

RE-COUNTING MATHEMATICS EDUCATION WITH TECHNOLOGY

JEAN-FRANÇOIS MAHEUX

Quoi de neuf?

Bah... Stuck again with this impression that everybody is trying to hit the nail when I want to take down the wall...

C'est-à-dire?

Take technology. I don't want to use it to improve mathematics education. I want it to help us think Math Ed differently!

I'm with you! My image of a child's relationship with a computer doesn't "go beyond" what is common in today's schools...

It goes in the opposite direction: A world without schools! (Papert, 1980)

Who questions the question of "how can technology hinder or facilitate learning mathematics"?

We just want to fix what we have!

[Papert!]

But this is NOT what we see in either the persistent resistance or the enduring enthusiasm toward new technologies in Math Ed

So, how will this make students learn maths?

Technology might be harmful in regard with students' mathematical abilities ... but it can also provide us with opportunities to strengthen and widen students' mathematics (Suydam 1979).

This is Math Ed defending itself, and at best trying to integrate this foreign novelty to its traditional way

We're dying for an upgrade!

À l'époque où la calculatrice commence à être accessible à tous, Suydam écrit déjà un "state-of-the-art review" dans lequel nos peurs et nos espoirs actuels sont déjà très bien formulés:

En recherche, on s'appuie beaucoup sur l'idée d'instrumentation (Rabardel, 1995), où on considère que la technologie transforme l'activité de l'élève et de l'enseignant. Technology changes school mathematics and what it means to know/do mathematics.

To divide, you push here.

But why?

Now we're talking math!

Mais ce n'est pas notre rapport profond à la technologie qui est questionné, ou à l'éducation mathématique.

Très Heideggerien mon cher!

[This one is Heidegger]

En effet! Nous nous enfermons dans un questionnement technique. Technology is a "means to an end" and all we want is to control it. For me it's essential to take heed of technology and technical thinking by questioning their way of enfaming the world.

Maybe if I put some numbers in there I will get closer to it...

Just take a picture!

That's not the point!

Then what is?

Et j'aurais une manière particulière de présenter le monde, comme les maths, ou la science?

Maths, science and technology all contribute to considering beings, i.e. manipulable 'things', rather than Being as verb. People always resisted this, even within science!

[This is Miss Technology...]

Oui! On connaît par exemple la résistance au calcul algébrique de Descartes, accusé d'être une «machine à raisonner» qui réduit la géométrie à des manipulations algébriques! Or Boethius' enthusiasm for digits against pythagorians' attachment to the abacus

Je voudrais qu'on aime cette impossibilité à me maîtriser... Can't people let go of doing more, faster, efficiently, and dwell in the pleasure of *doing*?

On s'acharne *et* on résiste à faire faire ceci ou cela aux élèves ou aux enseignants, toujours le plus efficacement possible...

...and enjoy the unpredictability of people doing math together

After all, we never truly master technology!

I'm still faster than your differential analyser

The same goes for Math Ed

Questionner la technologie c'est aussi s'ouvrir à l'opposé du technique: l'art. Both are forces bringing forth the world we live in. Avec l'art tout s'ouvre, tout est devenir

J'imagine que la réaction aux maths comme art sera similaire à celle face aux technologies

Art exposes this dwelling by unsettling us

You bet! Math Ed is still a nightmare despite efforts, like mine, to think of it as an art (Lockhart, 2009)

I like how technology never completely works, et comment l'éducation mathématique non plus n'est jamais sans difficultés. Ces «défaillances» sont au coeur de ce qui nous permet de faire (des) mathématiques ensemble...

So we do wrong by trying to do right?

If at least there's no more Benny and his IPI teaching machine

[He looks nicer on his website, but that's my best]

I'm not sure what you are saying, but it gets me thinking...

This sure is a tough, but fresh, account of Math Ed. Mettre l'accent sur le côté à jamais non-fini de tout ça...

Même les idées mathématiques ne sont pas des choses: nous sommes toujours à les évoquer. All mathematical invention is but a widening of a world of virtuality in which we keep encountering math anew (Châtelet, 1993)

Same goes for me! J'évolue à toute vitesse, je prends plus de place, but I am *more* than something you choose or not, more than a possibility

Because what matters is moving: A math concept is something **we provoke...** that was not there already

Et moi je transforme déjà tout ça! I "changed the game" already

Yes, because we'll never gain on invention, on (technological) novelty, and especially not by knowing (what do to). Technology keeps transforming itself, fashioning new inventions, more objects. Invention is always in excess. Cette différence signale sa nouveauté, mais elle n'est re-connaissable que parce qu'elle est reproduction. Technique is both repetition and displacement (Derrida, 1987)

Ce qui signifie aussi que nos innovations en recherche sont toujours déjà dépassées

En même temps qu'elles dépassent toujours ce qu'on croyait dire!

This reminds me of McLuhan's "the medium is the message." What if math is its technical incarnation in tools, signs, gestures, concepts: the medium is the math! But only so far as we do math and in ways which stimulate mathematical doings...

