Quality vs. Quantity

Daniel M. Stamm

This essay compares American and Asian education and illustrates how quantity is chosen over quality in the U.S. in the areas of teacher training, research in education, curriculum and textbook design, and the level of education given highest priority. After demonstrating that Japanese teacher-conducted classroom research (lesson study) has resulted in more practical, higher quality curriculum, textbooks, and teachers manuals, it address the objections to the use of those materials in the United States to improve teacher training and student achievement.

The misguided choice of quantity over quality is made nowhere more consistently than in American education. It occurs in teacher education, educational research, size of curricula and the length of textbooks. In addition, perhaps most important of all, primary schooling is emphasized far less than secondary and higher education, leading to a weak foundation revealed by poor results on comparative tests of mathematics achievement, and in the need for remedial coursework at the higher levels we favor so much.

Teacher Training

It applies very strikingly to the education of teachers. In *Knowing and Teaching Elementary Mathematics* (1999), Liping Ma relates that the Chinese elementary teachers she studied had only nine years of compulsory education and two or three years of normal (teacher training) school. The American teachers, in contrast, had bachelor's or master's degrees. Despite this, the Chinese teachers outperformed the Americans in content knowledge and understanding (p. xvii). Even more incredible was the fact that a sample of 20 ninth grade *students* also performed better than the American *teachers* (p. 146).

Interviews of the teachers who possessed especially deep knowledge of fundamental mathematics revealed something very significant. They reported that they acquired their knowledge by studying their pupil textbooks “intensively”. They had not learned it in education courses or in advanced mathematics courses, but from their *students’* textbooks, and she described in detail the kinds of things they studied. (p. 131) This, along with a sound education during their compulsory schooling, was the major source of the quality mathematics preparation of Chinese teachers.

Students in Japan have consistently been among the top performers on international tests of achievement in mathematics, but the training of Japanese elementary teachers is not characterized by advanced coursework in mathematics. In 1997 less than 5% of elementary teachers had master’s degrees. (Shimahara 2002a, p.57). The primary source of their knowledge of mathematics for teaching and methods for teaching it is not college coursework, but contact with veteran teachers. “The training of Japanese teachers is not thought to begin until they start their first teaching job, at which point they begin a long period of apprenticeship-like training in which they are supervised closely by master teachers.” (Stigler et al, 1996, p. 217).

Although Singapore ranked first in the world in mathematics achievement on the 1995 and 2003 TIMSS tests, its primary school teachers are even less likely than the Japanese to have advanced training in mathematics:

> “Primary school teachers in Singapore typically have considerably less college education than their U.S. counterparts. Two of three Singaporean primary teachers have earned only a two-year college certificate, usually a general education certificate from the National Institute of Education (NIE). Of course, their sound pre-college mathematics preparation and passage of a rigorous screening exam mean that these teachers know the mathematics taught at primary school very well before they ever attend college.” (Ginsburg, et al., 2005, p.106)

These facts demonstrate that lengthy coursework and advanced subject matter are not the keys to effectively educating teachers. What really constitutes quality is instruction about the *content that children are to be taught* and practical, effective methods to teach it.

Classroom Research

A key factor affecting the quality of American education is the lack of a practical, teaching-related knowledge base. This stems from the fundamental difference between American and Asian research in education. Stigler and Hiebert explain in *The Teaching Gap* (1999) that around 1900, a division of labor was created in which people with presumed expertise in educational matters took control of educational research and moved it out of the classroom, except for the testing of their ideas (p.173).

Because the researchers were out of touch with the realities of the classroom, both their theories and their applications turned out to have limited utility (p. 126).

