The School of the Future of the University of São Paulo: 1989-1999 What Was Learned and What Wasn't

Prof. Dr. Fredric M. LITTO
University of São Paulo and
President of Brazilian Association for Distance Education
São Paulo-BRASIL

The "School of the Future" of the University of São Paulo, Brazil's largest and most productive center of higher education, is an interdisciplinary laboratory investigating the question of how the new communications technologies can improve learning at all educational levels. Begun in 1989 as a departmental laboratory in the School of Communications and Arts, its growth and increasingly interdisciplinary nature took it out of that home in 1993 and placed it under the aegis of the Office of the Dean of Research, where it continues to flourish, financially self-sustaining and independent of the University budget, but with strong encouragement and guidance from the central administration.

Our work began with an erroneous point of departure: we assumed that the interactivity, the pretty pictures and sounds of mutimedia and the excitement of international collaborative work using the Internet (then Bitnet), were all that was needed to keep young people from abandoning the classroom. At that time, a mere 20% of primary school children in Brazil finished the fourth grade, and the average formal schooling of the Brazilian worker was 4.7 years in length. Fortunately we were spared the danger of committing many errors when the laboratory received a grant from the Inter-American Development Bank which permitted us to send ten of our researchers for observational visits to similar laboratories in other countries (U.S.A, Canada, United Kingdom, Norway, France, Spain, and Israel) and to bring ten leading foreign researchers for short periods to our place of work.

What we learned from the exchange program was very simple: technology is not the answer to education's problems, and that the best way to procede was to examine the present practices of our educational system, discover its favorable and unfavorable points, "design" a new model of practice, and only then begin to choose the technological artifacts and systems which could give good support to the new model. Our studies showed that the cluster of ideas circulating in everyone's mind about the role of education in society and how best to carry out the educational mission belonged to a type of social organization which was rapidly disappearing (the industrial society), being substituted by a new one (the information society). The new cluster of ideas, which we then (from 1991 on) called the "new paradigm in education", a term now somewhat overused, had the following configuration (and it, I believe, continues to be valid):

> ➢ instead of a fixed, basic body of knowledge which every citizen must know.....*in a pluralistic society, inhabited by people with varying talents, skills and interests, there can be no such fixed body of knowledge;*
> ➢ instead of having as the principal activity of students the memorization of factual knowledge.....*the principal activity should be the full exercise of the student's "higher order thinking skills" (such as interpreting knowledge, judging information and making good decisions;*
> ➢ instead of considering "intelligence" as a unique, measurable talent.....*we can better understand student performance and interests through the use of the*

concept of "multiple intelligences", that is, those highly personal learning styles which distinguish individuals from one another;

➢ **instead of evaluating student comprehension using measuring instruments such as tests and quizes.....***prefer portfolios, collections of student work which permit observing the student's development of his or her knowledge over time, and not merely his or her ability to memorize facts;*

➢ **instead of viewing students as "products" (vestigal concept of an industrial society).....***viewing students as "clients" is a better approach, not in the commercial sense of total liberty of choice, but with the idea that each student has the right to a custom-made education insofar as that is possible;*

➢ **instead of organizing what happens in the classroom such that the student has the passive role, and the teacher the active role.....***successful learning best occurs when the student "discovers" the knowledge through adquired problem-solving and information-searching skills, and assumes the active role in the classroom;*

➢ **instead of having the textbook and the teacher's verbal exposition as the principal vehicle for student contact with knowledge.....***the use of animated and static images, sounds and graphics should be employed to supplement textual representation of knowledge, both to aid comprehension of complex subjects and to respect differing learning styles;*

➢ **instead of always presenting information to students and receiving information from them in linear, sequential form......***attempt to vary presentations and student work, permitting both linear and non-linear or analogical organizations, thus encouraging greater creativity;*

➢ **instead of maintaining the student at a distance from the knowledge, only talking about it.....***involve the student in the knowledge through the use of simulations, especially in the case of extremely complex and difficult-to-understand subject-matter;*

