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Sandra Lee Sawyer
Ouachita Baptist University

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MATHEMATICS ON AN INTERNATIONAL BASIS

A Research Paper
Presented to
Mr. Ralph Ford

In Fulfillment of
the Requirements for
Honors Special Studies 491

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by
Sandra Sawyer
January 1970

MATHEMATICS ON AN INTERNATIONAL BASIS

Is the math of the United States inferior? In 1967 there was an international study of mathematics comparing twelve different countries: United States, Japan, Australia, Belgium, England, Finland, France, Germany, Israel, The Netherlands, Scotland, and Sweden. Funded in part by the United States Office of Education and five years in making, the report was based on a test given 133,000 students in different countries at the age of thirteen and at the end of high school.[1]

This was the first large scale, empirical cross-national study of achievement in mathematics by school pupils, and it yielded out administrative and methological experiences in this field. There were many important and instructive implications to be derived from this study of mathematics education.[2] The objective of this interprise was to discern more clearly the interrelationships between aspects of organization, curriculum, teaching, and social factors on the one hand and math performance on the other.[3]

The test of the thirteen-year-olds showed that seventy-six percent of the Japanese students were in the upper half, and thirty-one percent were in the upper tenth while forty-three percent of the United States students were in the upper half, and only four percent were in the upper tenth.[4]

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[1]"Why Johnny Can't Add," Newsweek, 69:117, March 13, 1967.

[2]Ryoichiro Sato, "Commentary on the International Study of Achievement in Mathematics," Arithmetic Teacher, 15:103, February, 1968.

[3]George S. Carnett, "Is Our Math Inferior?," American Education, 3:1, March, 1967.

[4]"Why Johnny Can't Add," loc. cit.

In 1948, the educational structure of Japan began adopting the American educational structure. In Japan, math is studied five periods of fifty minutes weekly for three trimesters totaling thirty-five weeks a year. Only in the ninth grade can this be reduced to three fifty minute periods weekly for those who attend to leave school, but practically all children elect the five periods a week.[1]

To enter senior high school it is necessary to pass an examination covering the first nine years of study.[2] This first examination at the end of compulsory education eliminates twenty to twenty-five per cent of the students from any higher attainment. They do not encourage these students to proceed any further in studying. Instead, they are trained for different jobs.[3]

Math is required for all students in the science or technology line during all years of senior high school, and the study includes a full year and a half of calculus and elementary differential equations. For the arts, language, general, and modern courses only one year of math study is required in senior high school.[4]

Many more math topics are covered in the Japanese schools than in the general curriculum of the United States. They deal in all branches of math. At the age of thirteen, the Japanese student knows a great deal more about algebra and geometry than the American student who must wait until the ninth grade to study algebra and the tenth grade to study geometry.[5]

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[1]Howard F. Fehr, "Some Remarks on Japanese Mathematics Education," Mathematics Teacher, 63:73, January, 1970.

[2]Ibid., p. 74.

[3]Ibid., p. 76.

[4]Ibid., p. 74.

[5]Ibid., p. 76.

While there are many curriculum makers and experts in the United States, there is only one national curriculum enacted by the Ministry of Education in Japan. Any curriculum of a particular school subject is constructed by the Ministry of Education. Textbook makers must arrange materials and content in accordance with the lines of national curriculum. Hence, teaching of mathematics is performed rather uniformly throughout the country.[1]

To enter any college or university, it is necessary to graduate from a senior high school and pass a university entrance exam. Those who do not pass the examination may retake it any number of times in subsequent years. There are a large number of young people who are between the ages of eighteen and twenty-two that have failed the entrance exam and keep trying to pass it year after year by self-study. They are called "ronin" and are one cause of social problems in Japan today.[2]

A first class junior high teacher must have a bachelor's degree with thirty-six units in general education courses and thirty-two to forty units in mathematics. A first class junior high school teacher may be a second class teacher in senior high school. A first class senior high school teacher must have a master's degree in math plus one more year of schooling for education courses and practice teaching. All teachers have to be at least twenty-two, but the first class senior high math teacher begins his professional teaching at the age of twenty-five or over. The junior high and senior high school ratio of teachers of men to women is respectively ninety percent to ten percent.[3]

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[1]Sato, op. cit., p. 106.
[2]Fehr, op. cit., p. 74.
[3]Ibid., p. 75.

