Humans-with-media and the reorganization of mathematical thinking: online distance education and "face to face" problem solving [1]

Marcelo C. Borba

GPIMEM
Mathematics Department
Graduate Program in Mathematics Education
UNESP- São Paulo State University
BRAZIL

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The transformation of mathematics in on-line courses

- **Changes in mathematics as media change: the most famous cases: click and drag dynamic geometry**
- **Functions**
- **Analogously can we propose that interfaces based on Internet-WWW will mean the same kind of change?**

Research of GPIMEM

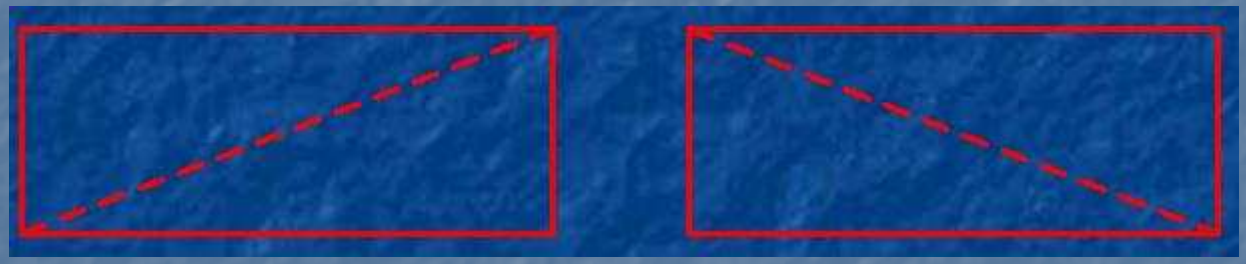
http://www.rc.unesp.br/igce/pgem/gpimem.html

- **Theoretical Perspective - Different Media - Different Mathematics**
- **Maybe different media mean different performance (Gadanidis) and different kind of coordination of representations**
- **Ethnomathematics - Oral Mathematics**
- **Demonstrations and Writing**

Research of GPIMEM

http://www.rc.unesp.br/igce/pgem/gpimem.html

- Different information and communication technology (ICT) associated with different mathematics produced - Social History of Media (Levy)
  - Kerckhove – The alphabet impregnates our brain



  - Humans-with-Media (Borba & Villarreal)

Examples:

- Multiple representations and the teaching of functions
- Click and Drag in dynamic geometry - Breaking the barriers between induction and deduction
- Is this true as well for online distance education?

Model of online course

- Books, Internet papers or math problems sent in advance
- Asynchronous debates through e-mail and Forum
- Synchronous activity through Chat
- More recently TelEduc - Free software (copies in English as well)

http://teleduc.rc.unesp.br/~teleduc2/cursos/aplic/index.php?cod_curso=15

Model of online course

- Courses have been offered for over five years now
- Extension combined with research
- Courses for teachers throughout Brazil (and Latin America)
- Social and Educational Perspective of this continuing education practice

Online Math Ed in Action

Math Problems given to them

Biology students at UNESP, São Paulo State University, take an introductory course in pre-calculus/calculus. The teacher of this course asks the students to explore, using a graphing calculator, what happens with 'a', 'b' and 'c' in $y=ax^2+bx+c$. Students have to report on their findings. One of them stated:

"When b is greater than zero, the increasing part of the parabola will cross the y-axis . . . When b is less than zero, the decreasing part of the parabola will cross the y-axis.". What do you think of this statement? Justify your response.

This problem: graphing calculator, experimental approach and paper and pencil

Online Math Ed in Action

(19:49:07) Carlos : "When a is negative, or b is positive, the parabola goes more to the right, but when a is negative and b is also negative, the parabola goes more to the left".

....

(19:54:53) Taís: It has something to do with the x coordinate of the vertex of the parabola.

(19:59:16) Norma: I constructed many graphs and I checked that it is correct, afterwards I analyzed the coordinates of the parabola vertex Xv= - b / 2a, and developed an analysis of the 'b' sign as a function of 'a' being positive or negative, then I verified the sign of the vertex crossing. . . . with the concavity upwards or downwards, and checked if it was increasing or decreasing. . . .did I make myself clear?

Online Math Ed in Action

Second solution:

(20:07:03) **Marcelo Borba**: Sandra, . . I just saw it a little differently. I saw it . I calculated y'(0)=b, . . and therefore when 'b' is positive the parabola will be increasing and analogously. . . . One medium does not erase the other; Winplot (free software) and paper and pencil used. .

Back to the issue: Is the mathematics practiced changed?

"Trivial answer": breaking the notion of physical space for education

Chat: Natural way to express oneself through writing

ü Is the nature of writing on the Internet the same as with paper and pencil?

ü Humans-with-media producing mathematics without "shareable" drawing!

ü Humans-with-media merging mother tongue and mathematical language

ü Analyzing in more details the nature of the chat text

ü Is there a psychology (cognition, emotion, . .) of online education?

ü But maybe we are still looking at the problem in a conservative way, trying to find there what we already saw with dynamic geometry and "dynamic function".

Differences Between Face-to-face Classrooms and Distance Courses Like This

Search for Answers in Different Domains of Media

Gestures	**" feelings icons or iconic feelings"**
Dialogue	**"multialogue"**
Video	**Kerckhove multimedia**
Problem Posing	**Asynchronous solutions**
Reports	**Internet : natural environment for video clip culture**
Internet impregnating classrooms	**Blended approaches**

Old computer technology (e.g. Winplot, Cabri) permeating mathematical text on Chat rooms

Interfaces change Maths (situatedness I)

Content changes the nature of a multialogue in a classroom (situatedness II)

Performance in regular classrooms and in chat rooms like this ...?!

Besides “chat text”, what else changed in the solution of the “b” problem?