➢ **instead of offering the student a fragmented view of the world, especially as represented by typical Cartesian separation of academic disciplines.....***provide a holistic, transdisciplinary vision of knowledge, the only way to understand a world that is increasingly more complex and more dynamic;*

➢ **instead of furnishing an environment for learning which is Spartan in nature and reduced to essentials.....***provide learning spaces which are rich in possibilities for collaborative work, intellectual growth and creativity, supported by state-of-the-art technology.*

Among the earliest research projects which were successfully concluded were two doctoral dissertations, defended in 1993, and which involved the production of two interactive videodiscos destined for classroom use in Brazil, with a concomitants evaluative study on their insertion into real classroom activities. Brasilina Passarelli's dissertation on the making of the videodisc "The History of Slavery in Brazil" was an early example in our country of how texts, animated and static images, music and sound effects could be employed in creating didactic material for a new type of learning. Antonio Carlos Nogueira's dissertation on the making of the videodisc "Living Beings and the Environment", was another successful project for learning in the field of Biology. Other projects in the line of multimedia presentations in the following years included, among others, such cd-roms as "Demystifying the Computer", "A Hypertext Catalog of Machine Tools for Technical Schools", and "Technical Drawing in Multimedia", which won the Ministry of Education's first prize for Educational Software in 1996.

In 1990 we began using the predecessor of the Internet, Bitnet, for projects linking schools within Brazil and abroad, in the area of Science. These projects continue until today, coordinated by Professor Nelio Bizzo, and now include some ten projects, repeated annually, designed for participation by primary and secondary school students. They always involve hands-on activities in learning about biology, chemistry, physics and ecology, and the use of the Internet to find information necessary for the project's operation, to confer information with data on sites elsewhere, and to exchange

information with the other schools participating in the project. The current projects of this research group **www.darwin.futuro.usp.br** are:

- ➢ **Carnivorous Plants (in which students plant and maintain these plants, recording growth conditions like size, ambiente temperature, humidity, and light in spread sheets in the computer and then share and compare the data with other schools);**
- ➢ **Sky (in which students learn about the earth's rotation and revolution, latitude and longitude, calculate where the shadow of a broomstick in the schoolyard will fall at any hour of any day of the year in other schools, and then verify their calculations with their partners through the Internet);**
- ➢ **Biogas (in which students bring discarded organic material to class where it is placed in a closed recipient which eventually produces measurable energy in the form of gas; the Internet is used to compare the results in different schools);**
- ➢ **Solar Energy (in which students use kits to collect measurable solar energy, which is used to provide power for other objects; and the Internet serves to help compare results among schools);**
- ➢ **Frogs (in which students receive tadpoles and study the morphological changes in frogs growth, again using the Internet to compare observations in other schools);**
- ➢ **Fruits (in which schools receive an envelope containign unidentified seeds which are planted; through close observation, the students attempt to be the first to determine the species, using the Internet to discuss possibilities with students in other schools);**
- ➢ **Findlay (in which students collect mosquitos, possible carriers of the denge virus, sending them to São Paulo for identification, and thus helping to create a national "atlas" of danger areas; the Internet is used to communicate among schools questions of procedures and results).**
- ➢ **We also have had several projects underway in recent years connected with the teaching of humanities and social studies and the use of the Internet, some of which are coordinated by Professor Brasilina Passarelli and others by myself, such as:**
- ➢ **creation of a "mediateca" (fusion of a library [biblioteca] with a computer laboratory) in a municipal public elementary school for children with hearing deficiency to determine if their access to multimedia and the Internet accelerates their learning to read and write [Coordinator: Professor Leland McCleary mccleary@usp.br];**
- ➢ **"Cultural (Mis)Encounters Between Brazil and Portugal" (in which primary school students in São Paulo and Lisbon each week used the Internet to exchange texts they wrote relating what they knew about the historical relations, cultural similarities and differences between Brazil and Portugal);**
- ➢ **MOOS and MUDS in the history of Brazil (in which students assume the identities of historical and literary figures of our country, and, using the Internet, create dialogues showing their knowledge of the past);**
- ➢ **Virtual Orchestra (on our site on the web, we have created, for student use, a resource center for studying the instruments of the orchestra: their appearance, sound, history and importance in the orchestra);**
- ➢ **Experts (in which 150 professors and graduate students of our University make themselves available to answer students' questions in most fields of knowledge, all based on e-mail correspondence);**
- ➢ **Virtual United Nations (in 1998 200 São Paulo public schools participated in this Internet-based project in which schools represent different countries and discuss and vote on international issues before a simulated United Nations; in 1999 there will be 2,000 schools participating) [see <www.educacao.sp.gov.br>;**
- ➢ **The Virtual Library of the Brazilian Student (a server on the Internet, available 24 hours a day, 7 days a week, where students have free access to a vast repository of Brazilian literary and historical documents (full text), the images of our country's flora and fauna, and the sounds of politicians of the past and of animals);**

