PROFESSIONAL DEVELOPMENT THROUGH LESSON STUDY: PROGRESS AND CHALLENGES IN THE U.S.[i]

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This paper provides a brief history of lesson study in the United States, with a focus on areas of progress and challenge. Four areas of progress are identified: growth of interest among educators; growth of tools and resources; growth of understanding; and emerging evidence of effectiveness. Five challenges are identified: access to rich models of mathematical instruction; premature "expertise;" simplistic research models; limited opportunities for cross-site learning; and inadequate feedback loops linking lesson study to changes in curriculum and policy.

INTRODUCTION

Lesson study is the core form of professional development in Japan, and is often credited for the steady improvement of Japanese elementary instruction (Hashimoto, Tsubota, & Ikeda, 2003; Lewis & Tsuchida, 1997; Stigler & Hiebert, 1999). U.S. educators have shown enormous interest in lesson study since the Third International Mathematics and Science Study brought it to public attention in 1999; however, the U.S. has a history of educational faddism, in which many promising innovations have been discarded before being thoroughly understood or implemented (Burkhardt & Schoenfeld, 2003; Fullan, 2001). Will lesson study suffer a similar fate? This paper examines evidence of lesson study's progress and challenges in the U.S. to date.

LESSON STUDY'S PROGRESS IN THE UNITED STATES

Four areas of progress are identified: growth of interest in lesson study among U.S. educators; growth of tools and resources for lesson study; improved understanding of lesson study; and emerging evidence of lesson study's effectiveness in U.S. settings.

Growth of interest in lesson study.

In 1999, the Third International Mathematics and Science Study brought Makoto Yoshida's (1999) work on lesson study to a broad public audience (Stigler and Hiebert, 1999), provoking enormous interest in lesson study among US educators and researchers. Within three years, lesson study groups emerged in at least 200 U.S. schools across at least 25 states (Lesson Study Research Group, 2004a), and lesson study became the focus of dozens of conferences, reports and published articles in the US (e.g., Brown et al., 2002; Chokshi & Fernandez, 2004; Lewis 2002a,b; Lewis, Perry, & Hurd, 2004; National Research Council, 2002; North Central Regional Educational Laboratory, 2002; Richardson, 2004; Stepanek, 2001, 2003; Wang-Iverson & Yoshida, 2005; Watanabe, 2002; Wilms, 2003).

We are not aware of a systematic source of statistics on public lessons in the US, but we do that public research lessons now occur in many regions. For example, in the first half of 2005 alone, public lessons occurred in Olympia, Washington; Chicago, Illinois; Fresno, San Mateo, and Sonoma, California; several locations in and around Watertown, Massachusetts; and Des Moines, Iowa. At least five of these had more than 100 people in attendance.

Some interest in lesson study in the U.S. has come from quarters where there is not extensive lesson study in Japan, such as universities. U.S. interest in lesson study in the U.S. has emerged across grade levels (from preschool to university) and across subject areas, including science, mathematics, language arts, English as a second language, art education, social studies, special education, and no doubt other areas as well (Teaching American History, 2005; University of Wisconsin-LaCrosse, 2005).

Growth of tools and resources for lesson study.

Various tools for the pursuit of lesson study have been developed in the U.S., some based on Japanese practice (e.g, protocols for classroom observation and the post-lesson colloquium), and others in response to challenges that may be more prevalent in the U.S. than in Japan (e.g., how to get started with lesson study, how to develop collaborative norms within a lesson study group). Resources include individual protocols and agendas for parts of the lesson study process; handbooks; practitioner-oriented articles; and videos of lesson study in Japanese settings and in U.S. settings conducted by U.S. practitioners and by Japanese practitioners (Fernandez & Chokshi, 2002; Lesson Study Research Group, 2004b; Lewis, 2002b; Mills College Lesson Study Group, 2005, 2003a,b, 2000, 1999a,b; Wang-Iverson & Yoshida, 2005).

Improved understanding of lesson study.

