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# Alphabetization in Science as a Process Consistent with the Pedagogy of Paulo Freire.

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I am the coordinator of an interdisciplinary team of scientists, and for the past two years we have had the fantastic opportunity of holding weekly meetings with Paulo Freire. We have found our pedagogic principles to be in perfect harmony with his ideas. Capitalizing on our heterogeneous experiences, we have been developing the ambitious project of rethinking Education.

Paulo Freire's method of adult alphabetization (see "O que e o metodo de P. Freire" - 16th Ed. - Editora Brasileira 1990 represents no more than the initial phase of a long process within an ample system of education. The establishment of such a system was interrupted when Paulo Freire was exiled by the military government in 1968.

During the 12 years of his exile Paulo Freire and his group continued his work in Chile, Africa, the United States and Europe, creating the IDAC (Institute of Cultural Action) in Geneva, which was the center of their activities.

In Brazil his work, and especially his books, had little distribution.

The twelve years of exile and the imposed "censurship", had made him an unknown for the younger generation in Brazil.

Although his prestige had spread around the world, he was remembered only by a few specialists in the educational field in his own country. We were left with the image of a subversive dreamer, a person who taught adults to read but who had introduced a "dangerous" method.

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I came to Brazil from Argentina in 1963 just after , the year before the military government was established. I was a recentgraduate in physics and I made a career as a Physicist at the State University of Campinas (UNICAMP). However I spent the period of 1967 to 1969 at the University of Southern California.

I was the director of the Physics Institute at UNICAMP when Paulo Freire was allowed to return to the country.

UNICAMP welcomed him, although the political situation was still in turmoil and, in fact, we were both subjected to political persecution at that time.

When I was forced to leave my position as director of the Physics Institute, I decided to dedicate myself to Science Education and I founded the Interdisciplinary Nucleus for the Improvement of the Teaching of Science (NIMEC).

In this nucleus was formed an interdisciplinary team, incorporating physicists, chemists, biologists, mathematicians, educators, and philosophers. In addition to our normal academic pursuits, all of us became very active in special science education projects, not only in teacher training in formal classrooms, but also in programs in museums and Science Centers, as well as on the education of Indians and of lay teachers in the Brazilian region of Amazonia. The team has already worked with Science Education at all levels from kindergarten to the university, and in large cities (including inner city (slum) and suburban schools), small towns, and Indian communities, as well as in Africa (Guinea Bissau).

A few examples of what we have done should help to clarify the scope of our action.

We developed 2 4-year programs in the region of Amazonia to train lay teachers ( teachers without any Normal school grades) who are actually teaching in the elementary schools). One of these programs was carried out in the state of Mato Grosso and the other has been initiated in Acre.

We founded a Museum of Science in Campinas which programs activities in conjunction with the local schools to serve some 40,000 students per year as well as administering refresher courses for the science teachers.

I also organized the first course for Science teaching based on the STS philosophy in Brazil, and it has been functioning since March of this year.

We ( the NIMEC team), also provides consultation for and educational organization throughout the country and abroad with funding provided by Unesco(UNDP), and other funding organizations.

In these 12 years of interdisciplinary work we have had to develop a line, a philosophy of work that was based to a great extent on our own intuition as scientists and intellectuals as well as on our own practice.

In the past year we have organized a large number of meetings to evaluate our work and attempt to lay the foundations for our pedagogical practices by providing an appropriate theoretical basis.



This procedure is based in the theories of participatory research and ethnomethodology in an attempt to recruit key concepts and "generative" themes to adopt in a discussion of science and the construction of scientific knowledge.

We are constructivists, but even more important is the fact that we are not destructivists. It is possible to build from nothing after first destroying what already exists, but it is also possible to build upon already existing cultural foundations which have been constructed throughout the ages.

A simple view of the present situation in Europe and the Middle East shows us the political atrocities resulting from a failure to consider ethnic and cultural diversities as old as the civilizations there.

We see science as a process. We separate this process from its results. We call the results "Dead Science". We feel that what we must do is educate the student so that he or she is able to discover the process of Science for himself and reach his own scientific conclusions without mechanically applying the so called Scientific Method.

A system in science education which is based exclusively on the simple transfer of scientific truths, does not teach science although it may be necessary to do so; moreover, such an approaching may become a political weapon of domination. A transferred science is an imposed science, and hence oppressive.

The Third World has thousands of examples of transfer of technological know-how, paid for with large sums of money, which eventually serve to increase technological and cultural dependence. Learning to create or construct science however, can be a tool for attaining liberation and freedom. For this reason we should never practice an "ingenuous" or "naive" science, but rather remove the shroud of scientific neutrality. This is what we call "conscientization" of the students, or making them aware of the responsibilities for their scientific actions.

We believe that what characterizes scientific thought, even before the stage of formal validation, is creative thought, and the first steps towards creative thought is that of meeting or discovery.

Since science has as its principal objective the understanding of nature, it is important to not to remove nature from the course of study. It cannot be replaced by any textbook nor by explanatory lectures delivered by a teacher. For this reason, education in science starts with the "Reading of Nature", within the general context of reading the world. The teacher must provide appropriate instruments for this reading, either intellectual or physical. And the world that should be understood first is the world that he is familiar with. The world of his day-to-day activities reveals sufficient complexities and "systemicity" for exploration.



## Rediscovering Paulo Freire

Between 1980 and 1990, our group (NIMEC), had no direct contact with Paulo Freire, but the democratic environment which has been developing in Brazil and in which we find ourselves today, made it possible for us to come into contact with, and gradually, gain a in-deep understanding of ideas of this great philosopher and educator (who ironically works only a few meters away on the same university campus).

