2002

Learning from International Studies of Teaching : The TIMSS-R Video Study.

James Hiebert
ACER

Hilary Hollingsworth
ACER

Learning from international studies of teaching: the TIMSS-R Video Study

James Hiebert and Hilary Hollingsworth

James Hiebert is the Robert J Barkley Professor of Education at the University of Delaware, where he teaches in programmes of teacher preparation, professional development and doctoral studies. His professional interests focus on mathematics teaching and learning in classrooms. He has edited books entitled *Conceptual and Procedural Knowledge: The Case of Mathematics and Number Concepts and Operations in the Middle Grades*, and co-authored *Making Sense: Teaching and Learning Mathematics with Understanding and The Teaching Gap: Best Ideas from the World's Teachers for Improving Education in the Classroom*. He currently serves on the National Research Council committee Mathematics Learning Study, is the director of the mathematics portion of the TIMSS-R Video Study, and is Principal Investigator on the, National Science Foundation-funded, Mid-Atlantic Center for Teaching and Learning Mathematics. He received a BA and MA in mathematics, taught mathematics in high school and then earned a PhD in mathematics education at the University of Wisconsin-Madison.

Dr Hilary Hollingsworth is a Senior Researcher and Director of Teacher Learning at LessonLab Learning at LessonLab Inc in Los Angeles, California. For the past three and a half years she has been the representative for ACER working on the Third International Mathematics and Science Study – TIMSS-Repeat Video Study. In that position she has shared responsibility for the development, implementation and analyses of the videodata coding scheme, the authoring of the international report, *Mathematics Teaching in Seven Countries: Results from the 1999 TIMSS-R Video Study*, the authoring of the TIMSS-R Video Study Public Release lessons, and the authoring of the Australian report. In addition to her research role in the TIMSS-R Video Study, she works with school systems, school districts, universities, professional development organizations and textbook publishers across the United States as a Director for the Teacher Learning Division of LessonLab. This work involves the design and implementation of video cases in a unique and powerful Web-based technology platform. She has published papers related to her research in teacher professional development, as well as resource books for teachers and parents.

The research reported here is the work of a large international team. It is the joint effort of our colleagues in the mathematics research team at LessonLab Inc, together with national research coordinators, specialist consultants and teachers in the participating countries of the TIMSS-R Video Study.

Background and goals of the TIMSS-R Video Study

The 1999 Third International Mathematics and Science Study-Repeat (TIMSS-R) Video Study was a successor to the 1995 Third International Mathematics and Science Study (TIMSS) Video Study. The 1999 TIMSS-R Video Study expanded on the earlier 1995 TIMSS Video Study by investigating eighth-grade teaching in science as well as mathematics and sampling classroom lessons from more countries. Although data were collected at the same time, the mathematics and science portions of the 1999 TIMSS-R Video Study are treated separately and only mathematics will be discussed in this paper.

The broad goal of the mathematics portion of the 1999 TIMSS-R Video Study was to investigate and describe teaching practices in eighth-grade mathematics in a variety of countries, including those with varying cultural traditions and with high mathematics achievement as measured in the 1995 TIMSS Achievement Study. The 1995 TIMSS Video Study included only one high achieving country – Japan. It was tempting for some audiences to draw the premature conclusion that high achievement is possible only by adopting teaching practices like those observed in Japan. The 1999 TIMSS-R Video Study addressed this issue by sampling lessons in more countries whose students performed well on the 1995 TIMSS achievement study.

Countries participating in the 1999 TIMSS-R Video Study were Australia, the Czech Republic, Hong Kong SAR,[1] the Netherlands, Switzerland and the United States. Japan did not participate in the mathematics portion of the 1999 TIMSS-R Video Study, however the Japanese mathematics lessons collected for the 1995 TIMSS Video Study were re-analysed. TIMSS achievement test scores for the participating countries are seen in Table 1.

In addition to the broad goal of describing mathematics teaching in seven countries, including a number of countries with records of high achievement, the 1999 TIMSS-R Video Study had the following research objectives:

- To develop objective, observational measures of classroom instruction to serve as appropriate quantitative indicators of teaching practices in each country;
- To compare teaching practices among countries and identify similar or different lesson features across countries; and
- To describe patterns of teaching practices within each country.

Design and methods

The 1999 TIMSS-R Video Study was designed to describe eighth-grade mathematics teaching in each participating country. The design included some unique features best described by the label 'video survey'. The concept is to marry videotaping (heretofore used mostly on a small scale for qualitative analysis) with national sampling (commonly used in survey research). Video surveys allow researchers to

[1] For convenience, in this report Hong Kong SAR is referred to as a country. Hong Kong is a Special Administrative Region (SAR) of the People's Republic of China.

integrate the qualitative and quantitative study of classroom teaching across cultures, increasing their chances of capturing not only powerful universal quantitative indicators but culturally particular qualitative categories as well.