Table 1 illustrates two alternative ideas about the mechanism by which lesson study improves instruction. We developed Table 1 as a foil for use in workshops, in response to the theory of lesson study that seemed to underlie questions often posed to us, such as “When do Japanese practitioners decide a lesson is good enough to be used widely?” and “If Japanese teachers spend so much time on one lesson, how do they ever get to all the lessons in the curriculum?” The view of lesson study labeled as hypothesis 1 – that it improves instruction primarily through the improvement of lesson plans – has characterized the early lesson work of some sites we have studied. For example, the teachers of Bay Area School District (BASD) initially used the phrase “Polishing the Stone” to describe their work, and originally planned to disseminate “polished” lesson plans on the district intranet as a primary outcome of their lesson study work. However, during their first year of work, BASD teacher-leaders began to redefine their work as teacher-led research on practice, and they began to regard the lesson plans as an inadequate representation of their learning from lesson study. As a result, they chose alternative methods to share their learning, such as open-house research lessons where visitors could participate in the whole process of lesson observation, data collection, and lesson discussion.

Emerging evidence of effectiveness of lesson study in U.S. settings.

When the senior author first gave talks about lesson study (in 1994), it was common for U.S. audience members to make comments like "lesson study is a good idea but it would never work in the U.S. because we are not a collaborative culture," or "Lesson study works in Japan because teachers know a lot of mathematics, but that's not true in the U.S." However, there are now emerging some "existence proofs" that U.S. teachers can use lesson study to *build* collaboration and content knowledge. The video of the U.S. lesson study cycle "How Many Seats?" illustrates how U.S. teachers can use lesson study to build both collaboration and content knowledge. In the segment of "How Many Seats?" excerpted in Table 2, Teacher 1 moves from confusion about the relationship of triangles and perimeter units ("tables" and "seats"; see problem in Table 3) to clear statement of the relationship between the two. Likewise, Teacher 5 gains insight into the physical reason for the numerical pattern. Solution and discussion of the problem to be presented to students and careful data collection during the research lesson support teachers' learning in these instances.

The teachers in "How Many Seats?" also build collaborative capacity, by setting norms for their work together, choosing one to monitor at each meeting, and sometimes changing their group operating procedures based on these discussions. For example, the group of teachers in "How Many Seats?" decides on a more active role for the (rotating) facilitator in confirming and marking group decisions, after monitoring of their norm "Sticking to the Process" reveals that some members are confused about the group's decisions. The following conversation occurs on Day 2 of the group's work, when group members are reflecting, at the end of the meeting, on the norm they chose to monitor that day: "sticking to the process." After one member comments that many ideas were discussed without a clear decision on them, another member suggests that the facilitator needs to take a stronger role.

> Teacher 6: I second what Teacher 3 says about, I think the facilitator's role is to stop, make sure you are on the process and make sure that everybody's, you know everybody's opinion is counted, you know.
>
> Teacher 5: hmm. So maybe we are hearing too that the facilitator needs to be a little bit more aggressive, a little bit you know more in there, saying let's slow down, let's poll everybody, let's say what we are doing right now. Would you feel more comfortable with that?
>
> (Nods, assents all around)
>
> The following day, when teacher 5 begins a segue into a new topic of conversation, the new rotating facilitator implements the more active role agreed upon the prior day: .
>
> Teacher 5: So this would be a good place for us to anticipate what we think is going to happen, misconceptions that might happen when they do 4, 5, and 6.

> Teacher 1: Okay. But first let's hear from everybody I think, because we had kind of a proposal on the table and I think one of the things that happened yesterday was we would have a proposal and we sort of assumed everyone was on board, but we weren't. Is everybody on board with this? (Each member assents.)

This segment suggests that the group has actively used one of the tools provided (norm-setting and monitoring of norms), to create a more effective way of working together.

Other U.S. lesson study evidence suggests other types of teacher learning during lesson study. For example, the U.S. kindergarten teachers studied by Murata (2005) made connections between state standards and their own curriculum knowledge in the course of their lesson study work, shifting their view of the state standard in question from "no way" our students can do this to confidence that it can be mastered and knowledge about how go about it.

A technology-based "lesson-study inspired" innovation studied by Ermeling (2005) led U.S. high school science teachers to increase the student inquiry basis of their classroom lessons.

