DIPARTIMENTO
DI MATEMATICA
GIUSEPPE PEANO
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European Women in Mathematics

Cultural Transposition and the Semiosphere: tools for analysing mathematical discourse

Manolino Carola - PhD student, XXXIII cycle

Supervisors: prof. F. Arzarello and Y. Chen

International Day of Women and Girls in Science

Università degli Studi di Torino, Politecnico di Torino

February 11, 2021

Gender Gap in Mathematics

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CrossMark

Investigating Gender Differences in Mathematics and Science: Results from the 2011 Trends in Mathematics and Science Survey

David Reilly[1] · David L. Neumann[1,2] ·

Ghasemi and Burley *Large-scale Assess Educ* (2019) 7:10
https://doi.org/10.1186/s40536-019-0078-1

Large-scale Assessments in Education

RESEARCH Open Access

Gender, affect, and math: a cross-national meta-analysis of Trends in International Mathematics and Science Study 2015 outcomes

Hansel Burley[1]

Abstract

Understanding why women are consistently underrepresented in STEM fields has been a constant puzzle, with a consistent feature of the puzzle being performance in math. This study uses data from TIMSS exams to investigate cross-national gender differences in math-related affect, more precisely liking mathematics, confidence in mathematics, and valuing mathematics. We compared fourth and eighth graders to track any differences in these gender-related affective characteristics. Our findings suggest that despite the variability and some changes to the magnitude and direction of gender differences in math affect, boys and girls are similar. We also found that cross-national sociocultural, political, and educational equality of adults does not necessarily predict positive affect for both genders. In fact, the researchers found that some countries with a smaller adult gender gaps have students with higher gender differences in mathematics-relevant affect.

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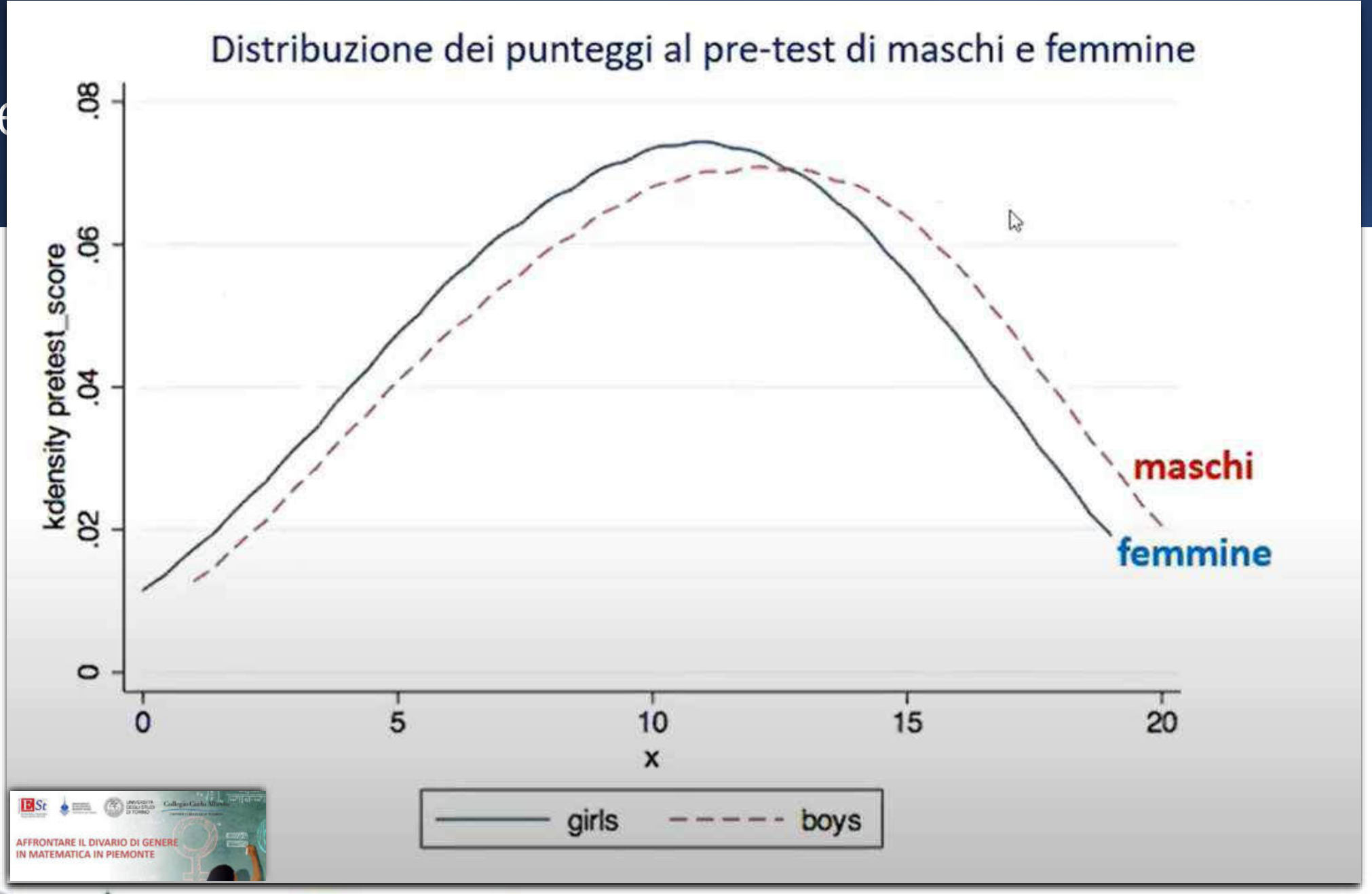
Fondazione Compagnia di San Paolo