Teachers and researchers are bound to stay behind technological innovation, both caught up in its nets and unable to catch up with it.

[Meanwhile on the FLM Advisory Board]

He's high!

Old ideas made unclear!

unpublishable!

<3!



So, what?

Wait! He's up to something. Writing about format and content in a graphic article... Oh oh!

Il parle de nous??

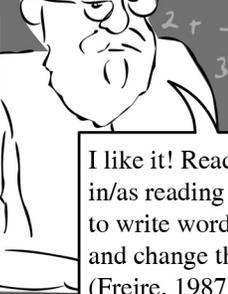
La technologie, les maths, la recherche, la science, l'art, l'imprévisible, la provocation: He's knitting it all together saying that doing things differently is what we do anyways



Can we even tell the difference?

And by technology I mean *all* kinds of means, apparatus and systems, any ordering expedient or contrivance, including writing research.

So he is asking us to be consistent with the observation of what we do with stuff we read or write: position and orient ourselves, try new things, talk to people about it, read and write new stuff



Something like this was said about math by Glaeser (1972): Le langage mathématique moderne est un instrument de découverte and at the same time a product of mathematical research.

This language literally opens up a whole different world!

J'en perd le nord!

[He's learning point-less topology...]

I like it! Reading the word in/as reading the world... to write words and touch and change the world (Freire, 1987).

Mais c'est encore faire de la recherche ça? How would you define it ?



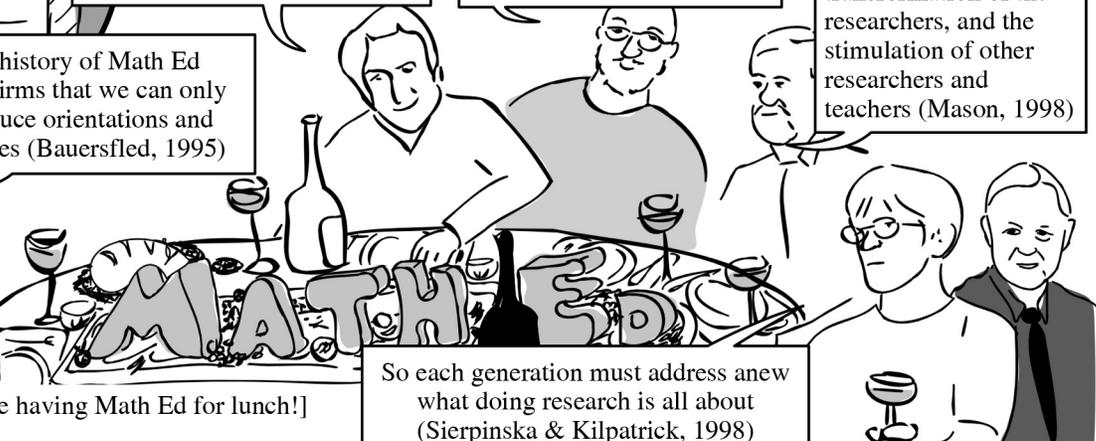
Well, research does study itself, and I am not sure if it's even possible to distinguish between concerns with teaching and learning, and mathematics education itself (Ernest, 1998)

Reflexivity entails reflecting on our sense of our research domain, how that sense is expressed in actions, and how these in return influence our sense of the domain (Thompson, 1995)



For me, there are two significant products of research: the transformation of the researchers, and the stimulation of other researchers and teachers (Mason, 1998)

The history of Math Ed confirms that we can only produce orientations and stories (Bauersfeld, 1995)



[Looks like they're having Math Ed for lunch!]

So each generation must address anew what doing research is all about (Sierpinska & Kilpatrick, 1998)

And yet, whatever journal I send my studies to, I always get something like: "We liked your paper but use a simpler language and have a more cogent argumentation, better data and analysis, a sharper presentation of the ideas, a deeper engagement with current research and more explicit links with the mathematical content"



A very technical take on research in Math Ed. There will be a few enthusiastic people, and a huge resistance to change which, in the end, very much resembles people's attitude towards you!

Peut-on vraiment changer nos manières de voir le changement? Nous voici plus que jamais à l'heure du virtuel, de l'impossible, siècle numérique dont l'enveloppement infini brouille toutes les frontières...



This one is harsh!

La bonne vieille mascarade! That is one stiff way to tell stories, to orient, to stimulate!

... and through all these trans-(national, cultural, historical, human), write different stories for one another.

need more space!



À SUIVRE...