At one U.S. elementary school, teachers voted to practice lesson study on a school-wide basis in 2002, after volunteer groups of teachers found it to be useful, and this teacher-led lesson study has continued in every year since, growing from mathematics to include other subject areas at the instigation of the teachers. Table 4 shows the scale scores for the school on the state mathematics achievement test, along with those for the district and state as a whole. Over 2002-05, the three-year net increase in mathematics achievement for students who remained at this school was more than triple that for students who remained elsewhere in the district as a whole (90.5 scale score points compared to 25.8 points), a statistically significant difference ($F=.309$, $df=845$, $p<.001$). While a causal connection between the achievement results and lesson study cannot be inferred, other obvious explanations (such as changes in student populations served by the school and district) have been ruled out. School-wide lesson study appears to be a primary difference between the professional development at this school and other district schools during the years studied. [ii].

CHALLENGES TO LESSON STUDY IN THE UNITED STATES

Five areas of challenge have also emerged as lesson study has unfolded in the United States: access to rich models of mathematical instruction; premature "expertise" about lesson study; simplistic research models; limited opportunities for cross-site learning about lesson study; and inadequate feedback links between lesson study and changes in curriculum and policy.

Access to rich models of mathematical instruction.

Kyouzai kenkyuu (investigation of teaching materials) is a facet of lesson study that may enable teachers to deepen their understanding of mathematics, pedagogy, and student thinking (Hashimoto, Tsubota, & Ikeda, 2003; Takahashi et al., 2005).

Visiting Japanese educators often ask U.S. teachers how a particular topic is presented in the textbook, or suggest that U.S. teachers study a topic's presentation in several textbooks. This may be useful advice if the textbook's approach reveals interesting features of the topic. Unfortunately, this is not always the case. One group of mathematics coaches in California conducted a lesson study cycle on proportional reasoning. Accounts of Asian treatments of proportional reasoning provided some of the richest material for discussion (see Table 5, from Lo,Watanabe & Cai, 2000); in contrast, a U.S. textbook might provide few examples for teachers to deepen their thinking about the mathematics or pedagogy of proportional reasoning (see Table 6).

Premature "expertise."

Lesson study is a simple idea but a complex process. Even after a decade of studying lesson study in Japan, we are all still learning about lesson study's many forms and purposes. Remarkably, some U.S. trainers seem to believe that participation in one or two lesson study cycles qualifies them as lesson study experts who can provide definitive blueprints to others. Premature expertise may pose a substantial threat to lesson study, by generating a "been there, done that" attitude instead of a realistic expectation that "the road is created as we walk it together." [iii]

In contrast, a learning stance seems to characterize the work of settings such as BASD where lesson study has been sustained. During the first year of lesson study work, one of the BASD leaders answered a question about the attitudes essential to lesson study in the following way: .

> That you can always get better at teaching. That you're never at the end of the road…If you came into [lesson study] and you were [acting] like 'I'm the hottest thing out there and I've got all these great ideas and I'll share them with you guys'....you're not going to get anything out of it.

The expectation that teachers will learn about subject matter and its teaching-learning through lesson study has been a steady theme throughout the five years of the lesson study effort. For example, a video shot in 2002 and widely used to introduce BASD's lesson study work prominently features teachers' initial struggle to understand the mathematics of a problem and their strategies to build their own mathematical understanding (Mills College Lesson Study Group, 2005). In 2005, as one BASD lesson study group shifted its focus from mathematics to writing instruction, experienced teachers readily volunteered that they did not believe they had effective strategies for teaching writing. Two members commented afterwards on how lesson study fostered and was fostered by a culture in which "You're learning. You don't know everything. You're not busy hiding what you don't know."

Simplistic research models.

When we ask a roomful of U.S. educators to raise their hands if they have ever seen a promising innovation discarded before it has been thoroughly tried, virtually every hand in the room goes up. Simplistic research models may be one contributor to premature innovation death. For example, lesson study might be regarded as something like aspirin, an easily transported treatment that interacts little with local site characteristics. Or lesson study may be regarded as a "recipe" that can be implemented at a site according to some fixed external instructions (perhaps with minor adjustments like one would make when using a recipe at high altitude).