TORINO METROPOLI

Ge


Distribuzione dei punteggi al pre-test di maschi e femmine
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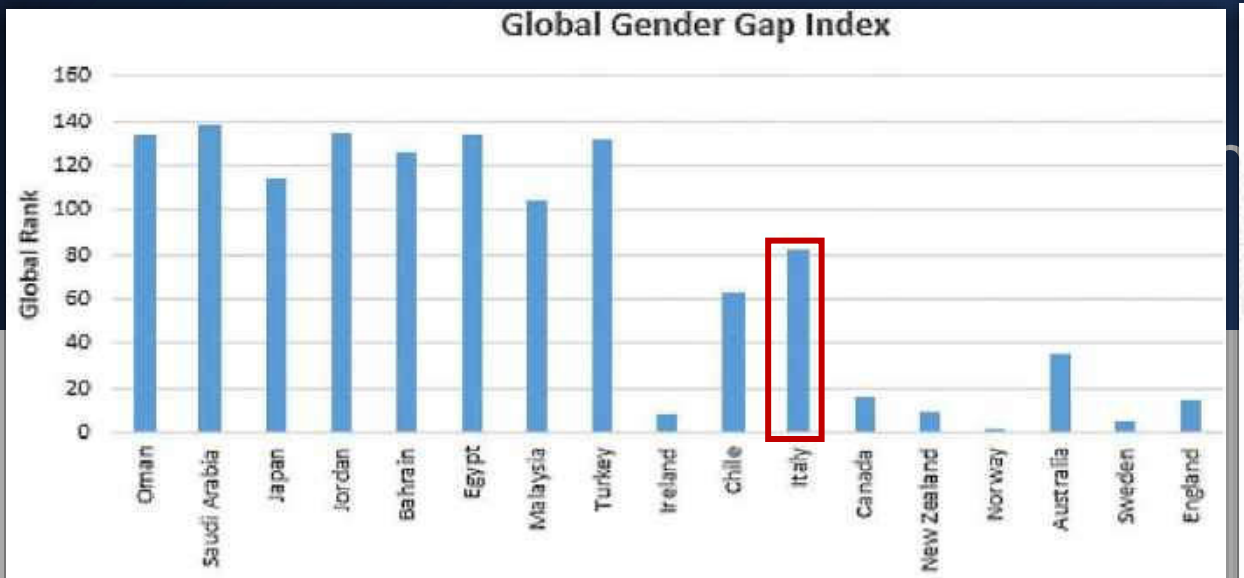
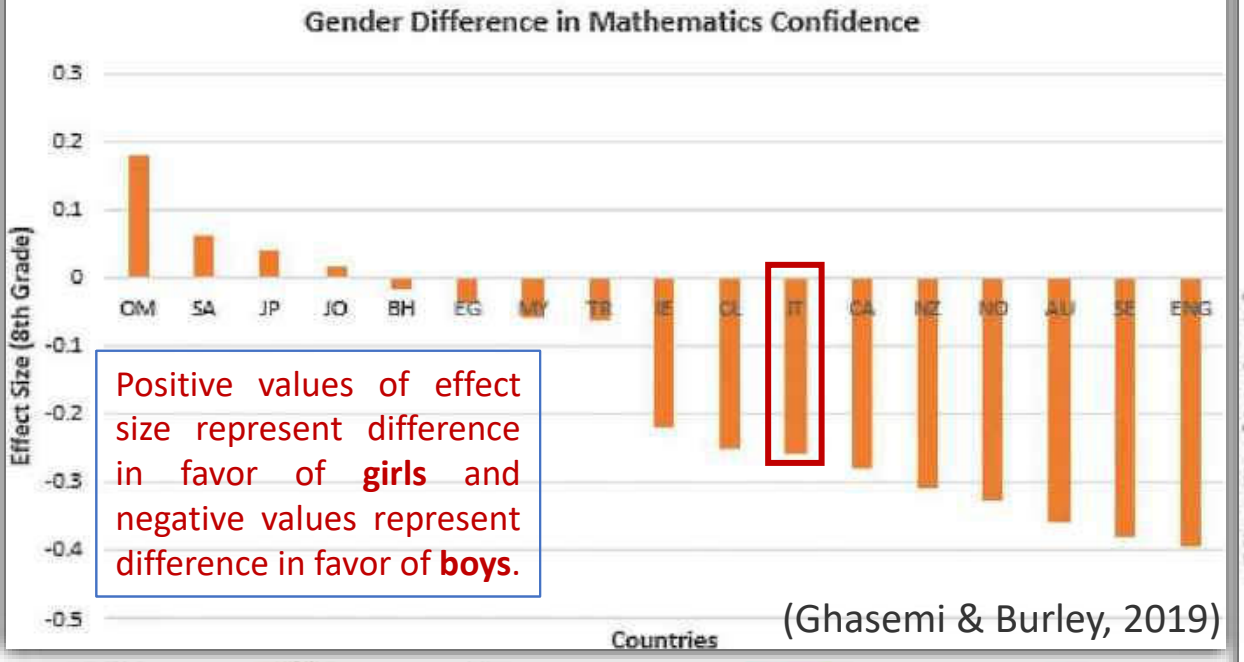
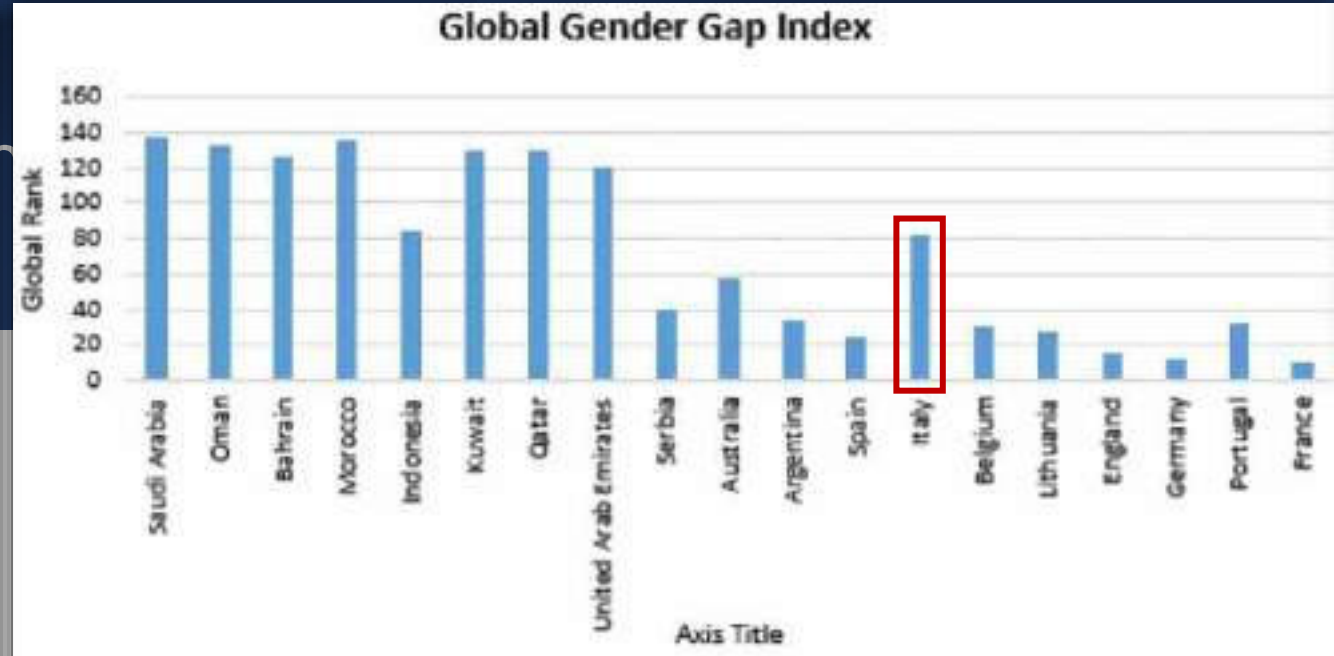
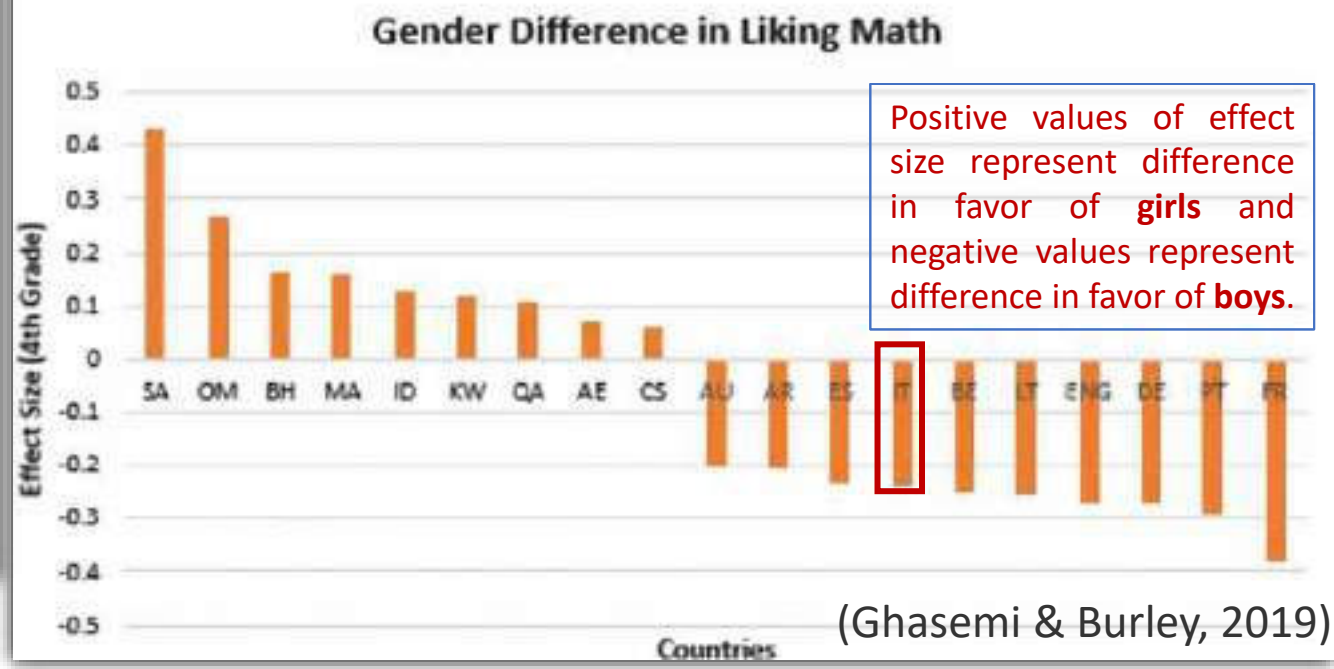