We have come to realize that our educational practices fit perfectly into the general outlines of his pedagogy, and little by little we made professional, intellectual and personal contacts until, a year and a half ago we began our weekly seminars to rethink education with him. If the method of rediscovering is one of the most efficient for learning science, it also served for "learning" Paulo Freire. The questions raised throughout the years have been quickly resolved in our discussions, due at least partially to the affinity generated by shared points of view and the long incubation period of our ideas.

One of the results of our weekly meetings was our discovery that there was a perfect conjunction between our pedagogical practices and the theory of Paulo Freire. For Paulo Freire the process of alphabetization is infinitely more than the simple acquisition of reading and the writing of conventional graphic symbols.

Paulo Freire defends, and is the principal proponent of critical alphabetization (as introduced by Granschi and others).

" The act of learning to read and write ought to begin with a general comprehension of the act of reading the world, something which humans do naturally before reading words."

It is in this broad concept of comprehension of the act of reading the world and in the "criticality" of this reading that one finds the possibility for generalization provided by the ideas of Paulo Freire. This is what makes it possible to transport these ideas to other areas of the acquisition of Knowledge.

The pedagogy of Paulo Freire is a pedagogy of liberation, and the process of alphabetization is the construction of a political weapon which permits a person to reconstruct his society from an ample concept of "empowerment".

One of the most important characteristics of the process of alphabetization of Paulo Freire is the search for "generative words". Such words already have a profound meaning, so they make it possible to have discussions which can be critical and lead to "conscientization".



Paulo Freire criticizes what he calls "Banking Education" in which the teacher "deposits" his knowledge in the supposedly empty heads of his students.

He says:

"Creativity must be cultivated not only on the level of the uniqueness of the individual as a person, but also on the level of his uniqueness in the social context."

"...Encourage the students to doubt."

"...The schools should never deny the importance of technology, but they should not reduce learning to a mere technological comprehension of the world."

In reality, technology represents human creativity and the expression of the need to take risks. On the other hand, we should not negate Humanism.

#### Alphabetization in Science

Science is a process and in this process we can distinguish the context of discovery and that of validation. In academic science the latter (the context of validation) is often confused with the scientific method. Discovery on the other hand, is not produced by a method or pre-determined formula. It is nourished by creativity and, like creativity, avails itself of unconscious thought in all its ramifications.

Within the creative process of science (\*\*\*), the most important phase is that of critical observation of nature. This observation of nature is part of the critical reading of the world, as proposed by Paulo Freire. In fact it is possible to equate Reading of Nature with Reading of the World even though the former requires special methods, strategies and devices which have been developed by scientists throughout history. These can, however, be re-discovered by the student. The child can, and should, read nature; the history of science provides the instruments and foresees the epistemological difficulties which he or she will encounter.

Reading nature ought to start from "generative" themes which are determined by ethnomethodological research and a continuous observation of the nature around us. In the Third World, however, there is a strong tendency to substitute the text book (sometimes a single one), or chalk and the blackboard, for the observation of nature.

Consider the case of a wood cutter in the Amazon forest. It is important for him to understand how the "boss" calculates the cubic measure of the wood that has been cut, using approximate empirical formulas that always exploit the worker and, how does one make and adjust a scale for weighing fish or the latex collected by the men who gather rubber?



The "generative" theme is relevant as a tool for liberation because in many cases it permits the critical discussion of the relationship between the oppressor and the oppressed in order to make it possible to establish new roles of social relationship. Science and technology, which generally determine the process of "disempowering" in the complicated network of power in the Third World, can and should be utilized in the opposite direction. In this case the alphabetization in science becomes even more important in the global Freirian sense of alphabetization.

In contrast to what most laymen think, science realizes that it is not infallible. It is the death of scientific theories that nourishes science itself, sprouting a new, like the Phoenix rising out of the ashes, stronger and more beautiful than ever before.

This is not true for myths and dogmas, which are born to last forever. They are used to explain everything, even things that are outside their original scope.

Create science is dominated, little by little, the "magic thoughts" of a child, without ridiculing it, until it is transformed.

Magic could serve as a source of questions, even as a "generative" theme, so that "the oppression due to superstition, whether religion, ideology or that of the cold war, whether due to liberal indoctrination or any of the other multiple forms of thought can be destroyed and one is liberated through the development of a critical consciousness" (Paulo Freire).

This path coincides with our educational practices for science, where extracting the "generative" themes from the every day culture of the different ethnic groups, makes it possible to use these themes to develop mathematical models, Science and its responsibilities and possibilities of transformations, History as the process of making history and language as the practice of production of texts. This is a natural way of developing a respect for one's culture and the knowledge which has been developed throughout the ages, as well as enriching the teacher understanding and satisfying ethic principle of not only repaying society for what it has taught him, but repaying with interest. In this way the roles of teacher student or school/society are not strictly defined, as the society becomes the school and the students often trade roles with the teacher.

In conclusion we say rather provocatively that the results of creating science are called "dead science" or, depending on the circumstances "Imposed Science", or "Allowed Science".

We make a definite distinction between creating science and the results of that science. Teaching only the results of science as created by others, even though it may be necessary, necessary is not teaching science: it is an example of the "Banking Education" which is so highly criticized by Paulo Freire. Teaching science involves getting the child to dive into the process, first learning to read the world and, eventually more specifically, nature. It is important to read critically and creatively.

Teaching science thus involves providing the instruments for this reading and instilling a sense of self confidence in the child so that he or she can discover that creating science is fun. In this way the moments of discovery are intensified so that this discovery serves as a springboard for future discoveries.

In conclusion, we have found a strong support for our educational practices in the Third World in the Pedagogy of Paulo Freire, and his concepts of alphabetization as reading of the world and reading the word and the fundamentals for the critical reading of nature or Alphabetization in Science that have oriented our work in the teaching of science in the elementary school.