When the International Project for the Evaluation of Achievement announced its results in mathematics, the low scores of the United States students brought strong reaction on radio, television, and in the press.[1] There were many analyzes either sustaining or disproving the superiority of Japanese mathematics education. What are some reasons why the United States might have scored lower on the examinations than Japan and other countries? Marice L. Harting of the University of Chicago and Arthur W. Foshay of Columbia Teachers College suggested one reason for the difference in scores may be that other nations introduce math ideas to their students at a much earlier age.[2]

Some critics think that the big difference in the scores seems to be that math is a lived experience in Japan, and it is largely a school experience in the United States. Much less time is spent in America than abroad in arithmetic frill and memorizing formulas for performing operations and solving problems.[3]

Another reason for the difference may be that the United States has comprehensive high schools that serve the population better than the selective secondary schools on the European model. Rebuttals by educators stressed that seventy percent of American children go through high school compared to a much lower number in other countries.[4]

In the United States, there is an area of perennial teacher shortage at all levels of instruction in mathematics.

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[1] "Math Scores--Whose Fault?," Instructor, 76:10, June, 1967.

[2] "Why Johnny Can't Add," loc. cit.

[3] J. L. Creswell, "Are American Children Behind in Math?," Parents Magazine, 43:107, March, 1968.

[4] "Math Scores--Whose Fault?," loc. cit.

In 1966, the college graduates who were qualified for mathematics teaching credentials filled only seventy percent of the vacancies, and teachers in other fields were frequently deficient in math preparation.[1]

Another theory is that the more homework that a student in a particular country does, the better the national performance. The United States was about average for thirteen-year-olds but was well below average in the final year of pre-university work. However, on the whole, the ratio of math homework to all homework was above average.[2]

Japan is trying to catch up with Americans and Europeans. Advances in science and technology are especially being sought. The national mood and interest of the children is one of learning.[3]

Not included in this international study, but a powerful nation of particular interest, is Russia. Russians are good at producing academic excellence. There record of Nobel Prizes since 1945 is the best, per head, of the population in the world.[4] The first impression an American has of the Soviet education system is the diligence and precision developed from the minutest foundations of imitation.[5] The Soviet education system is built on three major levels: primary-secondary general school, specialized secondary school, and higher school. This system provides

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[1]George S. Carnett, loc. cit., p. 2.

[2]Ibid.

[3]Ryoichiro Sato, loc. cit., p. 106.

[4]Lord C. P. Snow, "Elitism and Excellence," Mathmatics Teacher, 62:506, October, 1969.

[5]"Education U. S. S. R.," Soviet Life, January, 1968, p. 30.

for seventy-four million students and thus, for the most part, meets the needs of the country. In the primary-secondary school, there are two and one-half million teachers for forty-eight million students between the ages of seven and seventeen. The students begin their primary-secondary education with the first grade and end with the tenth grade.[1]

Much work has been done in the Soviet Union over the past years in improving the school programs. A Commission of the Content of Education, convened by the Academy of Sciences and the Academy of Pedagogical Sciences of the U. S. S. R., prepared a new academic plan for high schools and programs for all subjects including mathematics. The chairman of the program commission in mathematics was A. N. Kolmogorov. In December of 1967, the Ministry of Education of the U. S. S. R. adopted the new program of material. Schools will continue to implement the new program in following years.[2]

School tests and methodological materials for teachers are being printed that express the fundamental ideas of the new content of the courses in math. The school programs of the U. S. S. R. includes, as required material for each student, all of the basics in the natural, mathematical, and liberal disciplines in sufficient quantity to permit continuation of his education in any type of institution of higher learning. Six hours per week are allocated to the required courses in math in the first eight years of schools and five hours per week during the next two years. Required courses include both the theoretical and practical study of the field of rational and real numbers, solutions

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[1]Mikhail Prokofyev, "Schooling Twenty-First Century Leaders," Soviet Life, January, 1968, p. 7.