Neither the metaphor of aspirin or recipe captures lesson study, because of the extensive interaction between lesson study and the local setting. What is needed to practice lesson study in a site where there is a coherent curriculum, tradition of collaboration, and history of careful study of student learning may be quite different from what is needed in sites where these do not exist. Lesson study might more appropriately be thought of as a system of learning with certain core principles, as sketched out in Table 1. Spreading a culture from one geographic location to another is perhaps the best analogy for lesson study; such cultural spread is something that can happen and has happened many times in human history. However, cultural spread is distinctly different from simply spreading the tools or recipes of a culture.

Limited opportunities for cross-site learning.

The United States is geographically large. Even though there are many lesson study efforts springing up, many U.S. teachers have little opportunity to experience lesson study outside of their own setting. To the extent that this is true, sites will reinvent the wheel, rather than learn from one another. For example, the idea of setting group norms and choosing one to monitor at each meeting, developed by teachers in one U.S. school district was eagerly embraced by others when they saw it in a workshop. Opportunities to see research lessons and post-lesson colloquiums conducted by teachers from other sites can provide an opportunity for immersion in another culture of lesson study, providing a vantage point on one's own assumptions, practices, and so forth.

Cross-national learning that includes educators from Japan may be a particularly potent form of cross-site learning, judging from U.S. teachers' reflections on cross-national workshops. Comments from U.S. teachers who engaged in cross-site lesson study with Japanese colleagues in August 2001 illustrate the kinds of reflection about lesson study and mathematics teaching-learning that may be stimulated by cross-site collaborative lesson study:

> [I learned that lesson study] is not so much about lesson planning as it is about research and watching children's learning
>
> I love the Japanese teachers' polite, validating comments to the students. "I don't require the correct answer."
>
> At the beginning of the week, I was more focused on the teacher. Now I can see and record students' mathematical thinking.
>
> There is no shortcut to doing the lesson planning and participating in lesson study yourself to become a helpful observer – DARN!

> Effective observation involves skills, knowledge and preparation. This includes a "record of lesson" sheet, a copy of the lesson plan itself, and how effectively you can link teacher action to child's expression.
>
> Create a need (hunger) for mathematical language; don't just give it to kids.
>
> The blackboard is a <u>record</u> of the lesson. I often use the overhead (thus, erasing a lot) or erase what I've written on the blackboard due to lack of space. Mr. Takahashi's use of the blackboard has made me think of how I will use it in the future.

Inadequate feedback loops linking lesson study to changes in curriculum and policy.

In Japan there is an intimate relationship among lesson study, textbooks, and the national Course of Study. Advances in one arena tend to reshape the other arenas as well. For example, when Japanese elementary teachers used lesson study to try out lessons on solar energy (which was not then in the curriculum), this topic was picked up by other teachers, noticed by policymakers, and eventually became part of the national *Course of Study* (Lewis & Tsuchida, 1997). New elementary lessons are expected to prove themselves widely in public research lessons before finding their way into textbooks, and teacher-authors of textbooks are typically very active in lesson study, incorporating successful new approaches into textbook revisions.

MEXT (the Japanese Ministry of Education, Culture, Sports, Science and Technology) provides funding to schools across Japan that apply to be "designated research schools" for curricular innovations under consideration. Over a period of several years when an innovation is being considered or initiated, teachers at designated research schools engage in repeated cycles of lesson study, often inviting in university-based specialists and nationally known teachers interested in the particular innovation (Bjork, 2004; Lewis & Tsuchida 1997, 1998; Tam, 2004; Tsuneyoshi, 2001, 2004). Teachers at the designated research schools study existing curricula and materials (often including approaches from abroad), adapt or develop approaches they think will work in their own settings, and study students' responses to the new types of instruction. After cycles of internal lesson study, teachers conduct public research lessons that bring to life the local vision of the innovation, enabling visiting educators to observe the instructional approach and the students' learning and development, and providing a public forum for lively discussion of the local theory of the innovation. In this way, instruction, textbooks, and standards can evolve in tandem.