References

- Bauersfeld, H. (1995) The structuring of the structures: development and function of mathematizing as a social practice. In Steffe, L. P. & Gale, J. (Eds.) *Constructivism in Education*, pp 137-158. Hillsdale, NJ: Lawrence Erlbaum.
- Châtelet, G. (1993) *Les enjeux du mobile: mathématique, physique, philosophie*. Paris, France : Seuil.
- Derrida, J. (1987) *Psyché : Invention de l'autre*. Paris, France : Galilée.
- Ernest, P. (1998) A postmodern perspective on research in mathematics education. In Sierpiska, A. & Kilpatrick, J. (Eds.) *Mathematics Education as a Research Domain: A Search for Identity*, pp. 71-85. Dordrecht, The Netherlands: Kluwer.
- Freire, P. & Macedo, D. (1987) *Literacy: Reading the Word and the World*. Westport, CT: Bergin & Garvey.
- Glaeser, G. (1972) La transmission des connaissances mathématiques hier, aujourd'hui, demain. *L'Enseignement Mathématique* **18**, 277-287.
- Heidegger, M. (1977) *The Question Concerning Technology and Other Essays* (trans. Lovitt, W.). New York, NY: Harper & Row.
- Lockhart, P. (2009) *A Mathematician's Lament: How School Cheats Us Out of Our Most Fascinating and Imaginative Art Form*. New York, NY: Bellevue Literary Press.
- Mason, J. (1998) Researching from the inside in mathematics education. In Sierpiska, A. & Kilpatrick, J. (Eds.) *Mathematics Education as a Research Domain: A Search for Identity*, pp. 357-378. Dordrecht, The Netherlands: Kluwer.
- Papert, S. (1980) *Mindstorms: Computers, Children, and Powerful Ideas*. New York, NY: Basic Books.
- Rabardel, P. (1995) *Les hommes et les technologies: Une approche cognitive des instruments contemporains*. Paris, France : Armand Colin.
- Sierpiska, A. & Kilpatrick, J. (1998) Continuing the search. In Sierpiska, A. & Kilpatrick, J. (Eds.) *Mathematics Education as a Research Domain: A Search for Identity*, pp. 527-548. Dordrecht, The Netherlands: Kluwer.
- Suydam, M. N. (1979) *The Use of Calculators in Pre-College Education: A State-of-the-Art Review*. Washington, DC: National Institute of Education.
- Thompson, P. W. (1995) Constructivism, cybernetics, and information processing: implications for technologies of research on learning. In Steffe, L. P. & Gale, J. (Eds.) *Constructivism in Education*, pp 123-134. Hillsdale, NJ: Lawrence Erlbaum.

From the archives

Editor's note: The following remarks are extracted from an article by Peter Taylor (1980), published in FLM1(1). Peter's current thinking about teaching mathematics to undergraduates can be found on p. 33.

The trouble is that you have spent almost all your time copying the works of others, like the school boy who is detained to copy 200 lines of Latin poetry. A sad and mindless task that, especially if he knows almost no Latin. Guaranteed to turn him bitterly against the language.

Of course it might have been Virgil. I can imagine copying Virgil under some circumstances. I can certainly imagine reading him, preferably aloud. The Aeneid is a masterpiece.

*ARMA virumque cano, Troiae qui primus ab oris
Italiano fato profugus Laviniaque venit
litora, multum ille et terries iactatus et alto
vi superum, saevae memorem lunonis obi ram,
multil quoque et bello passus, dum conderet urbem
inferretque deos Latio; genus unde Latinum
Albanique patres atque altae moenia Romae.*

Good stuff that, though it takes a bit of practice.

But the texts you have copied so meticulously year after year are not masterpieces. For the most part they are tedious tales by minor Latin poets. The meter is poor and the stories are contrived. They describe obscure battles or ill-conceived skirmishes, where victory comes not by any stroke of genius, but from some unseen technical advantage enjoyed by the other side.

Your teachers chose this carefully-edited pulp over Virgil because they thought it would be easier to digest. That may be so, but it has ruined your appetite.

You would have been better to write your own poetry. The trouble is, you know hardly any Latin. You can't read it very well, and you can't speak it at all. You never acquired any burning desire to master it because you weren't exactly turned on by the pathetic examples that were put before you.

My first task then is to restore your appetite for Latin poetry. I shall do this by reading the Aeneid. Not for you to copy however, not even Virgil should in fact be copied. I shall read aloud in as rich and melodic a voice as I can muster, and you must sit back and let the stately hexameter capture your soul, and the heroic tale set it on fire.

And then I shall read you a few modest poems of my own that have been inspired by my encounters with Virgil. They are not great like the Aeneid, but I have worked on them very hard and they are the best that I can do. In spite of their modesty they have an important place in this classroom because I am your teacher.

Then finally you must find the muse yourselves. At that time you will be glad that I shared my poems with you. For Virgil is a hard act to follow.

What do you think?

Reference

- Taylor, P. (1980) On Virgil: my opening lecture to Mathematics 120. *For the Learning of Mathematics* **1**(1), 49-52.

Correction: *Apologies to Nick Wasserman and Julianna Connelly Stockton who were co-authors of a communication entitled "Horizon content knowledge in the work of teaching: a focus on planning" in the last issue, 33(3). While both their names appeared on the communication, Julianna Connelly Stockton's was inadvertently omitted in the contents pages.*