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Age and Pedagogy Effects on Conceptual Access in Child L2 Learning

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The research demonstrates rather conclusively that the Revised Hierarchical Model does not apply to elementary-aged L2 learners, as they demonstrated conceptual access from beginning instruction.

It also suggests that use of pictures in elementary vocabulary instruction is particularly effective.

The study investigated L2 vocabulary acquisition in over 1000 4th-6th graders in 7 elementary schools in Akita, Japan. The results show that elementary-aged students are faster across the board matching L2 vocabulary to pictures compared to L1 translations. This effect was strengthened significantly when students were taught the vocabulary via pictures (as opposed to L1 translation), even when the test stimulus image was not the same as that used for teaching. This further asymmetry in reaction times strongly suggests that the null hypothesis, that children are bound to the Revised Hierarchical Model, should be rejected. In effect, it suggest that children are able to map L2 vocabulary to mental concepts from the first time they hear said vocabulary, and that they can retrieve L2 for meaning directly from concept, as opposed to translating L2 to L1 and retrieving semantic information from the L1 form. This effect continues, but rapidly diminishes, through 6th grade.

Linguistics

RHM young learners vocabulary acquisition conceptual access

One of the key goals in vocabulary acquisition as part of learning a foreign language is to forge direct linkage between foreign language (L2) words and mental concepts. According to the Revised Hierarchical Model (Kroll & Stewart, 1994), foreign language learners connect word form and meaning gradually. At first, L2 words can only access the "concept" (i.e., mental representation of meaning) by first translating them to learner's native language (L1). As such, access of meaning is a two-step procedure: L2➔L1 translation, only after which mental representations can be accessed. It is only as learners increase their proficiency in the target language and their familiarity with the target vocabulary that they gradually develop the means to bypass their native tongue and forge direct pathways from L2 vocabulary forms to mental representations of their meanings

While still debated, the Revised Hierarchical Model (RHM) has significant intuitive appeal, and was well-formulated to provide a "middle-ground" approach to models of mental representation of L1 and L2, providing more concrete details on how a subordinate model of representation could potentially turn into a coordinate model as L2 fluency developed. The RHM was originally proposed to explain why L1➔ L2 translation was significantly faster than L2 picture naming for beginning students, but such differences disappeared with advanced proficiency students. Clearly there were important differences in conceptual access. The RHM is supported by additional evidence, such as asymmetries in categorical interference, translation, and picture naming between languages (e.g., Kroll & Stewart, 1994; Sholl, Sankaranarayanan, & Kroll, 1995).

However, while there has been fairly extensive research on adult learners and bilinguals, child learners have received considerably less attention; however, as children are still engaged in near-daily vocabulary acquisition in their native tongues, they might theoretically be able to forge direct links between concepts and foreign vocabulary more easily than can adult learners. A study by Comesaña, Perea, Piñeiro, & Fraga (2009) of Spanish-L1 elementary learners of Euskera (Basque) suggest that this may indeed be the case. Furthermore, it suggests the possibility that pedagogical methods may directly influence whether or not learners successfully link L2 vocabulary to preexisting mental concepts. If children have this ability to directly link newly learned L2 vocabulary forms to mental concepts (thereby bypassing the L1), and especially if this ability were directly impacted by pedagogical methods, this would have serious implications for both the establishment of foreign language education policy making, as well as pedagogical methods, as enabling direct conceptual access would potentially speed vocabulary acquisition, thereby enabling faster, more efficient L2 learning.

This study investigated Japanese elementary schoolers to test whether or not they are able to create direct links between L2 word form and mental concepts after a single teaching session, and whether this ability would be affected by teaching methodologies which deemphasize L1 translation. This research would enable to the researchers both to verify whether or not the Revised Hierarchical Model is applicable to young (i.e., elementary school-aged) L2 learners, as well as to possibly identify more effective means of vocabulary instruction for these young learners. By investigating across grade levels, from 4th to 6th grade, the researchers hoped to be able to answer the following questions:

1) Do children possess the ability to establish L2➔concept links?
2) Do specific pedagogies impact those abilities?
3) At what age do these abilities start to atrophy?

Twelve hundred and sizty elementary school students, grades 4-6, were recruited from elementary schools located in northern Japan to participate in this study. By grade, there were 437 4th graders, 346 5th graders, and 477 6th graders. All subjects spoke Japanese natively. Fifth and 6th graders all would receive one 45-minute English class each week (pursuant to the national curriculum), but 4th graders had not yet begun formal study of English. All students had normal or corrected-to-normal vision, and no students with physical or learning disabilities were included in the results.