In contrast, the hard work of U.S. teachers to understand, for example, how a particular standard might be brought to life for first-graders (Murata, 2005) may remain within their group.. The major information conduits linking lesson study, textbooks, and educational policy in Japan are missing or sparse in the U.S.: for example, the well-known educators who travel to many lesson study sites to provide public commentary; the teacher-authors of textbooks who are heavily involved in lesson study; and the regional and national policymakers who attend research lessons and use them as formative data on the strengths and shortcomings of policy and its implementation (Watanabe, 2002).

Conclusion.

In this international symposium, we have a valuable opportunity to find out whether the advances and challenges of lesson study experienced in the U.S. are similar to those found in other countries. We also have a valuable opportunity to share strategies for building progress and overcoming obstacles. As the Japanese say, “When three people gather you have a genius.” I hope we can work with the great genius we have assembled here.

Table 1: How Lesson Study Results in Instructional Improvement: Two Conjectures

VISIBLE FEATURES OF LESSON STUDY

- **Consider long term goals for student learning and development**
- **Study existing curricula and standards**
- **Plan and conduct research lesson**
- **Collect data during research lesson**
- **Present and discuss data from research lesson, draw out implications for future instruction**

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Intervening Changes

CONJECTURE 1

LESSON STUDY IMPROVES LESSON PLANS

CONJECTURE 2

LESSON STUDY STRENGTHENS 3 PATHWAYS TO INSTRUCTIONAL IMPROVEMENT:

1.TEACHERS' KNOWLEDGE, e.g.:

- **Knowledge of subject matter**
- **Knowledge of instruction**
- **Capacity to observe students**
- **Connection of daily practice to long-term goals**

2.TEACHERS' COMMITMENT-COMMUNITY, e.g.:

- **Motivation to improve**
- **Connection to colleagues who can provide help**
- **Sense of accountability to valued practice community**

3. LEARNING RESOURCES, e.g:

- **Lesson plans that reveal and promote student thinking**
- **Tools that support collegial learning during lesson study**

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Improvement of Instruction

Date	Evidence	Researcher's Inference
8/7/02	Planning Meeting Teacher 1: I thought when we added a triangle we were adding two, but the output chart here is adding one, and I'm not, I don't understand why that is….. Teacher 6: Because the third one is now a combined one. Teacher 2: One plus two. It's plus two *this way* (moves finger horizontally across Teacher 1's chart, to show comparison between seats and tables). Teacher 1: Oh. Wait a second (studying triangles). Teacher 5: So maybe it would be a good time for us to do the activity? Teacher 1: (Laughing), yeah maybe! [teachers work problem with manipulatives and discuss]… Teacher 6: Because if you have one triangle you have three [sides], but then when you have two [triangles], one of those three [sides] becomes a combined. Teacher 1: *Two* of them become combined, that's why you don't have 5. Cause I'm thinking, how come I don't have 3 plus 2? Teacher 6: I just did the same thing! Teacher 4: You don't count the shared side. Teacher 5: It's the number of triangles plus two. Teacher 2: It's all plus two. It's plus two *this* way. [Gesturing across Teacher 1's chart, comparing triangles and perimeter units]… Teacher 1: But now why is that?… I'm still,	Teacher 1 is trying to understand the meaning of the "plus two" pattern in the chart. She initially merges the plus one pattern (each additional triangle adds one perimeter unit) and the plus two pattern (the number of perimeter units is two more than the number of triangles). Through trying different numbers with the manipulatives, she grasps the plus-two numerical pattern.

	though, why isn't it if I add a triangle…why am I not…[continues to work with the triangles, initially with puzzled tone of voice, then increasingly matter-of-fact as she tries different numbers of triangles] Three. So there's the two….[With confidence] This does not fit for zero triangles. This formula is not an n formula, it is not like "in any case" cause it has to fit for zero stage, right? Teacher 2: I don't know. I'd have to ask. Teacher 1: If the number of triangles is zero, you do not have two sides when you have no triangles.	
8/9/02	Planning Meeting Teacher 1: (Reading from group's instructional plan goals). Students will discover a pattern and they will represent the pattern as a rule. They will understand what a mathematical rule is and will be introduced to the idea of representing the rule as an equation. Teacher 2: So, representing the rule as an equation, that's a little bit.. Teacher 3: going in another direction Teacher 1: But it is an equation. We're saying: Number of tables plus two equals the number of …seats; that *is* where we want to get them to at the end of the easel time.	Now teacher 1 clearly describes the plus two pattern in her own words as she advocates for it in the lesson goals.
8/12/02	First teaching of research lesson: Teachers record the activities and speech of selected students, trying to create a complete record of what the selected student heard, saw, and did during the lesson.	
8/12/02	Colloquium of First Teaching Teacher 2: I noticed kids counting the seats different ways, and this was a kind of a big aha for me… When I've done the problem	Observation of student counting methods enabled Teacher 2 to understand the mathematics of the

