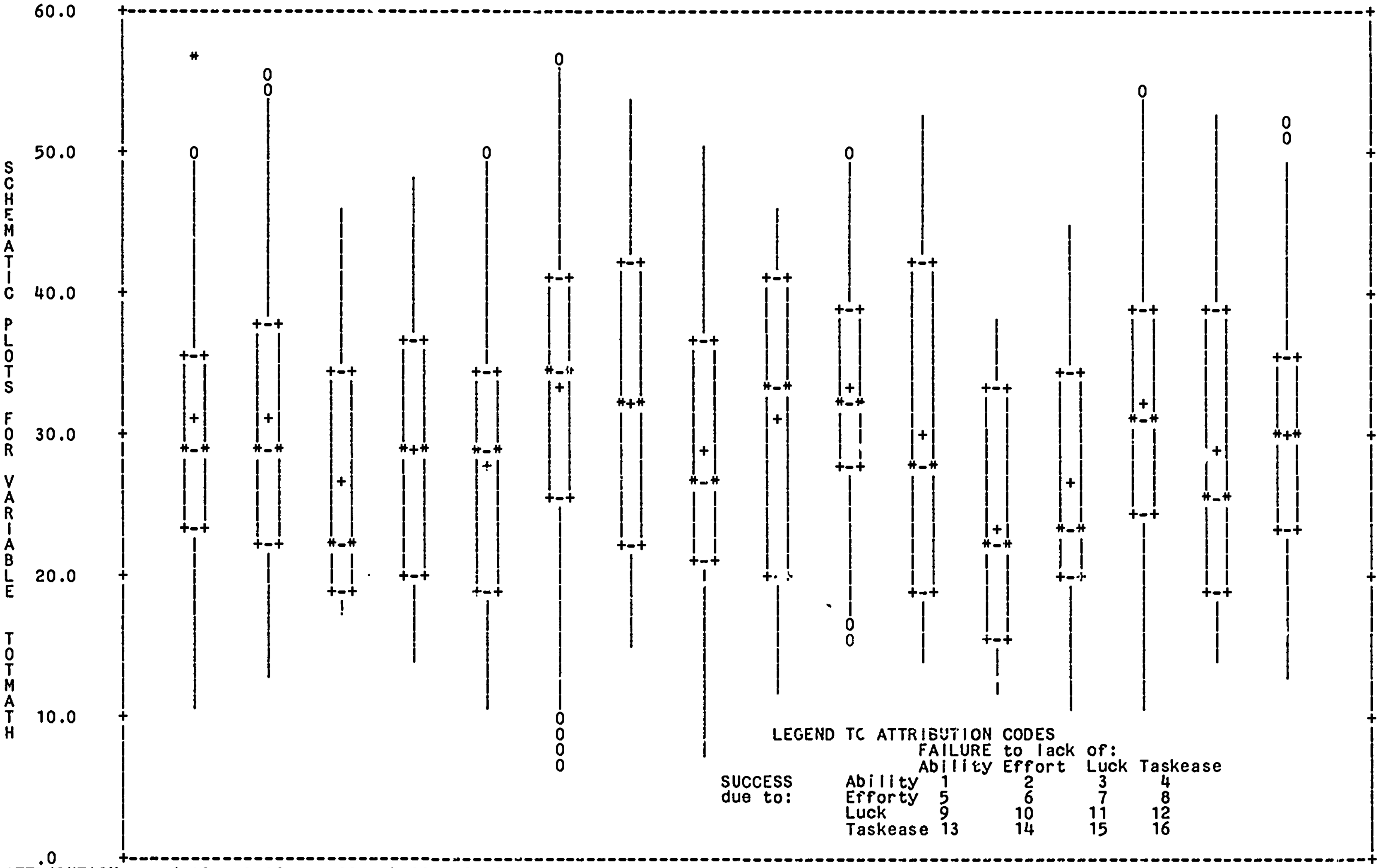


Figure 1. Mathematics Achievement Percentiles by Age for students in the United States (N=9582), Japan (N=1700) and India (N=1446)

Legend

Percentile	Code
99	A
95	B
90	C
75	X
50	Y
25	Z



ATTRIBUTION	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.0	11.0	12.0	13.0	14.C	15.0	16.0
SAMPLE SIZE	26	45	7	8	22	779	47	107	8	28	14	15	22	173	19	86
MEAN	30.8	31.3	26.3	29.0	27.9	33.6	32.4	28.6	31.0	33.3	30.1	23.9	26.9	31.9	29.1	30.2
STD DEV	11.1	11.7	10.2	11.3	10.6	9.8	11.0	9.9	12.5	9.7	12.7	9.3	9.6	10.0	10.6	8.7

Figure 2. Box Plots of Math Achievement by Attribution Groups for India Seconaary Youth (n = 1446)

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