Forty-two vocabulary items were selected through consultation with a number of home room teachers from the test sites, seeking to avoid using terms that students would already know (whether due to *katakana* vocabulary used in Japanese or its use in popular video games or TV shows). The primary goal in word-selection was that the test words would be familiar items/concepts to the students, but the students would be highly unlikely to have come across the English vocabulary. After generating the word list, two sets of laminated cards were created – one with picture representations of the vocabulary words, and the other with Japanese translation (written in *kana*). Finally, a computer test script was written using DMDX software (Forster & Forster, 2003).

The research was conducted in a two-day pattern for each class tested. On the first day, the class would be randomly split into two groups, which would be separated into two classrooms, each with a different instructor. During the subsequent 45-minutes English lesson, the first 20 minutes would be spent learning and reviewing the 42 vocabulary words. In one group, the instructor would teach the vocabulary using the picture cards,

and was not allowed to use or acknowledge the Japanese equivalents to the vocabulary. In the other group, the instructor would use the Japanese translation cards to teach the vocabulary (and could freely say the Japanese words during instruction). The following 25 minutes of the lesson was spent on games and learning activities not directly related to the study.

On the second day, another special 45-minute English lesson was provided. During the class period, students would be take in groups of 6 to a separate room in order to take the computer-mediated vocabulary test. During the test, participants would listen to the English vocabulary learnt the previous day, presented one at a time via earphones. Upon hearing each vocabulary item, either two side-by-side pictures or two side-by-side Japanese words (written in *kana*) would immediately be displayed on the computer screen, and subjects were asked to push designated "LEFT" and "RIGHT" buttons to indicate which side of the screen was displaying the image or word that best corresponded to the word that they had heard. Reaction times and error rates were recorded for analysis.

Reaction times are shown in Table 1. All grade levels displayed significantly faster processing time for matching L2 vocabulary with pictures than to L1 word equivalents (F1 $p<0.01$), and those taught via picture cards also displayed a significant item effect (F2 $p<0.05$). Comparison of teaching methods found that only 4th graders displayed a significant difference in processing time, with the faster response time for pictures being facilitated to a significant degree when they were taught using the picture cards (F1=3.79, $p<0.05$). This asymmetry in results according to teach methodology fades by 5th grade (F1 $p<0.10$), and disappears entirely by 6th grade.

Table 1: Reaction times by grade and teaching condition

Grade	Teaching condition (translation vs pictures)	Average time for matching pictures with L2 words (in milliseconds)	Average time for matching L1 words with L2 words (in milliseconds)
6th	Translation	1330	1498
6th	Pictures	1251	1482
5th	Translation	1390	1576
5th	Pictures	1326	1537
4th	Translation	1540	1652
4th	Pictures	1422	1629

The results do support the hypothesis that young learners can directly access the concept. While one cannot completely dismiss the confounding factor of reading speed, if the learners did not have direct access, they would have mentally translate L2 words to L1 before matching, and picture recognition speeds wouldn't consistently outpace matching to L1 translation equivalents. Additionally, pedagogical methods for L2 instruction do

seem to matter, at least at young ages. While this effect seems to fade as the students increase in age, given the limited age range tested, it's currently impossible to say with any certainty whether this was an effect of age, or rather, an effect of experience in learning L2. Because the 4th graders did not regularly experience English classes, and the 5th and 6th graders did, it is possible that this difference is merely reflective of the older children having developed learning strategies that better enable them to tie L2 words to their Japanese equivalents. As L2 instruction has been lowered to the 3rd grade, nationally, from the current academic year, in the future, it may be possible to test this hypothesis. Finally, the test did not determine an end point for this ability to override the RHM. It's clear that, by the 6th grade, students still had direct access to mental concepts from L2 vocabulary. Whereas the bulk of RHM-supporting data was collected from tests with university-aged subjects, it is obvious that the emergence of the restriction on conceptual access to L1 words hypothesized by RHM emerges sometime between elementary school and university, but further study into junior high ages and beyond would be required in order to determine precisely when conceptual access becomes restricted. In the present study, the data set shows a gradual decline in effect size by age; however, item reaction time (F2) still shows some robust effects, suggesting that perhaps that conceptual access has internal variability according to inherent features of vocabulary (e.g., imageability, familiarity to the test-taker, word frequency, etc.).

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