this site in 1999 had an average of 3,300 visitors per day and was voted the best site in education in Brazil [see: **www.bibvirt.futuro.usp.br**].

On our web homepage **www.futuro.usp.br** we also offer a useful service to teachers throughout Brazil called "Edusoft", which is an regularly updated directory of all educational software in the Portuguese language to be found on the Brazilian market, now including over 1,000 items. We were originally planning to include our evaluations of each product but found it too expensive to do, and we could not find a sponsor for such a task. Hence, we have decided to create a space for educators to place their own evaluations of each software and let potential buyers be better informed before their purchases.

Another project which broke new ground in the field of educational technology was the development of a kit, to be used in primary and secondary schools, and composed entirely of discardable material (with the exception of the laser pen), and which permits students to create their own credit-card size holograms. Professor Marcio Ueno, who developed the kit and the accompanying teacher's manual, "Holographic Pedagogy", has demonstrated its success in student learning of difficult concepts in physics and chemistry and aesthetics.

In order to shorten the time between the results of our research and their dissemination among schoolteachers, we early on created a policy of regularly offering courses, seminars and workshops for teachers. We have had substancial contracts for providing teacher introduction to computers in the São Paulo Municipal and State public school systems, as well as in Bahia and Niteroi in the State of Rio de Janeiro. In 1996, we inauguerated, in partnership with UNISYS Brasil, at the downtown extension center of the University of São Paulo, two "Classrooms of the Future", where we carry out segments of this mission, giving courses from "Computerphobia" up to "Teaching your Students Writing in Java". The two classrooms are state-of the-art technology, with monitors built-in under the surface of the tables and viewed through a window, thus permitting good working space and use of the rooms for meetings or classes which alternate between face-to-face discussions and the use of multimedia or networked sources. [See: <www.capacita.futuro.usp.br>] We believe that the physical environment influences the quality of productivity, and that educational environments rich in technology not only facilitate collaboration but also deepen and intensify the learning process. For this reason, in 1999 we created a new research group, to study both physical and cognitive ergonomics in educational environments. It is led by Professor Laerte Sznelwar, and currently it is investigating the use of wearable computers as supports to learning by persons with physical disabilities.

Another project of importance is the "Mutirão Digital", or "Digital Barn-Raising", a cooperative venture with the Rotarian Foundation of São Paulo and the Rotary Clubs of Brazil, and which has its origin in the "Net Days" of the United States. Begun in early 1998, it features funding-raising by members of Rotary Clubs throughout Brazil and the identification of local public schools to receive the donation of computers, telephone lines, teacher training and Internet access. The School of the Future provides orientation for the teacher training, the computer configuration, and creates web sites to which the schools can go for learning activities. To date, over 600 schools throughout the country have been benefitted by this project, which is an example of civil society not waiting for the state or the government to solve its problems, but finding solutions among its own constituents [see: **www.mutirao.futuro.usp.br**].