	myself I've always counted [shows counting around the edge] and it didn't occur to me there was another way of counting it…But [student name] had laid out 20 triangles…and she was counting [demonstrates counting top and bottom alternately, followed by ends] and then it looked totally different to me; I could see there's 10 triangles on top, 10 on bottom, and a seat on either end. Now I was seeing the pattern a different way. Up until then, I had always seen it as you're taking away a seat and adding these two, taking away a seat and adding these two [shows adding a triangle and subtracting the side that is joined]. I was seeing a pattern from somebody else's perspective. That's why I thought it might be helpful to have kids talking about how they're counting it. How are you seeing the seats, and the numbers, and the increases, and where does that come from? So I think definitely having the kids use the manipulatives is important, and watching how they use them is going to tell us a lot about how did they see the pattern.	problem in a new way: that the two ends contribute the "plus two."

Table 2: Excerpts From The Lesson Study Cycle "How Many Seats?"

We have a long skinny room and triangle tables that we need to arrange in a row with their edges touching, as shown. Each side can hold one "seat," shown with a circle. Can patterns help us find an easy way to answer the question: How many seats fit around a row of triangle tables?

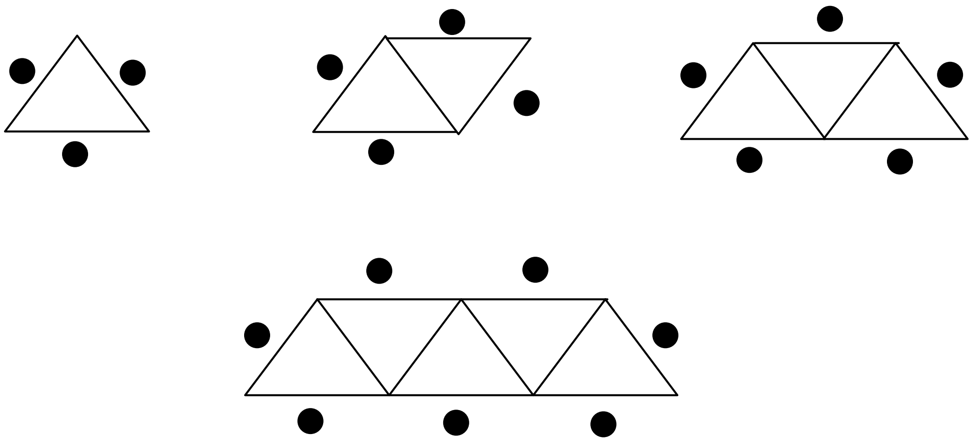

Table 3: Illustration of Problem Used In Lesson Study Cycle "How Many Seats?"