The TIMSS-R Video Study sought to provide national-level pictures of teaching. Consequently, it was important to maximize the number of teachers participating, even though this meant videotaping each teacher, teaching a single classroom lesson, only once. Furthermore, to get a nationally representative picture of eighth-grade mathematics teaching, lessons were randomly selected across the school year. Different countries use different curricula and move through different sets of topics. The only reasonable way to deal with this variation is to sample steadily across the school year and to randomly select lessons at each point. The sample size and participation rate for each country in the TIMSS-R Video Study can be seen in Table 2.

Once collected, the videotapes were coded. Most codes were developed and later applied by international teams whose members were cultural insiders. All coders were fluent in the language of the lessons they coded. However, not all of them were experts in mathematics or teaching. Therefore, several specialist coding teams with different areas of expertise were employed to create and apply codes for special aspects of the mathematical nature of the content, the pedagogy, and the discourse.

What can we learn through international studies of teaching using video?

Why undertake such an expensive and labor intensive study of teaching involving the collection and analyses of hundreds of hours of videotaped classroom lessons from all over the world? There are at least five reasons. First, studying teaching can lead to improvements in what and how well students learn. Although research suggests it is difficult to draw clean and direct connections between teaching and learning, there is little doubt that teaching affects learning. The more educators learn about teaching, the more they learn about providing effective learning opportunities for students. So, although no empirical links can be drawn between teaching and achievement levels in the participating countries, the comparative descriptions of teaching in seven countries afford unprecedented analyses of teaching.

Second, examining teaching in different countries reveals one's own teaching practices more clearly. When everyday routines and practices are so culturally common that most people do things in the same way, they can become transparent and invisible (Geertz, 1984). To the extent they are noticed, everyday practices can appear as the natural way to do things rather than choices that can be re-examined. A powerful way to notice the practices of one's own culture is by observing others. This is a principal aim of cross-cultural, comparative research (Ember & Ember, 1998; Whiting, 1954).

Third, looking at other cultures might not only help to see oneself more clearly, it might also suggest alternative practices. Although variation exists within cultures, truly distinctive methods of teaching are, by definition, the exception. By stepping outside one's own culture, chances can increase for seeing something new.

Fourth, a cross-cultural examination can stimulate discussion about choices within each country. Alternative practices, discovered in other countries, might not transpose readily across cultures. They might be based on cultural conditions that do not exist elsewhere. But, seeing oneself more clearly by comparing practices across cultures, and seeing alternative practices that can generate new ideas for practices at home, can prompt the following useful response: classroom practices are the result of choices; they are not inevitable. Given this fact, and given the alternatives that are revealed, questions can be asked about whether the choices that have been made in the past are the most appropriate for the current instructional goals.

Finally, cross-cultural studies help deepen educators' understanding of teaching. They provide information about different systems or methods of teaching and different ways in which the basic ingredients of teaching can be configured (Stigler et al, 2000). Descriptions of contrasting methods can help researchers construct more informed hypotheses about teaching and about how different methods of teaching might influence learning.

Using the results of international video survey for research and professional development[2]

A significant challenge of any large-scale study of teaching is communicating the results. Teaching is a complex activity, and analysing the teaching in hundreds of hours of videotapes can yield a complicated mass of data. Fortunately, the advantages of video data do not end with the analysis. Video can be used to convey a much richer story than words and numbers alone.

[2]The results of the 1999 TIMSS-R Video Study are not yet available. It is expected that they will be released by early 2003 and published in a National Center for Education Statistics report: Hiebert et al (in press) *Mathematics Teaching in Seven Countries: Results from the 1999 TIMSS-R Video Study*.

Video can provide visual, concrete definitions for abstract research terms and give life to research results. Quantitative data and video examples work hand-in-hand to present a more complete and reliable picture than either could achieve by itself. Videos are extremely powerful communicators and create lasting images that can be helpful if appropriate, or misleading if aberrations. Quantitative results document the way in which the video images are, or are not, representative of the full sample of teaching.

Public Release videos from all participating countries were collected to accompany the written report for the TIMSS-R Video Study. These videos serve two purposes. First, they help present the findings from the study, and the methods that were used. For example, clips from these videos illustrate the definitions for the categories used for coding and analysing the videos. This provides readers of the report and viewers with a better sense of the codes used to generate the results and, in turn, a more meaningful basis for interpreting the results.

Video lessons can also provide teachers with new ideas and can stimulate deeper discussions about choices that can be made in designing lessons. A further purpose of the public release videos is to give educators access to a new source of ideas on how to teach common topics of eighth-grade mathematics, and to encourage educators to re-examine their own practices in light of these alternatives.

Hopefully, this video study will launch a deeper and more widespread international discussion among educators about the options available for teaching mathematics. Perhaps the greatest contribution of this work will be the establishment and growth of an international community of teachers, administrators, and researchers dedicated to the proposition that the study and improvement of classroom teaching can and should be a collective professional enterprise.

