A Colombian Approach to the Concept of "Technological Literacy"

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During the 1990s Colombia witnessed the inception of a movement of huge political reforms, which sought to search for an improvement in the quality of education. In 1998 we saw the emergence of the idea of "evaluation of competence." Some Colombian thinkers shaped the concept of "competence" associated to all areas of knowledge present in school. These researchers used Noam Chomsky's notion of "linguistic competence" (Torrado M. C., Vinent M., 1998). In general terms, although scholars have not reached a consensual definition, one could define competence as the ability to "creatively use the knowledge acquired inside and outside the school… able to manifest itself in different daily circumstances and to establish relationships between different and apparently unconnected contexts" (Vinent M., 1998, 34).

Students in different grades must now be evaluated by means of tests centered on this notion. Through the resolution of situations, the student must prove that he/she knows how to use knowledge in different contexts. Educational institutions receive state exams results as feedback and must generate curricular changes to improve their own scores.

In this process I found some similarities and differences with the notion of "technological literacy" presented in her talk by Keiko Yasukawa. Nevertheless, in this brief presentation I want to show that, although many people are aware of an individual's educational needs when confronting the society he/she lives in, changing a mathematical education system that has been working for several decades to educate students in the usage of a knowledge that is decontextualized and unconnected from daily life is a hard and difficult task which moreover must rely on the concourse of many people.

Keiko Yasukawa was just telling us that "Numeracy" could be defined as "The ability to situate, interpret, critique and perhaps even create mathematics in context, taken into account all the mathematical as well as social and human complexities which come with that process." (see Yasukawa in this volume) In order to reach this level of competence it is not enough to possess some mathematical knowledge. It is necessary to develop different kinds of abilities. In Colombia, three levels of mathematical competence were defined, which then had to be measured in the students' performance.

A first level corresponds to the "identification and description of mathematical objects, attributes, qualities, representations and operations" (Bedoya D., 1998, 18). A second one, related to "the classification, comparison, estimation, information organization, solutions and results verification, relationship and translation establishment between representations, and

hypotheses formulation" (Bedoya D., 1998, 18). And finally, a third level associated with "the construction of models and representations, problem formulation, argumentation, analytical and algebraic transformations, inference and generalization" (Bedoya D.,1998, 18). To these three levels I would add, in order to establish a connection with Keiko Yasukawa's definition, the ability to situate knowledge, to interpret, criticize and create mathematical knowledge in context.

The evaluation of high school graduates was centered on measuring the amount of mathematical knowledge they had, as well as their capacity to apply it when solving both pure and semi real mathematical problems. For Colombian education the paradigmatic shift in evaluation has meant a tremendous challenge. Indeed, as I have been able to observe in my experience as teacher educator, they conceive of math as a list of contents and routines not tied to the daily lives of individuals, as a knowledge already established and impossible to be affected by them. They see themselves as information transmitters and not as facilitators in the process of construction of new knowledge. Many researchers and professors fail to become precisely that which their students are expected to be.

Let us take a close look to Trinidad's case. She is a math teacher at a lower class neighborhood where most adolescents belong to gangs of apartment robbers. She has been teaching at this school for several years, and her salary is one point higher due to the fact that she works in a highly dangerous neighborhood. In order to be able to maintain her lifestyle, Trinidad has to work at two educational institutions, one during the morning session and the other one in the evening. The time she can devote to lesson preparation is very limited. The city Board of Education wants to help her improve her education, so it provides for her to take a course on Saturdays. In this course, she has to learn both how to analyze her pupils' results in competence tests, and to initiate a shift in her teaching practices. She has a hard time understanding the meaning of the numbers that appear in the exam report and the difference between the kind of assignments and exercises she gives her students and those they find in the test. Trinidad has made it her challenge to search for new textbooks with new problems for her students, but she has no time to go to the library. During the Saturday sessions, her professor does not give her explanations, but instead he makes her solve problems. This methodology is hard for her, since she would like to receive explanations about some concepts that are difficult for her. The problems Trinidad's professor gives her seem very difficult to her, and she feels that she would not be able to confront her pupils with problems she herself is unable to solve. Nevertheless, she is aware that she learns when sharing her ideas and listening to her peers during the resolution process. She and her Saturday colleagues have assumed the task of searching for some situation in their students' real life that they could bring to the classroom. This has not been an easy task, but they have come up with the idea of setting up a small shop for

the students to manage. In spite of the fact that she has lived through a new experience as a learner, Trinidad does not feel that she has the knowledge required to change the way she conducts her own class.

On the other hand, she still does not understand the way in which a real life situation is tied to a mathematical model, or the fact that the relationship between the concepts is similar to that between certain elements of the real situation they present. It has been equally difficult to understand how it is that an inequality can be solved from the algebraic or functional point of view. Trinidad sees that her students have difficulties when solving the tests, but she has a hard time finding a methodology that leads her to help them get better results. What has been explained to her has created some confusion in her mind.

Trinidad's situation is similar to that in which most teachers in our country find themselves. Math education researchers who designed the competence tests and the state exam for all high school graduates have since several decades searched for a paradigmatic change in mathematical education. They have devised policies that have allowed, for instance, for curricular freedom for institutions; they have created manuals that showed a different way of perceiving mathematics, the way it is taught and now the way it is evaluated through competences. And yet the mathematical education system to which elementary and secondary schoolteachers conform has not been transformed. The social situation and the context in which they have to live makes it extremely hard that, on their own, they can generate such a transcendental shift as the one presupposed by the new paradigm. So far I have just mentioned issues related to "Numeracy;" I still would have to explore the critical reading and what Keiko calls "Competence." The school institution cannot change its practice just simply because students are now evaluated in a different manner. A permanent support for both teachers and institutions is needed, one which leads them to understand and to incorporate a paradigmatic shift of this magnitude into their pedagogical conceptions. And in order to achieve this in a massive way, it becomes necessary that a large number of people who can permanently remain in the schools be trained.

I am convinced that the profile I have just described is not unique in the world. Indeed, in several research papers on teacher knowledge similar phenomena –though in social contexts with quite different conditions--are described. Citizen education towards a "technological literacy" is a challenge of enormous dimensions in any country of the world. One actually finds many efforts in the media, such as standard publications and web pages with didactic materials that match those standards. But I am also sure that these do not reach the whole teacher population. Thus, if we do not educate the teachers to become "technologically literate," how are we going to manage for all citizens of the future to be so? Or, even more complex, if I observe the idea that this is about a collective competence as opposed to an individual one, how are we to generate a

collective culture towards a different social behavior in which technological systems and their relationship with social injustice are questioned?

In Colombia, we math educators work permanently in search of teacher education schemes. With this, we intend to find equality in education. Our cultural and social context systematically forces us to be creative and to use our determination to pull through in the most possibly adverse situation. As García Márquez has said, we Colombians have two gifts. "One is the gift of creativity… and the other one… a demolishing determination for personal ascent." Trinidad, in the midst of the hardships imposed by this social context, worries that her students learn, questions the state exam results, regularly attends her Saturday class, and on Sunday works on her own homework. She believes in herself and in her abilities.

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