

Thoughts of a mathematics teacher, concerned with social and environmental justice

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In reaction of "Mathematics and technological literacy", by Keiko Yasukawa

My main activity is to work as a mathematics teacher in a Portuguese secondary school. In this quality I was invited by the organising committee of MES 3 to react to the lecture of Keiko Yasukawa. What I will say next must be understood in this context, that is, my talking is about teachers and students in schools, in reaction of some ideas from Keiko, a person that I never had the chance to meet or read before.

When I was moving forward in the reading of Keiko's paper, my first reaction was a miscellaneous of feelings, very uncomfortable feelings, which I later turned into thoughts and questions about me and my practices as a teacher.

The ignorance of a teacher

One of the feelings was about my ignorance: I know nothing about the technological systems described, and similarly, and I can hardly reach their complexity. My global knowledge – mathematical and others – is not sufficient; it doesn't allow me to analyse, criticise and decide about most of the situations similar to those described in the paper. I really felt to be completely illiterate about technological systems.

It came up to my mind some public discussions about the environment and social issues that have been taking place in my country, and the feeling of ignorance was the same that I have experienced then. The awareness of the complexity of social and cultural reality brings to light my ignorance about economics, politics or even scientific issues related to those situations.

Keiko's search for a definition of technological literacy, based in some definitions of literacy, numeracy, competence, etc., made me reflect about my own competence and literacy. Although I feel concerned about social and environmental justice, I also feel very impotent to interfere, as I realize the limitations of my knowledge.

The responsibility of a teacher

At the same time, I feel an enormous responsibility because I do want my students to become more and more critical, literate citizens, empowered to interfere in the course of technology, regarding socio-cultural and environmental concerns. How can I carry out such a task, if I feel so often illiterate myself?

For example, many of my students are attending a course on equipment design, and others intend to study architecture. In their future work they will

have the responsibility of thinking and drawing the space where people live. Whether intentionally or not, they will interfere in people's lives and they will shape social interactions by shaping the space where they take place. To accomplish their tasks, they use powerful computational tools, such as *AutoCAD*, and *3-D Studio*, which are based on mathematical models. As a mathematics teacher, I should make visible to them the ways mathematical models shape their projects and, consequently, how they interfere in the people's ways of life. But *AutoCAD* and *3-D Studio* are very complex systems and, until today, I haven't been able to learn myself what mathematical models are implicit, how they work, and how they influence the thinking of their users. Nowadays, teachers are asked to accomplish so many tasks, such as manager, administrator, supervisor, curriculum developer, animator, therapist, researcher, etc., that is impossible to carry out all of these roles the way we would like to. Even if I consider myself a dedicated teacher, I fall short in fulfilling all these demands.

Thinking collectively

In fact, as Keiko's stresses, the goal of turning into a literate citizen, as the goal of being a teacher who works to improve social and environmental justice, by educating literate citizens, cannot be an individual goal. In my perspective, one of the major problems of Portuguese schools today, is the prevailing individual logic: Each teacher has a discipline to teach by himself, in a specific piece of time and in a specific piece of space. Each teacher assesses each student, etc.

Let's think about a school, my school for example, as a technological system in the way Keiko's presented it: "a seamless web of messy, complex, problem solving components including physical artifacts" – school space and equipment – "organisations" – direction, assembly, pedagogical council departments, classes, etc. – "scientific components" – books, software, curricula, subjects – "and legislative artifacts" – regulations, external legislative documents and internal rules. It is clear that in a school all these components are interdependent and work to a common goal – the instruction and education of the students. It is clear, also, that my school involves human actors – students, teachers and other staff – and non-human actors that negotiate goals and are enrolled into a network that eventually finds some stable state.

How do these human actors participate in this system? Are they engaged participants, do they interfere in the trajectory of the system, when they realize the social injustices that school promotes? Are the teachers technologically literate, or are the students learning to be technologically literate about the school system to which they belong? Are they aware of how the system is shaping the social fabric and the social environment around them?

My experience in Portuguese secondary schools tells me that our human actors – especially teachers – have a lot to learn together in order to build collective competences such as working under democratic principles, dealing

with technological complexity, and interfering with the trajectory of the educational system to promote social justice.

I believe that we should start by creating and developing technological literacy about our own system – the school and its practices – and the ways we are shaping our citizens. The goals and trajectories of schools are negotiated and dynamically built by their human actors – teachers and students. The knowledge of the system should lead to the questioning of its goals, by those actors, and to the constant redefinition of new goals that would point to an increasing social justice.

At the present, the Portuguese school system is exclusive. It stresses social discrimination, and school mathematics has great responsibility in this. Technologically literate teachers and other people should interfere to change this trajectory, but almost nothing is being done. How can we hope our students to learn to be technologically literate, if we are not tackling these problems?

Teaching and learning mathematics

When we are concerned about people, about social and environmental justice, the mathematical knowledge in itself, disconnected from everything else, doesn't have great value, as Keiko stressed in her paper. Technological literacy includes knowing mathematics as a part of a whole, complex knowledge. Teaching mathematics for literacy only makes sense if it is situated in meaningful contexts in respect to social, cultural and environmental concerns.

On the other hand, I believe that concerns with social equity don't imply that everybody has to know the same mathematical facts at the end of their courses. That would lead us to a very poor cognitive world, since each one of us has so much to know and so little time to learn. In my perspective, the richness of the human kind lays in the differences of cultures and knowledges and in the ability of creating new forms of knowledge from their interaction.

Changing the concept of knowledge from the individual to a socially distributed knowing between human and non-human actors of a community of practice, will lead us to change the trajectory of schools, namely by changing the ways we organize human and non-human actors, the ways we organize knowledge, that is, the curricula, and the ways we organize space and time in schools.

How to conceive a mathematics curriculum that pursues *technological literacy* and *matemacy* as main goals? What changes does it imply in the role of teachers? And in the organization of schools?