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Cross-Cultural Differences in Use of Comparisons: Imagery and Visual Cues

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Abstract

Comparison has been studied in laboratory contexts, but less is known about how this reasoning practice differs across cultures. Findings are reported from a cross-cultural study of comparisons used within US, Japanese, and Hong Kong mathematics classrooms. Two findings are reported: the use of imagery and the use of visual alignment. These data reveal that US teachers use reliably fewer imagery and visual alignment supports for comparative reasoning. These suggest that US teachers provide fewer cues of the type known to facilitate learners' use of structural comparisons than Hong Kong and Japanese teachers.

Cognitive scientists have widely argued that the ability to map structure from one object context to another plays a central role in cognition, learning and problem solving (Gentner, Holyoak, & Kokinov, 2001). However, systematic failures to notice and use structural comparisons have also been documented (e.g. Gick & Holyoak, 1980), suggesting that the reasoning context can have serious consequences for effective use of structural comparisons.

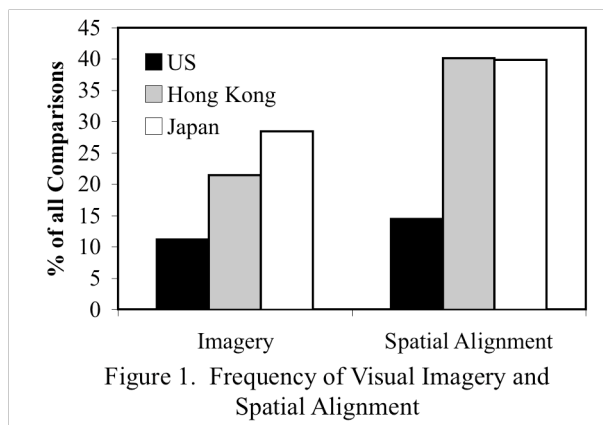
The current study examines cross-cultural differences in the types of contextual cues given to support learners' comparative reasoning during everyday instruction in US, Hong Kong, and Japanese mathematics classrooms. Video-data from 8th grade everyday teaching were collected as part of the Third International Mathematics and Science Study-Repeat. A subsample of ten lessons per country was analyzed for the present study. Comparisons were identified within the 30 lessons, resulting in 520 total comparisons.

All comparisons were coded in many ways to capture information about their form and function by coders native to all three countries. Two codes are discussed in this paper.

Imagery. All comparisons were coded to determine whether imagery was invoked as part of the comparison, or whether only mathematical notation was used. A chi square analysis compared the use of imagery across countries, revealing a significant difference $X^2(2) = 8.08, p < .001$, such that the US invoked the least imagery and Japan invoked the most.

Visual Alignment. The second code measured teacher's use of visual alignment between source and target structures

during comparisons. This also differed by country: $X^2(2) = 39.7, p < .001$, revealing that the US teachers were least likely to provide visual alignment cues (see Figure 1).



Visually aligning sources and targets reduces working memory demands and reduces the likelihood that a learner would fail to notice or retrieve a relevant source. This is particularly important since US teachers were less likely to use imagery than Hong Kong and Japanese teachers. Imagery can draw attention to abstract structure and/or draw comparisons into contexts familiar to learners, which can facilitate noticing and using comparison (Goswami, 1995).

Altogether, these data indicate that US teachers provide fewer of these supports for comparative reasoning than Hong Kong or Japanese teachers. This reveals cultural differences in patterns of comparative reasoning as well as correlates with international math achievement patterns. The US traditionally performs below Hong Kong and Japan, potentially indicating a correlation between higher support for comparative reasoning and effective teaching practices.

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