Japanese teachers, on the other hand, have for many decades routinely carried on research in their classrooms. "*Kenkyu jugyo* [research lesson] is a widespread popular practice embedded in the culture of teaching, an ethos that Japanese teachers cherish as a proven means to improve teaching." (Shimahara 2002b, p.114). This practice simply involves testing a lesson under the exact conditions in which it is to be used, to see if it *works*. It requires no sampling and no statistics, only careful work in designing it, and observing and evaluating its effectiveness. (Lewis & Tsuchida 1998) "Because researchers, university-based mathematics educators, district mathematics supervisors, and even the officials from the Ministry of Education regularly participate in lesson study open houses, lesson study serves as an important feedback mechanism for curricular development, implementation, and revision." (Watanabe 2007, p. 6). For this reason, it affects the choice of topics, their sequence in the curriculum, and the methods and materials used to teach them. The practical knowledge base which has resulted makes their approach to research clearly preferable to that of the American system described above by Stigler and Hiebert.

Rational Curricula

For American teachers one of the most frustrating aspects of their job is the excessive length and irrational structure of the curricula they are expected to teach. "Coherent Curriculum" (Schmidt et al 2002) provides a composite view of state curricula in the U.S. which are compared with the curricula of the "A+" (i.e., high achieving) countries. Two straightforward conclusions we can draw from their study are that 1) the number of topics covered in each grade in the U.S. is greater (sometimes *much* greater) than in the A+ countries, and 2) the number of grades spent per topic (i.e., the amount of repetition) is almost double that of those countries.

The data on topics per grade show emphasis on quantity carried to an extreme degree. In first and second grades the number of topics covered in the U.S. is almost *five times* that of the A+ countries. This is at a stage in a child's development when the greatest care should be taken to foster understanding and mastery of the basic ideas that form the foundation of all later learning in mathematics. This excess in U.S. curricula precludes anything but the most superficial treatment of the topics studied.

Through lesson study the Japanese have determined exactly which topics should be treated, in which grades, and for how long. With a reasonable curriculum, ample time is devoted to every topic at the correct stage in the development of a student's mathematical understanding.

High Quality Textbooks

It will come as no surprise, then, given the bloated state of our curricula, that American textbooks are extremely large. In “Coherent Curriculum”, the photograph of a set of five A+ countries’ 8th grade math texts next to an equivalent set of American books, provides a graphic illustration of this fact (p. 10). The situation is similar for science texts, although it is due to the quality of the lesson design, rather than an oversized curriculum. A comparison of U.S. and Japanese elementary science textbooks revealed American texts that were three times the size of the Japanese. The difference in size is attributable almost solely to verbiage. “The greater use of language in the U.S. texts is striking… One of the U.S. texts devoted 165 sentences to the explanation of electricity, while the Japanese text used 18.” (Tsuchida & Lewis 2002, p. 37).

The quality of the Japanese texts, as well as that of the Chinese, stems from the fact that elementary texts are written by experienced classroom teachers. “Japanese elementary teachers are the primary architects and writers of Japanese elementary science textbooks…” (Lewis et al 2002, p. 57). “[Chinese t]extbooks and manuals are carefully composed by experienced teachers and experts in school curriculum.” (Ma 1999, p. 131).

Correct Priorities

The misplaced emphasis on later stages of education results in the neglect of primary preparation which other countries use to build a solid foundation for their children’s later learning. In *The Challenge of Eastern Asian Education: Implications for America* (1997), William K. Cummings writes:

> “Reflecting the Eastern Asian conviction that excellence derives from a command of the basics, Eastern Asian educators placed special emphasis on the development of effective primary schools (Passin, 1965). Much care was devoted to the curriculum and teaching methods at this level. And adequate funding was provided to ensure a solid basic education for all.” (p. 283)

Harold Stevenson in “The Asian Advantage” (*American Educator*, Summer 1987) wrote “…There is ample evidence that insufficient attention is being directed to improvement of elementary school training.” (p. 25). That was almost a quarter century ago, but, although we are known throughout the world for our institutes of higher learning, the people most capable of using our colleges and universities are more and more frequently those from other countries who make primary education their first priority.

Culture is No Obstacle

Given the practical, content-oriented, and thoroughly classroom-tested nature of the Japanese elementary mathematics teaching knowledge base, the obvious question now is whether it can be used in the United States. The immediate objection to this always involves presumed cultural barriers which would preclude our doing so.