[2]A. I. Markusheirtz and G. G. Maslova, "Mathematics in the Schools of the U. S. S. R.," Mathematics Teacher, 62:232, March, 1969.

of linear equations, and inequalities and systems of quadratic equations.[1]

Half a century of experience in teaching math in Soviet education has enabled the educator to work out carefully the methodology of teaching all topics in the program, to compile a well-conceived and sufficiently complete collection of exercises for each class, and as a result, to insure comparatively high levels of achievement by graduates of high school. In the upper grades, ten to twelve hours are alloted to mathematics. The following is usually the course of study in some of the grades from one to ten:

Grade 1 to 3:	Sets
Grade 4:	Intersection and union of sets and the basic concepts of geometry
Grade 6:	Concept of a function
Grade 9:	Derivative
Grade 10:	Integral[2]

In 1917, seventy percent of the Soviets were illiterate. In the early 1950's, changes began because some of the top mathematicians in the Soviet Union were not satisfied with the academic standard of the brightest pupils that enter the university. Russians felt that the young talents would be partially wasted if they went through the long, drawn-out, continental type of education. So Kolmogorov started a special boarding school attached to the Moscow University, and he managed it himself. Now there are special boarding schools at Kiev, Tbilisi, and Novosibirsk. Candidates are selected by competitive examinations at the age of fifteen to attempt to make allowances for disadvantages of background. Much teaching of these students is done by real mathematicians.[3]

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[1]Markushevitz and Maslova, op. cit.

[2]Ibid., p. 232.

[3]Snow, op. cit.

After a couple of years, they enter the Mathematical Olympiad, a curious name for a large scale mathematical competition something like our university open schoarship competition, but more national prestige is involved. The top fifty of the Soviet math students under the age of eighteen would be able, in any kind of competition, to take on the rest of the world.[1]

Most people believe the real secret lies in what physicists call "critical mass." That, is if you assemble enough bright pupils and enough good teachers, you would produce a level of excellence which is far higher than if the bright pupils and good teachers were split up and scattered over the Soviet Union.[2] Entry to mathematics departments is on a competitive basis, and usually there are several applicants per place. The course is from five to six years, and lectures are given the highest priority. Other media of teaching like seminars, diploma papers, and scientific societies are alson in great favor in Soviet education.[3]

As our society is becoming more complex and urbanized, science and technology are growing by leaps and bounds. Mathematics is becoming an important and essential part of our education system and life. All countries are trying to expand and change their curriculum not only in mathematics but in all fields. The United States, Russia, and Japan are only three examples of great nations that are really trying to move ahead.

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[1]Snow, op. cit.

[2]Ibid.

[3]I. Vinogradov, "Mathematics Looking Ahead," Mathematics Teacher, 61:45, January, 1968.

BIBLIOGRAPHY

Carnett, George S. "Is Our Math Inferior?," American Education, 3:1-3, March, 1967.

Creswell, J. L. "Are American Children Behind in Math?," Parents Magazine, 43:58-59+, March, 1968.

"Education U. S. S. R.," Soviet Life, January, 1968, p.30.

Fehr, Howard F. "Some Remarks on Japanese Mathematics Education," 63:73-77, January, 1970.

Maslova, G. G. and A. L. Markushevitz. "Mathematics in the Schools of the U. S. S. R., " Mathematics Teacher, 62:231-239, March, 1969.

"Math Scores--Whose Fault?," Instructor, 76:10, June, 1967.

Prokofyev, Mikhail. "Schooling Twenty-First Century Leaders," Soviet Life, January, 1968, pp. 7-8.

Sato, Ryoichiro. "Commentary on the International Study of Achievement in Mathematics," Arithmetic Teacher, 15:103-107, February, 1968.

Snow, Lord C. P. "Elitism and Excellence," Mathematics Teacher, 62:505-507, October, 1969.

Vinogradov, I. "Mathematics Looking Ahead," Mathematics Teacher, 61:44-45, January, 1968.

"Why Johnny Can't Add," Newsweek, 69:117, March 13, 1967.