Positive values of effect size represent difference in favor of **girls** and negative values represent difference in favor of **boys**.

(Ghasemi & Burley, 2019)





Positive values of effect size represent difference in favor of **girls** and negative values represent difference in favor of **boys**.

(Ghasemi & Burley, 2019)

Gender Gap in Mathematics

The findings:

- "[…] show that the gender difference are very small and negligible in general. However, variations were observed in the magnitude of the **differences across different nations**. This provides further evidence for the malleable nature of the existing gender differences in mathematics."
- "[…] revealed an increase in the gender gap from fourth grade to the eighth grade. Although the increase was relatively small, and the differences were still negligible, it could be a representation of an **ascending trend** in gender differences **as students grow** and get closer to the final years of compulsory education."
- "[…] imply that more gender parities in social, educational, economic, and health standards did not lead to less gender distinctions in attitudes towards mathematics (in a number of European countries) and less gender parities in those standards did not lead to more gender differences, as in the case of Middle Eastern nations. Moreover, this implication further illustrates the **significance of regional differences and motivational patterns in cross-cultural studies**."

(Ghasemi & Burley, 2019)

«Teaching methods gap» in Mathematics

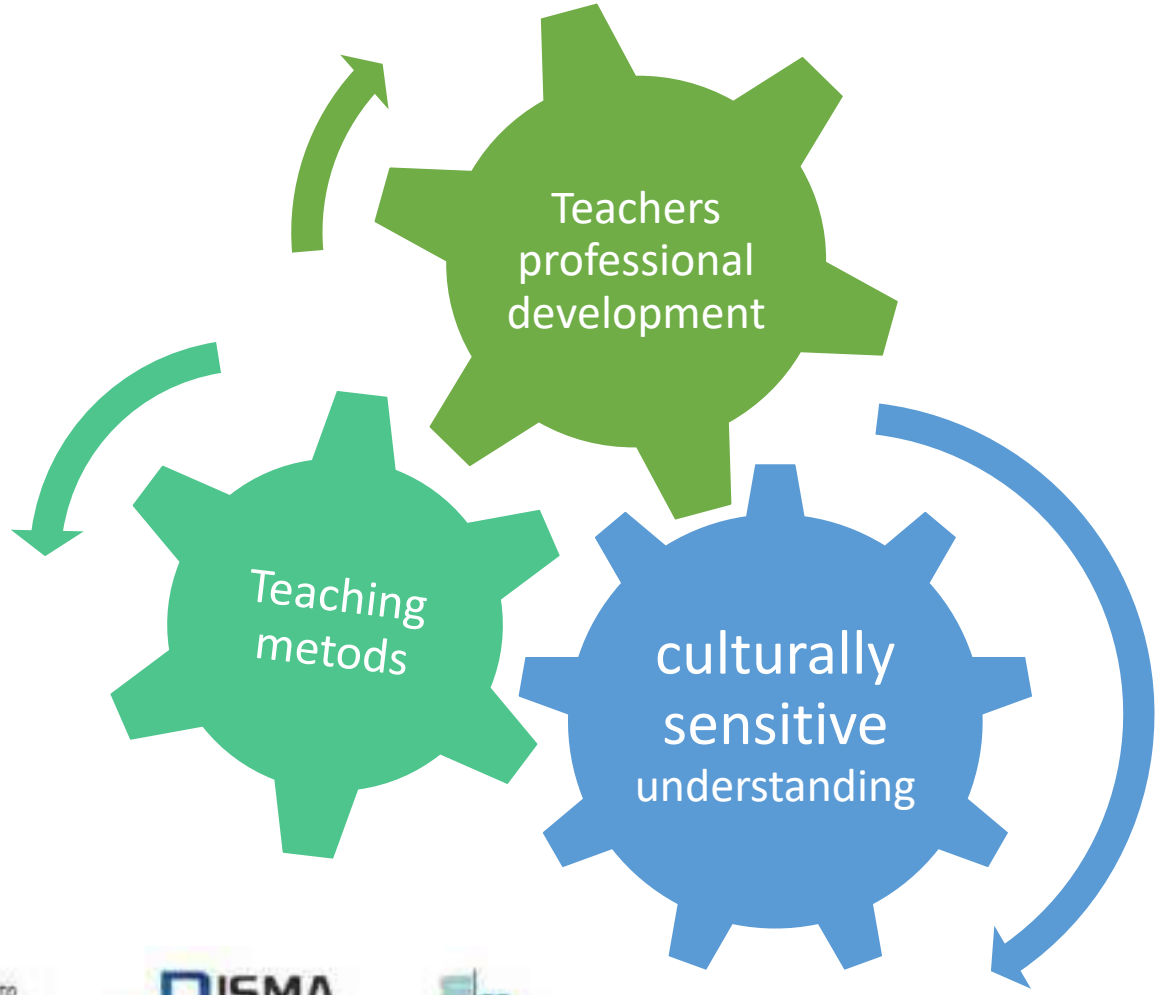
(Stigler & Hiebert, 1999)

[…] **Looking across cultures is one of the best ways to see beyond the blinders and sharpen our view of ourselves**. […] we were struck by the homogeneity of teaching methods within each culture, compared with the marked differences in methods across cultures. Readers who are parents will know that there are differences among American teachers; they might even have fought to move their child from one teacher's class into another teacher's class. Our point is that these differences, which appear so large within our culture, are dwarfed by **the gap in general methods of teaching that exist across cultures**.

We are not talking about a gap in teachers' competence but about a gap in teaching methods. **These cross-cultural differences in methods are instructive because they allow us to see ourselves in new ways**.

[…] In our view, teaching is the next frontier in the continuing struggle to improve schools.

The culturally sensitive understanding in Mathematics



Mathematics as a DISCOURSE

Bishop, A. J. (1988). Mathematics education in its cultural context. *Educational studies in mathematics*, 19(2), 179-191.

CULTURE LANGUAGE THOUGHT

Sfard, A., & Linchevski, L. (1994). The gains and the pitfalls of reification—the case of algebra. In *Learning mathematics* (pp. 87-124). Springer, Dordrecht.

The culturally sensitive understanding in Mathematics

Learning mathematics could be defined as “individualizing mathematical discourse, that is, as the process of **becoming able** to have mathematical communication”.