> “Some people think that the purpose of an international comparison is to see which country is best and then get the U.S. to emulate its practices. That idea is naïve. You cannot lift something from one cultural context and expect it to work in another.” (Schmidt et al 2002, p.2)

In reality, there are several reasons for which using the Japanese knowledge base in elementary mathematics is neither naïve nor difficult. The first is that everything about their curriculum and related methods has been developed in mixed ability classrooms. The Japanese do not track in elementary school (Stevenson 2002, p. 104). Learning of this, most Americans immediately assume that the Japanese are simply superior intellectually, but this was shown not to be the case by Stevenson and Lee (1990, p. 4). Japanese teaching methods are designed to be effective with average students, and if used in a system where ability-grouping is the norm, would simply give brighter students a firmer grasp of the concepts in a shorter time. Slower students would benefit from the emphasis on understanding and the concrete methods used to develop it.

A second reason is that the vast majority of Japanese lessons are not culturally dependent, but founded on universal pedagogical principals such as using concrete materials to illustrate concepts; a finely graded, logically sequenced development of concepts and skills; attention to mastering material before proceeding to later topics; appealing to student’s interests and personal experiences; and the use of social interaction, carefully designed to teach concepts or skills. All of these factors apply equally well to American children as to Japanese.

Third is the fact that the widely held negative stereotypes of Japanese education do not apply at the elementary level. These are that children are pressured to achieve; that the subject matter is rigorous in quantity and quality; that creativity is totally neglected; and that lecturing and rote memorization are the dominant modes of teaching and learning. These characteristics *are* widespread in high school (Rohlen 1983), but the complete opposite holds true at the elementary level within the school and the public education system in general. (Lewis 1995; Benjamin 1997).

A final reason for the usefulness of their materials for us is that they are standardized and widely available from different sources in Japan. All the lessons and materials for all textbook series must be consistent with the national Course of Study. Even though there are six series of primary mathematic texts (Watanabe 2001, p.194), they have essentially the same content. (Stigler et al, 1996, p. 215). This has led to a uniformity in topics, methods of instruction, materials, and activities, which stems from the fact that they have all been shown to be effective in the classroom with lesson study.

A Well-developed Knowledge Base

The Japanese knowledge base for elementary mathematics consists of the national curriculum and the lessons and materials used to teach it. Because it is empirically tested, largely independent of Japanese culture and developed for students of average ability, it represents a gold mine of effective techniques and perfectly sequenced content. Our use of it in education at the elementary level would also serve to correct our neglect of primary education in the past.

Legitimate objections can be raised about how practical it would be to use in the context in which American teachers must work. Varying state requirements are a key problem, but since the Japanese curriculum is smaller than that of any state, supplementary materials could be devised for missing content. Another problem is the difficulty in preparing American teachers to use the materials, but the very fact that the lessons are designed for students of average ability means that our teachers could surely master the material, if they worked through all the texts in the series with proper guidance from instructors knowledgeable in using them. In addition, the accompanying teachers' manuals, written by experienced Japanese teachers in a user friendly format, would be an invaluable resource (Lee & Zusho 2002).

My own examination of first thrrough fifth grade texts, and lessons from third through fifth grades, has revealed numerous examples of meticulously carefully sequenced lessons with multiple methods of developing basic concepts. For the earlier grades the methods include games and activities providing concrete experiences with the topics and repeated exposure to the ideas in different forms; for the later grades equally ingenious activities are used, centering on a single question for whole-class discussion. In all cases they show all the signs of development and testing through lesson study, which the authors, as experienced teachers, routinely engage in throughout their careers.

Conclusion

It must seem strange to most people that after a career of teaching high school physics, I should be interested in elementary mathematics instruction. The reason is that I went to great lengths to base my own teaching on topic analysis, concrete experience, and correct sequencing of topics, only to find that these principles are much more important, and more effective, for younger children. This, combined with the fact that Japanese elementary teachers have spent decades researching the best methods to apply them, has resulted in a fascinating collection of pedagogica1 technology, which eventually could be used to teach American children. As a country that spends more than most others on education the United States would do well to invest in material of such superb quality by at least studying it and making the information available to our teachers, and possibly by completely adopting it for their training and use.

