

# Japanese and American Teachers' Implicit Theories of Mathematics Learning and Instruction

Jacobs, J.K., Yoshida, M., Fernandez, C. & Stigler, J.W.

University of California, Los Angeles

## Background

While American mathematics teachers are having a difficult time shifting from their traditional approach to instruction to the widely recommended "constructivist" approach, Japanese mathematics teachers consistently and successfully use a constructivist approach in their elementary school classrooms (eg. Stigler, Fernandez & Yoshida, 1990). Research suggests that teachers' beliefs about mathematics and instruction exert a large influence on their classroom behavior (eg. Thompson, 1992).

Our study investigates the nature of American and Japanese teachers' implicit theories regarding mathematics learning and instruction.

## Method

Subjects were 4 teachers from Los Angeles and 4 teachers from Kobe, Japan. All of the participants were currently teaching elementary school, and had at least 5 years of experience. The American and Japanese subjects were matched to have roughly comparable teaching experience.

Each teacher participated, individually, in a 2 hour session during which they watched and critiqued a videotaped mathematics lesson, filmed in either Nagano, Japan or Chicago, IL. Half the teachers from each country watched the Japanese lesson, and half from each country watched the American lesson. Both lessons cover the same topic (area of a triangle), but exemplify the different teaching strategies typical of their culture. The foreign tapes were dubbed, and the sessions were held in the teacher's native language. Subjects watched one of the math lessons in its entirety stopping the tape whenever they wanted to make a comment. The teachers were specifically asked to address the strengths and weaknesses in the instruction.

## Results

We divided all of the teachers' comments about the lessons into "idea units" -- defined as a distinct shift in focus or change in topic. Interrater agreement in identifying idea units was 86%, and agreement in coding the idea units ranged from 85-95%. We found that the majority of the all the teachers' idea units (82%) could be coded as relevant to one of four issues: what students should do during a lesson, how instructors should use language, how instructors should pace lessons and address ability differences, and how instructional materials should be used.

However the Japanese and American teachers had very different things to say regarding these issues. The Japanese teachers wanted to see: signs of students' intellectual engagement, not too much talking by the teacher, a relatively slow pace with a special concern for slow students, and a blackboard neatly depicting a wide array of student responses. By

contrast the American teachers preferred: behavioral indications of student engagement, clear language and explanations by the teacher, a relatively fast pace with a special concern for fast students, and that a blackboard be used by the teacher or fast students.

## Conclusions

Four issues - student engagement, teachers' language, pace, and material - are the core features of all of our subjects' theories regarding mathematics learning and instruction. These features fit with both the American and the Japanese teachers, however the parameters are "set" differently. These culturally specified parameters map easily onto existant classroom practices.

Japanese math teachers typically present an interesting problem for their students to work on, and therefore a main requirement is student intellectual engagement. Teachers use minimal direct instruction, as the students figure out solutions on their own. In a problem-solving lesson, students can search for multiple ways to arrive at the same answer, so there is little need for a rapid pace. Teachers are more concerned with the slower students, and ensuring that each child can find at least one approach to the problem. The blackboard becomes a tool to neatly depict the wide variety of children's solution strategies.

American math lessons are typically teacher-centered. Students' behavioral engagement is critical because the instructor is imparting important information, and the students must remain on-task in order to receive the information. The teachers' role is to clearly transmit knowledge, at a pace rapid enough so that students' do not become bored. Classroom tools are used by the teacher and knowledgeable students, and depict only correct answers.

## Implications

Both American and Japanese teachers seem to have coherent implicit theories, which map easily onto their differing classroom instructional approaches. We hypothesize that in order for teachers to reform their classroom practices, they must simultaneously reflect on and question their beliefs about learning and instruction.

## References

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