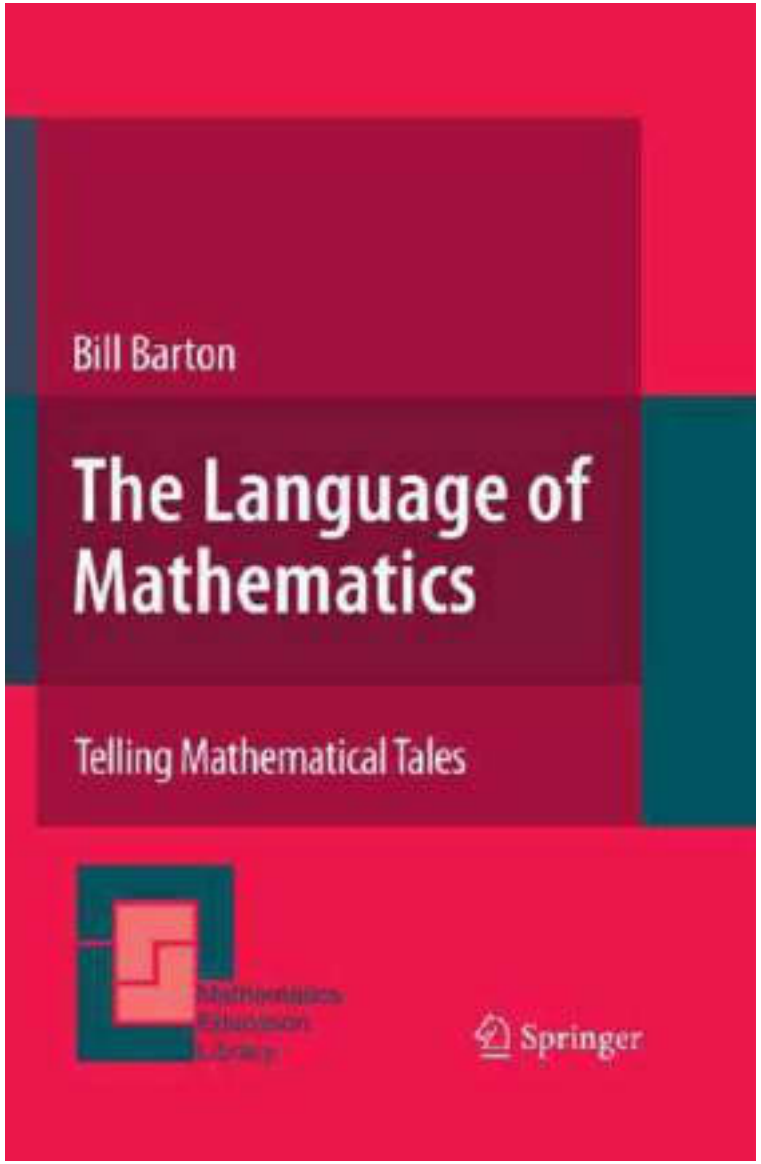
[…] by learning to participate in increasingly complex types of discourse of an increasingly complex degree of difficulty: where the mathematical content (the mathematical object) may still be the same, but the discourse about it evolves.

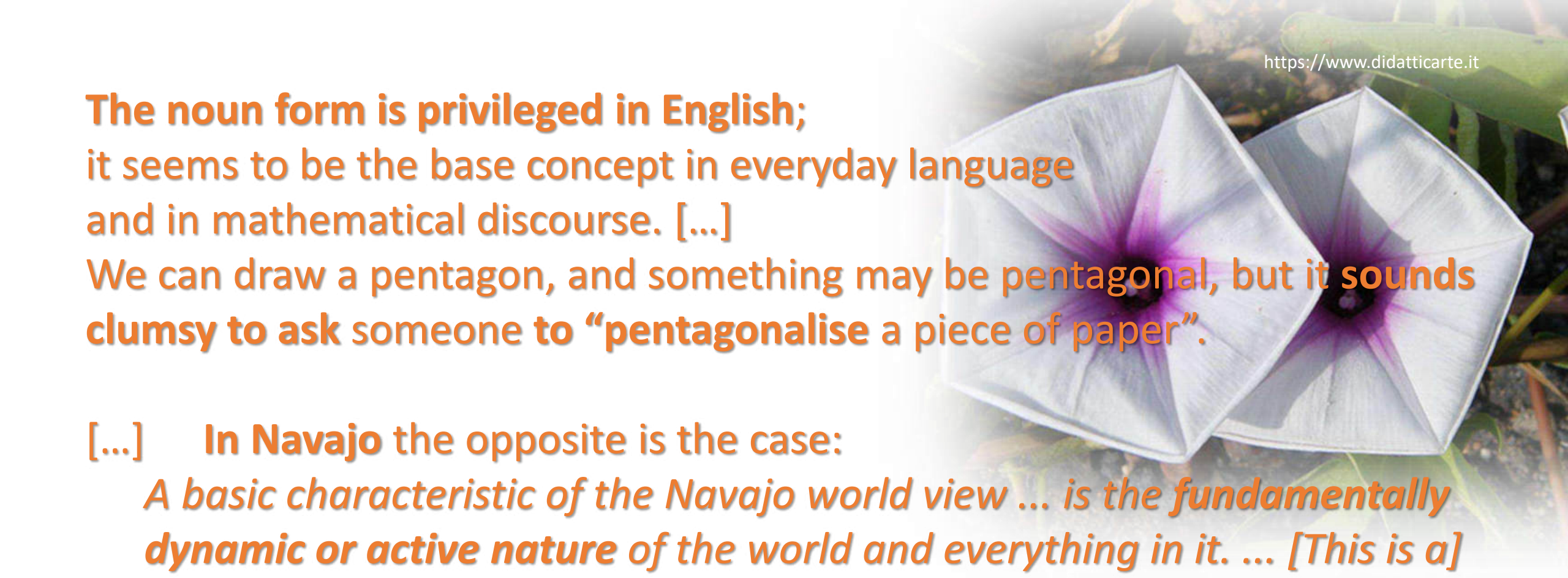
(Kim, Ferrini-Mundy & Sfard, 2012)

“Verbal shapes?
Let us think about this first in English.
Shape is expressed in many ways.”

(Barton, 2008, p. 28)

Bill Barton





The noun form is privileged in English;
it seems to be the base concept in everyday language
and in mathematical discourse. […]
We can draw a pentagon, and something may be pentagonal, but it **sounds clumsy to ask** someone **to "pentagonalise** a piece of paper".

[…] **In Navajo** the opposite is the case:

> *A basic characteristic of the Navajo world view … is the **fundamentally dynamic or active nature** of the world and everything in it. … [This is a] basic perspectival difference from Western thought and language*. (Pinxten et al., 1983, p. 15,

in Barton, 2008, p. 28-28)