References

Benjamin, G. (1997). *Japanese Lessons: A Year in a Japanese School through the Eyes of an American Anthropologist and Her Children.* New York: New York University Press.

Cummings, W.K. (1997). Human Resource Development: The J-Model. In Cummings, W.K. & Altbach, P.G. (Eds.) *The Challenge of Eastern Asian Education: Implications for America.* Albany: State University of New York Press.

Ginsburg, A., Leinwand, S., Anstrom, T., & Pollock, E. (2005). *What the United States Can Learn From Singapore's World-Class Mathematics System*. American Institutes for Research. http://www.keysschool.com/Documents/SingaporeReport.pdf

Lee, S.Y., & Zusho, A. (2002). Comparing Japanese andU.S.Teachers Manuals: Implications for Mathematics Teaching and Learning. In DeCoker, Gary (Ed.) *National Standards and School Reform in Japan and the United States*. New York: Teachers' College Press.

Lewis, C.C. (1995). *Educating Hearts and Minds: Reflections on Japanese Preschool and Elementary Education.* Cambridge: Cambridge University Press

Lewis, C. & Tsuchida, I. (1998, Winter). A Lesson is Like a Swiftly Flowing River. *American Educator*, pp. 12-17

Lewis, C.C., Tsuchida, I., & Coleman, S. (2002). The Creation of Japanese and U.S. Elementary Science Textbooks: Different Processes, Different Outcomes. In DeCoker, Gary (Ed.) *National Standards and School Reform in Japan and the United States*. New York: Teachers' College Press.

Ma, L. (1999). *Knowing and Teaching Elementary Mathematics: Teachers' Understanding of Fundamental Mathematics in China and the United States*. Mahwah, N.J.: Lawrence Erlbaum Associates.

Rohlen, T. (1983). *Japan's High Schools.* Berkeley and Los Angeles: University of California Press.

Sato, N. & McLaughlin, M. (1992). Context Matters: Teaching in Japan and in the United States. *Phi Delta Kappan,* 73 (5),359-366

Schmidt, W., Houang, R, & Cogan, L. (2002, Summer). Coherent Curriculum. *American Educator,* pp.1-18

Shimahara, N. (2002a). *Teaching in Japan: A Cultural Perspective.* New York: RoutledgeFalmer.

Shimahara, N. (2002b). Teacher Professional Development in Japan. In DeCoker, Gary (Ed.) *National Standards and School Reform in Japan and the United States*. New York: Teachers' College Press.

Stevenson. H.W. (1987, Summer). The Asian Advantage. *American Educator,* pp. 26-31

Stevenson. H. W, & Lee, S. Y. (1990). *Contexts of achievement: A study of American, Chinese, and Japanese children*. Monographs of the Society for Research in Child Development, 55(1-2).

Stevenson. H. W. (2002). Individual Differences and Japan's Course of Study. In DeCoker, Gary (Ed.) *National Standards and School Reform in Japan and the United States*. New York: Teachers' College Press.

Stigler, J.W., Fernandez, Clea, & Yoshida, M. (1996). Cultures of mathematics instruction in Japanese and American elementary classrooms. In T. Rohlen and G. LeTendre (Eds.), *Teaching and learning in Japan* (213-247). New York: Cambridge University Press.

Stigler, J.W. & Hiebert, J. (1999) *The Teaching Gap: Best Ideas from the World's Teachers for Improving Education in the Classroom*. New York: The Free Press.

Tsuchida, I. & Lewis, C.C. (2002). How Do Japanese and U.S. Elementary Science Textbooks Differ? Depth, Breadth, and Organization of Selected Physical Science Units. In DeCoker, Gary (Ed.) *National Standards and School Reform in Japan and the United States*. New York: Teachers' College Press.

Watanabe, T. (2001). Content and organization of teachers' manuals: An analysis of Japanese elementary mathematics teachers' manuals. *School Science and Mathematics, 101*(4), 194-205.

Watanabe, T. (2007). In Pursuit of a Focused and Coherent School Mathematics Curriculum. *The Mathematics Educator, 17*(1), 2-6.

dms@dmstamm.org