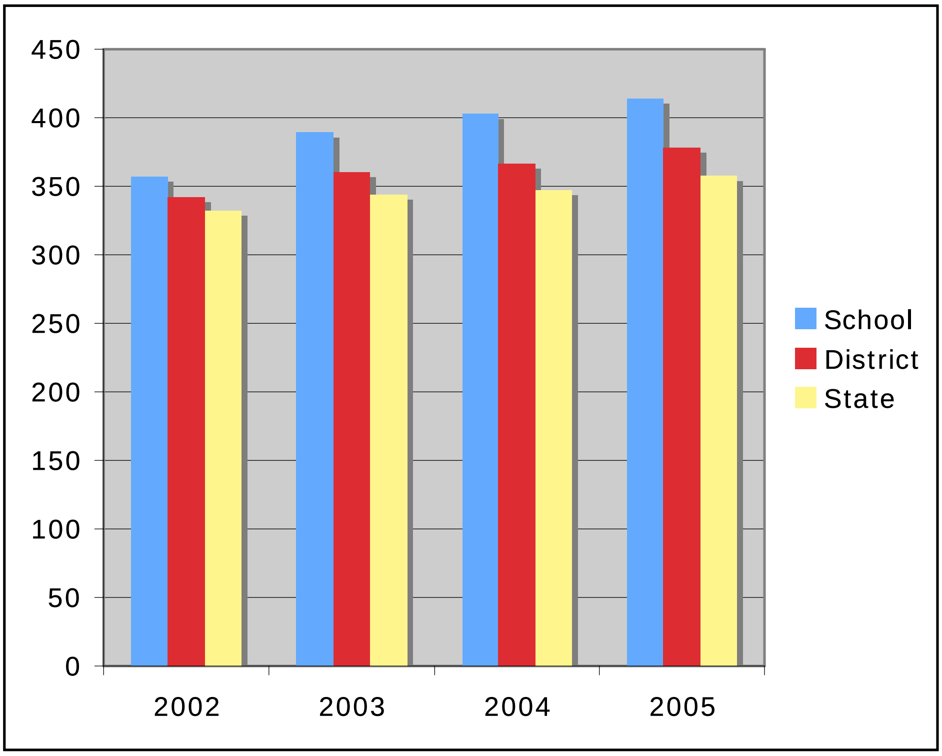

Table 4: California Standards Test in Mathematics: Mean Scale Scores, Grades 2-5

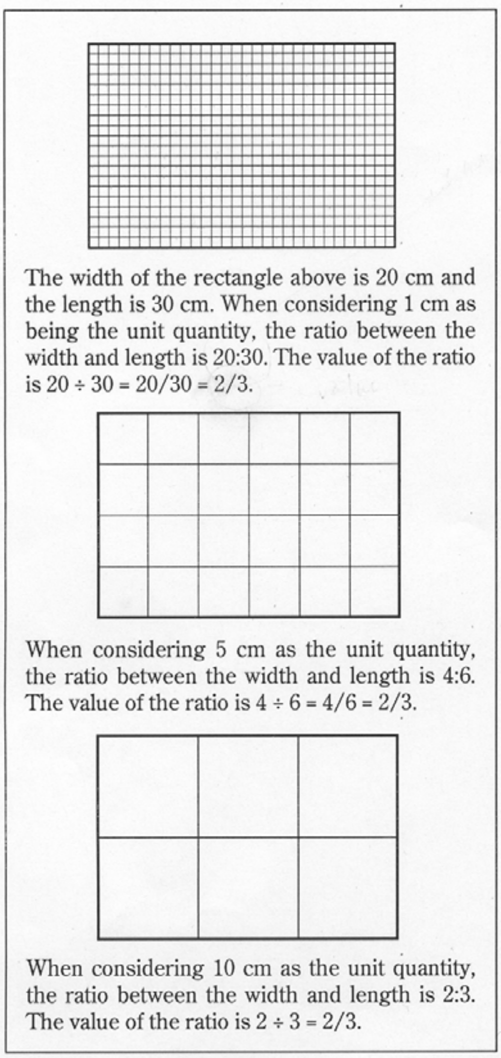

Fig. 2 Conceptualizing equivalent ratios

Table 5. Ideas about proportional reasoning introduced from research on Asian curricula (Lo, Watanabe, & Cai, 2004)

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[ii] To rule out competing hypotheses about causes of the increasing achievement, we identified other reform efforts that the school-wide lesson study school participated in during 2001-2005, and identified all other elementary schools (five) that participated these reform efforts. Gains in achievement for students who remained at each of these schools for longer than one year were compared with gains for all students who remained in the district. Only one school other than the lesson study school showed any statistically significant achievement gains relative to the district as a whole, and that school did not show sustained gains over three years. (The school that showed these gains was initially an Integrated Thematic Instruction school like Foothill, but the program was discontinued.)

[iii] From “Proverbios y Cantares, XXIX” by Antonio Machado, http://www.geocities.com/Athens/Delphi/5205/Proverbios_y_cantares.html; translator not given.