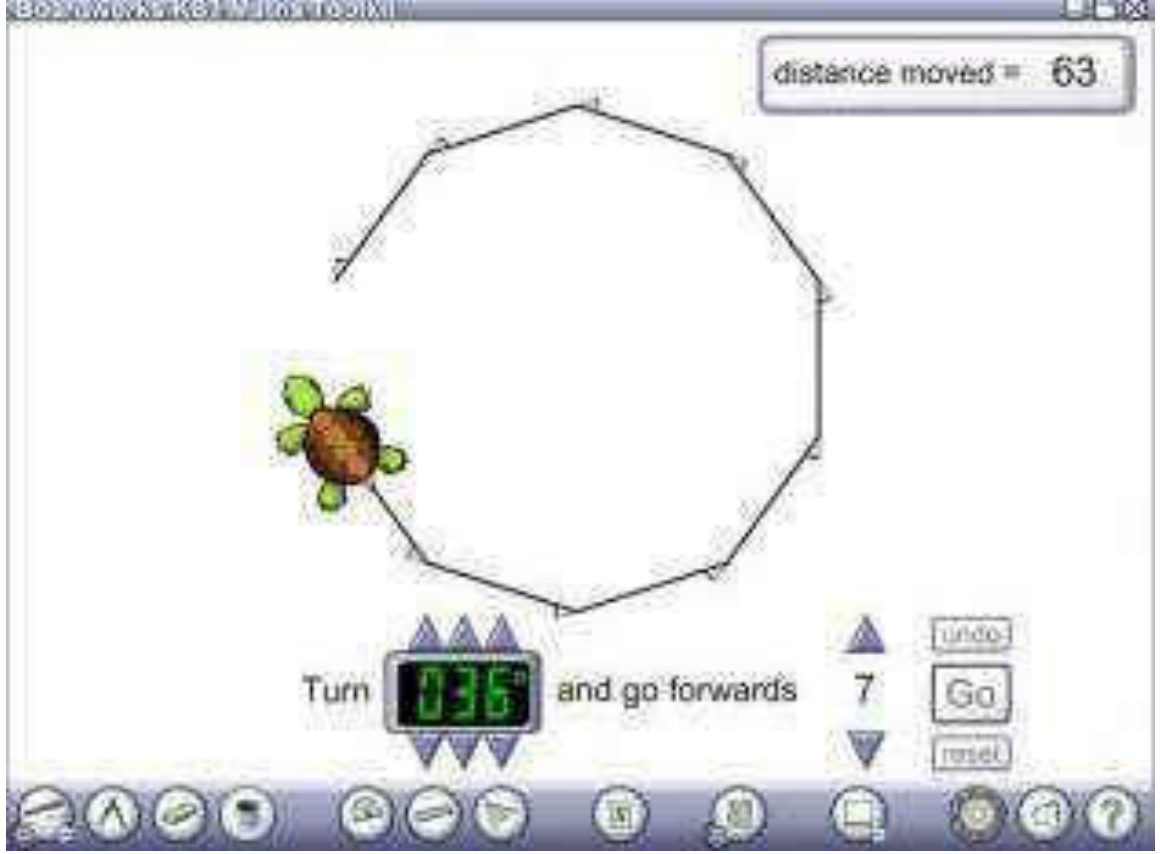
“The mathematician in me is intrigued by the **idea of verbal expression of shapes**.
Could this make a difference mathematically?
Does the way we think about the idea of triangularity affect what we understand about it? [...]
How might geometry be different?

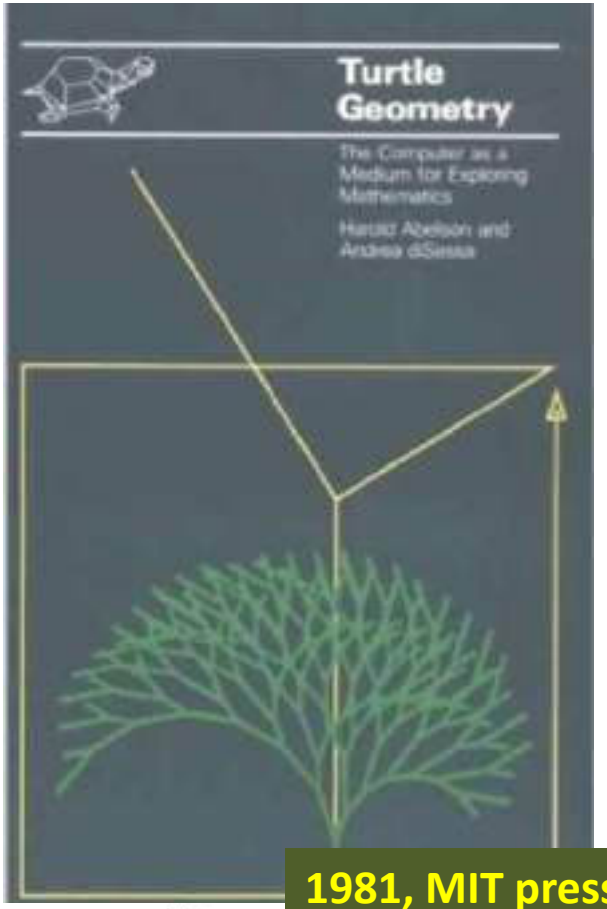
Let me be clear that this is my mind-game, not a Navajo mind-game. The way I am using the idea of «circle as an action» is my conception of that idea, not a Navajo one.”

(Barton, 2008, p. 29)

Imagine, then, that circularity is an action, not an object, thus we must talk about **circling**, not a circle.
What do you think/do?