References

Ember, C. R. & Ember, M. (1998). Cross-cultural research. In H. R. Bernard (Ed.). *Handbook of Methods in Cultural Anthropology*. Sage Publications, Walnut Creek, pp. 647–87.

Geertz, C. (1984). From the native's point of view: on the nature of anthropological understanding. In R. A. Shweder & R. LeVine (Eds.). *Culture Theory: Essays on Mind, Self and Emotion*. Cambridge University Press, Cambridge, pp. 123–36.

Gonzales, P., Calsyn, C., Jocelyn, L., Mak, K., Kastberg, D., Arafeh, S., Williams, T. & Tsen, W. (2000). *Pursuing Excellence: Comparisons of International Eighth-Grade Mathematics and Science Achievement from a US Perspective, 1995 and 1999*. National Center for Education Statistics, US Department of Education, Washington, DC.

Hiebert, J., Gallimore, R., Garnier, H., Givvin, K. B., Hollingsworth, H., Jacobs, J., Chui, A. M., Wearne, D., Smith, M., Kersting, N., Manaster, A., Tseng, E. A., Etterbeek, W., Manaster, C. & Stigler, J. (in press) *Mathematics Teaching in Seven Countries: Results from the 1999 TIMSS-R Video Study*. National Center for Education Statistics, US Department of Education, Washington, DC.

Stigler, J. W., Gallimore, R. & Hiebert, J. (2000). Using video surveys to compare classrooms and teaching across cultures: examples and lessons from the TIMSS video studies. *Educational Psychologist, 35* (2), 87–100.

Whiting, J. W. M. (1954). Methods and problems in cross-cultural research. In G. Lindzey (Ed.). *Handbook of Social Psychology*, Addison-Wesley, Cambridge, pp. 523–31.

Table 1: TIMSS-R Video Study participating countries and their average score on the 1995 TIMSS and 1999 TIMSS-R mathematics assessments

Country	TIMSS mathematics score		TIMSS-R mathematics score	
	Average	Standard error	Average	Standard error
Australia *	519	3.8	525	4.8
Czech Republic	546	4.5	520	4.2
Hong Kong SAR	569	6.1	582	4.3
Japan	581	1.6	579	1.7
Netherlands *	529	6.1	540	7.1
Switzerland	534	2.7	–	–
United States	492	4.7	502	4.0

* Nation did not meet international sampling and/or other guidelines in 1995. See Beaton et al (1996) for details.

NOTE: Rescaled 1995 TIMSS mathematics scores are reported here. Switzerland did not participate in the 1999 TIMSS-R assessment.

SOURCE: Gonzales, P., Calsyn, C., Jocelyn, L., Mak, K., Kastberg, D., Arafeh, S., Williams, T. & Tsen, W. (2000). *Pursuing Excellence: Comparisons of International Eighth-Grade Mathematics and Science Achievement from a US Perspective, 1995 and 1999*. National Center for Education Statistics, US Department of Education, Washington, DC.

Table 2: Sample size and participation rate for each country in the TIMSS-R Video Study

Country	Number of schools that participated	Percentage of schools that participated including replacements[1] – unweighted[2]	Percentage of schools that participated including replacements[1] – weighted[3]
Australia	87	85	85
Czech Republic	100	100	100
Hong Kong SAR	100	100	100
Japan[4]	50	100[5]	100[5]
Netherlands	85[6]	87	85
Switzerland[7]	140	93	93
United States	83	77	76

1 The participation rates including replacement schools is the percentage of all schools (ie, original and replacements) that participated.

2 Unweighted participation rates are computed using the actual numbers of schools and reflect the success of the operational aspects of the study (ie, getting schools to participate).

3 Weighted participation rates reflect the probability of being selected into the sample and describe the success of the study in terms of the population of schools to be represented.

4 Japanese mathematics data was collected in 1995.

5 The response rates after replacement for Japan differ from that reported previously (eg, Stigler et al, 1999). This is because the procedure for calculating response rates after replacement has been revised to correspond with the method used in the 1994–1995 TIMSS and 1998–1999 TIMSS-R Achievement Studies.

6 In the Netherlands, a mathematics lesson was filmed in 78 schools.

7 In Switzerland, 74 schools participated from the German-language area (99 per cent unweighted and weighted participation rate), 39 schools participated from the French-language area (95 per cent unweighted and weighted participation rate), and 27 schools participated from the Italian-language area (77 per cent unweighted and weighted participation rate).

NOTE: For Australia, the Czech Republic and the Netherlands, these figures represent the participation rates for the combined mathematics and science samples.

SOURCE: US Department of Education, National Center for Education Statistics, *Third International Mathematics and Science Study-Repeat, Video Study*, 1999.