



Culture Counts: Culture, Language & Mathematics in the U.S.

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Abstract

- This study explores the interaction between culture, language, and mathematics through the experiences of multicultural individuals in the United States as they learn math in English as a second language. I focus on the power relations implicit in not only the standard English of the classroom, but also the standard forms of mathematics that students must learn to succeed, and the effects that this power has on student comprehension and on students as subjects.
- As subjects, the students were forced to assimilate in the different linguistic and cultural contexts of the classroom. They described their math experiences in terms of struggles that extended into conflicts their own identities as they confronted their differences and conformed to the dominant form of mathematics that they learned at school in standard English. It is critical that the effects of the standardization of math in the classroom are acknowledged when educating students so that students like those in this study do not continue to be devalued and to struggle without knowing why.

Language & Mathematics

Cardinal Numbers in Different Languages

	English	Chinese	French
1	One	Yi	Un
2	Two	Er	Deux
3	Three	San	Trois
4	Four	Si	Quatre
5	Five	Wu	Cinq
6	Six	Liu	Six
7	Seven	Qi	Sept
8	Eight	Ba	Huit
9	Nine	Jiu	Neuf
10	Ten	Shi	Dix
11	Eleven	Shi yi	Onze
12	Twelve	Shi er	Douze
13	Thirteen	Shi san	Treize
20	Twenty	Er shi	Vingt
21	Twenty-one	Er shi yi	Vingt et un
30	Thirty	San shi	Trente
40	Forty	Si shi	Quarante
99	Ninety-nine	Jiu shi jiu	Quatre vingt dix neuf

- Some languages make mathematics more intuitive than others.
- For example, to say 20 in English may require more linguistic knowledge than 20 in Chinese, since 20 in Chinese literally translates to “two tens”.
- Addition and multiplication are built into Chinese numbers, while doing math in English requires language skills.
- Hence, it is easier for Chinese children to learn numbers and basic arithmetic (Devlin, 2001).

Translating Mathematics Culturally

Long Division in Different Countries

USA

$$\begin{array}{r} 31.75 \\ 4 \overline{)127.00} \\ \underline{12} \\ 07 \\ \underline{4} \\ 30 \\ \underline{28} \\ 20 \\ \underline{20} \\ 0 \end{array}$$

Germany

$$127 : 4 = 31,75 \\ \begin{array}{r} -12 \\ 07 \\ -4 \\ 30 \\ -28 \\ 20 \\ -20 \\ 0 \end{array}$$

Spain, Italy, etc.

$$\begin{array}{r} 127 \overline{)4} \\ -12 \quad 31,75 \\ \underline{07} \\ -4 \\ 30 \\ -28 \\ 20 \\ -20 \\ 0 \end{array}$$

France

$$\begin{array}{r} 6359 \overline{)17} \\ -51 \quad 374 \\ \underline{125} \\ -119 \\ \underline{69} \\ -68 \\ \underline{1} \end{array}$$

Latin America

$$127 \overline{)4} = \\ \begin{array}{r} 12 \\ 07 \\ \underline{4} \\ 30 \\ \underline{28} \\ 20 \\ \underline{20} \\ 0 \end{array}$$

Wikipedia.com: Long Division

- During my semester abroad in Senegal, I taught 7th grade mathematics in English to 44 Senegalese students. One day, they were doing long division on the board and paused to ask me the next step. The students were using the French process (see left) and I had never seen anything like it before.
- This experience taught me that mathematics required translation just like language, and I wondered what other differences in math became apparent to individuals learning in a new cultural context.

Theoretical Framework

Knowledge and Power

- *Verran (1987)*: “Standardized forms” of mathematics are taught in the classroom.
- *Bourdieu (1991a)*: Standard languages
 - “This state language becomes the theoretical norm” (p. 45) against which all people are measured.
 - Individuals acquiesce to standard languages in order to gain access to power.
- *Foucault (1972)*:
 - “*Regime du savoir*” (p. 781)—knowledge represents the beliefs of those who are in power.

Theoretical Framework

The Individual and Power

- *Foucault (1972)*: Subjectivation
 - “Power categorizes the individual” (p. 781), making her/him subjects to the power.
- *Stets & Burke (2006)*: Role Identity
 - “A particular role identity means acting to fulfill the expectations of the role” (p. 226)
 - Normative roles are those defined “along stereotypical normative lines as held in the culture” (p. 230)

Methods

- Seven semi-structured interviews
- Convenience sample of college students of multicultural backgrounds
- Open-ended questions regarding mathematics experiences during transitional periods:
 - Home to school
 - Elementary to middle school
 - Middle school to high school
 - High school to college
 - From one country to another
 - Other language transitions

Results

- *Struggles with context and language (specifically, word problems):*
 - Latina student compared herself to “White Bobby and White Lucy” in the word problems.
 - Students discussed problems “relating to lifestyles and events that [they] didn’t grow up with” and getting hung up on understanding the context.
 - Referring to the people in the problems, one student said, “they were always in some situation that I don’t think I’d ever find myself in.”
- *Assimilation:*
 - In all cases, students assimilated to the standard English language and cultural context(s) of the classroom.

Results

- *The student as the subject and role identity:*
 - “I was the weird immigrant child and I didn’t want to be that. So in everything I did, I didn’t identify with that anymore...I probably do feel really comfortable in English ‘cause I always strive to be *‘American.’*”
 - “I feel like a lot of Chinese students [who] are good at math, it’s not because they’re smart, or they’re really talented with math, it’s more like we were *trained* well...[if] you do that every day, how could you not do that well?”
 - “American students choose math because they really love math and they’re really good at it, but Chinese people choose it because it’s easy for them...A lot of Chinese students are good at math, but they are not really loving math.”

Analysis

- This study reveals the outcomes of math's standardization as students interact with power. Assimilation was a key theme in the interviewees' responses since it allowed them to gain access to power; at the same time, the standard forms taught in school devalued the students' various backgrounds by forcing them to take on the dominant culture and language in order to succeed.
- Subjectivation and role identity explain the most important and lasting effects of the power implicit in standard forms of math. Much of the "trauma" experienced by students is due to this feeling of otherness in comparison to the dominant culture that can only be remedied by taking on the role of an English-speaking math student of the dominant culture.
- The standard form of math taught in the classroom must be considered in terms of the effects it has on students whose backgrounds are not aligned with the dominant culture represented by the standard. These students may feel devalued in this process, due to the ideologies promoted in the educational institutions and the values placed on English instead of their first language, which lead them to assimilate given no other choice.

Conclusion

- The conflicts with context that students in this study experienced due to the standardization of mathematics can also be avoided by recognizing the orientation of the educational institutions and the dominant ideologies they represent, and altering teaching methods and word problems to be more culturally appropriate.
- While the effects of standard languages on students are well-acknowledged in educational institutions, the notion of standard forms of math has not been included in discussions of math education in the U.S. The dominant culture that designates the standard languages of the classroom and the ideology of the institutions is the same authority that promotes a standard form of math, leading to difficulties with cultural context and language.

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Acknowledgments & Contact

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