F. Arzarello – 30.4.2020 https://www.airdm.org



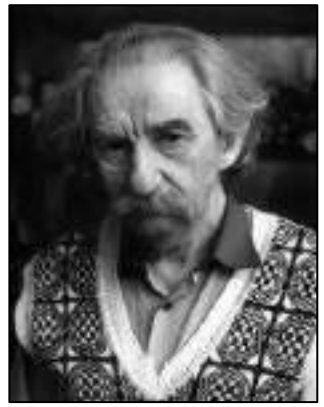


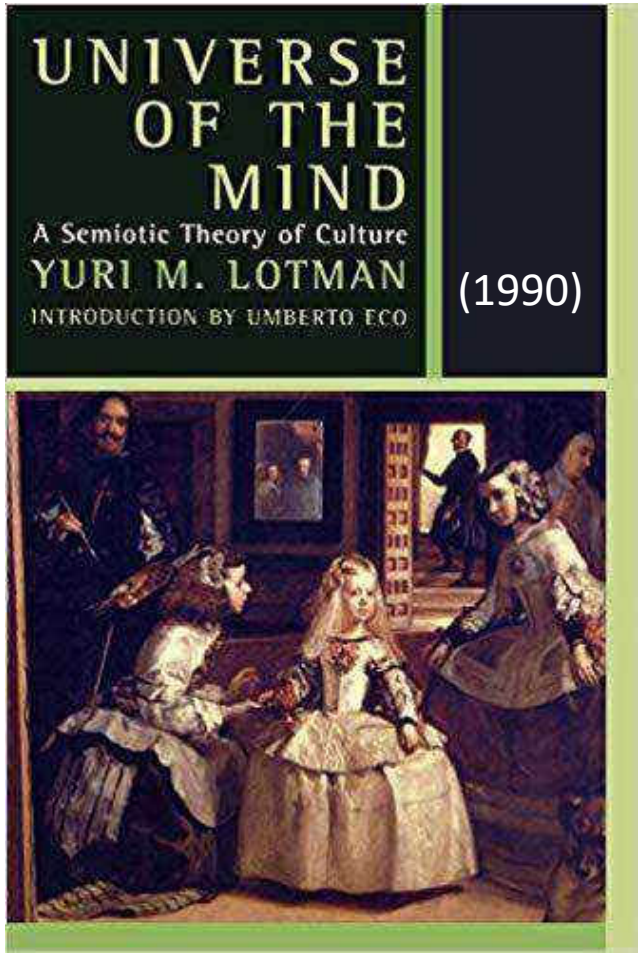
1981, MIT press

One major difference between turtle geometry and coordinate geometry rests on the notion of the *intrinsic* properties of geometric figures. An intrinsic property is one which depends only on the figure in question, not on the figure's relation to a frame of reference. (Turtle Geom., p. 13)

Culturally sensitive tools in Mathematics Education

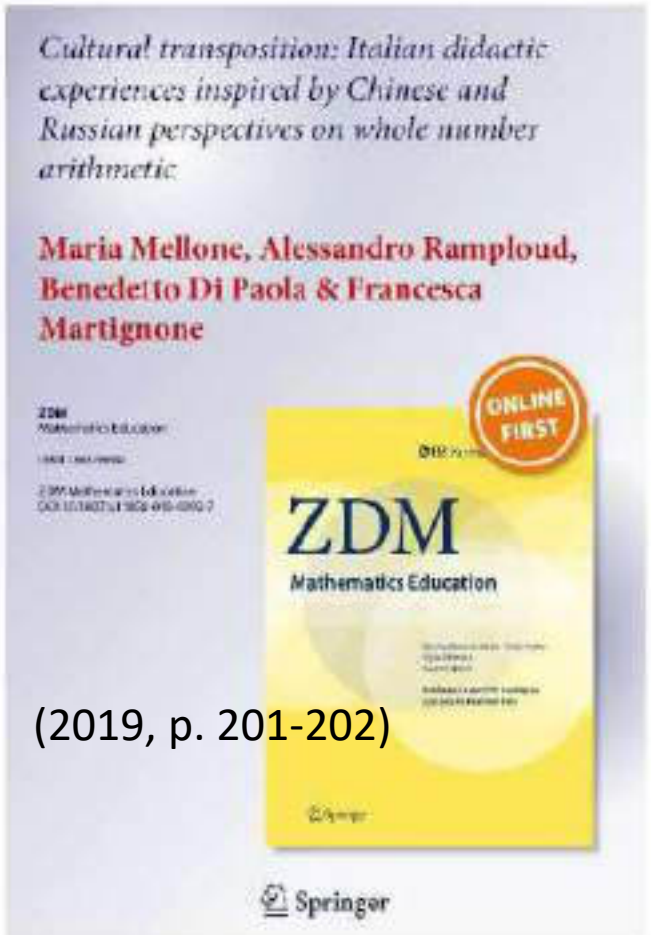
(2019, p. 201-202)





(1990)

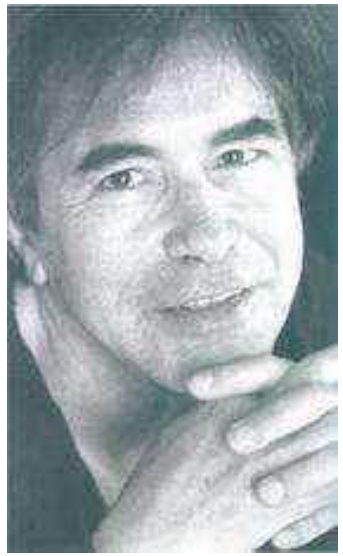
The Cultural Transposition



(2019, p. 201-202)

"This **is not about comparative** philosophy, about paralleling different conceptions, but about a philosophical dialogue in which every thought, when coming towards the other, **questions itself about its own *unthought***." (Jullien 2006, p. 8)

The Cultural Transposition is a process activated by researchers, educators, and teachers. **Through the contact with** educational practices of **other cultural contexts**, they **reconsider the issues of educational intentionality** in educational practice of one's own cultural context, which is the background of any educational practice."



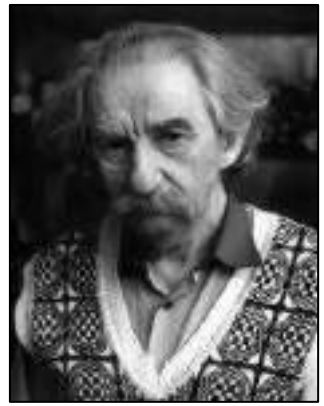
François Jullien

The SEMIOSPHERE

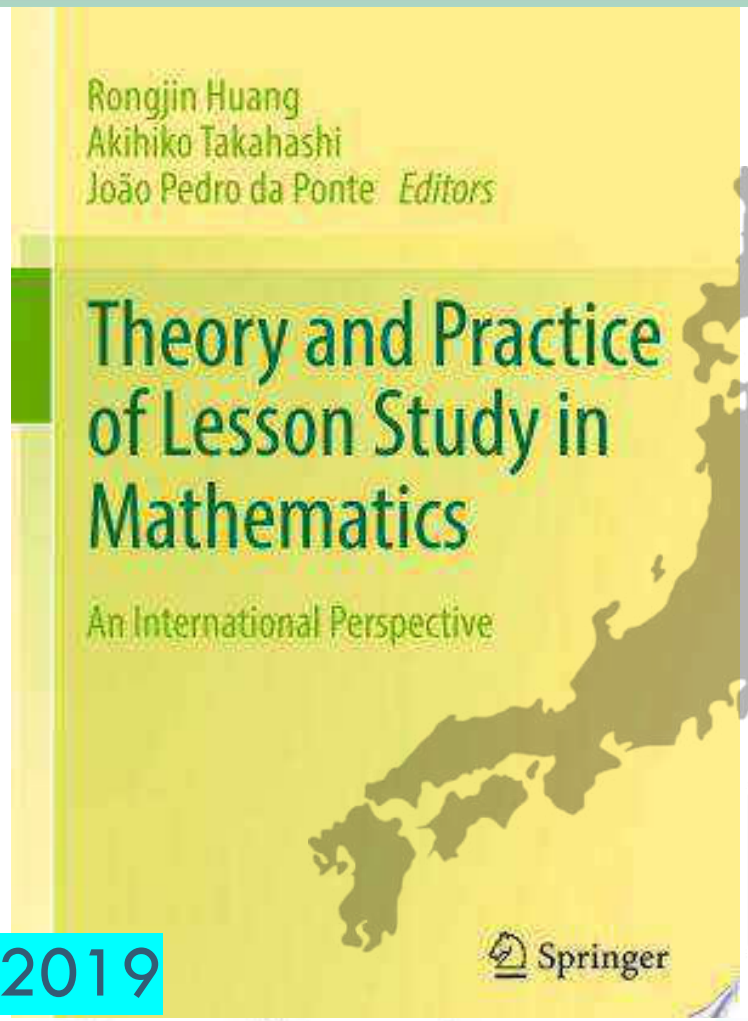
Asymmetry

Explosion

Cultural Conflict



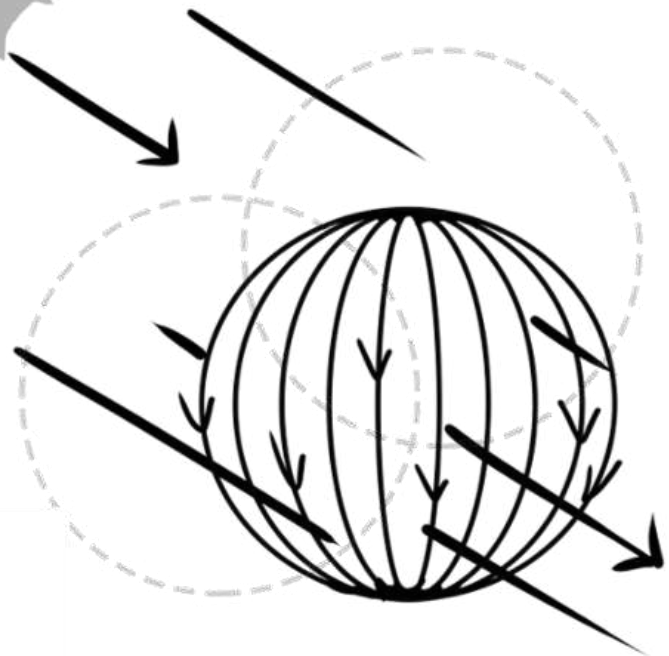
TIMSS 1999



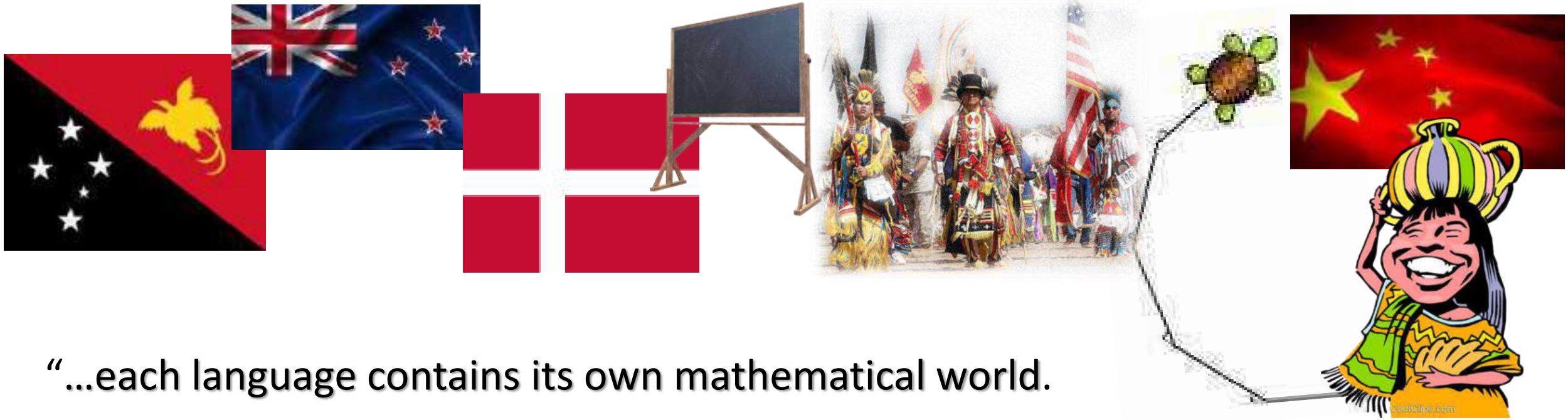
2019

WALS
World Association of Lesson Studies

https://www.walsnet.org/



2018



"…each language contains its own mathematical world.

The worlds may be implicit, of small scope, and/or undeveloped, but these worlds exist—they are not just rudimentary versions of conventional mathematics […].

These worlds represent systems of meaning concerned with quantity, relationships, or space, and are, in some sense, incommensurable with NUC-mathematics." = **N**ear-Universal, **C**onventional **M**athematics

(Barton, 2008, p. 144)


NUC-Mathematics