Consulting work is yet another activity of the School of the Future, one which enables us to put into practice our ideas and strategic plans for a more modern and dynamic educational scenario for Brazil. In late 1996, a group of Chinese businessmen of São Paulo asked us to "design" a new primary school, a community institution open to students of all backgrounds, and the philosophy of which would be a fusion of Buddhist

principles (such as harmony, peace and love for other human beings) with the new paradigm in education (as cited in the introductory pages above), all supported by the good use of the new information technologies. We produced a 450-page study, coordinated by Professor Silvia Fichmann, on what such a school would be like, and its favorable reception led to the next step: the recruiting and training of the first group of teachers, during the six-month period prior to the start of classes. This guaranteed that *all* the instructional staff was totally comfortable with computers and web-based learning, and more, that it knew how to work as a real team, and not just a cluster of individuals, each interested merely in defending his or her own turf. The school, called Colégio Sidarta, opened its doors in early 1998, and has had continued success since then. Its site can be visited at <www.sidarta.G12.br> and the School of the Future is now completing a new study for the creation of a middle school for the same institution, to begin in early 2000.

The success of the Sidarta experience brought us a new partner in the consulting area: Colégio Nacional, of Uberlândia, Minas Gerais, a highly successful private educational institution consisting of a primary and secondary school and a university-entrance-exam preparatory course, wishing to establish a new center for higher education, invited the School of the Future to "design" a new university based on the ideas of the new educational paradigm and characterized by substantial use of information technologies and the incorporation of distance education. The leadership of the Colégio Nacional, all coming from the ranks of idealistic high school teachers and former student political activists of the decade of the 1970's, is far-sighted, and will very probably be successful in establishing its new institution, which hopes to eliminate the outmoded forms of the teaching-learning process in higher education, and substitute for them new principles based on the results of research in human cognition and proven good practices in the employment of new technologies in the support of knowledge construction.

There are two study groups in the School of the Future which help orient our research projects: one is CETRANS, or the Center for Transdisciplinarity, which seeks points of intersection and a common vector among the different areas of knowledge. *Trans* is a suffix signifying that which is at the same time *among, through and beyond* different disciplines. The group is presently preparing forty educators, through both presential and virtual means, for the implementation of pilot research projects. The center coordinators are Professors Maria de Mello, Américo Sommerman and Vitória Mendonça de Barros. The second study group, denominated Cognition and Epistemology, and coordinated by Professor Luiz Prigenzi, attempts to maintain our researchers up to date with new concepts circulating in the field and the constant questioning of older concepts.

Finally, in this description of our activities, I must mention two events which we regularly organize to incentivate innovations in the use of computers and the Internet in education in Brazil. The first is the "Computer Jamboree--the Annual Carousal of Educational Informatics", which is a kind of science-fair, but with informatics in education as the focus. Now in its third annual edition, the Jamboree offers a space for schools and universities to show their creativity and originality in developing projects in the fields of robotics, use of networks, multimedia and tutorials. It is expected that in this year's edition (1999), about 100 institutions will show their work, and several thousand visitors will view the stands.

Now, what have we learned in the ten years of activity in research and development at the School of the Future? It is an illusion to try to reach *all* the schools or students in the short run.

> It is better to work with pilot-project schools which later serve as models for others.
> It is more productive to work initially with teachers who are highly motivated towards change and towards learning new skills.

It is more economical and more pragmatic to build knowledge systems wherein students and teachers *come to the information*, rather than vice-versa. Sites on the Internet represent the possibility of "just-in-time" solutions to the problem of knowledge construction.

Producing didactic material using new media is much more difficult than it seems from afar.

> ➢ **It requires true interdisciplinary teams of serious professionals; improvised workers do not produce products adequate for the demanding and highly critical student target group.**
> ➢ **Pedagogues, writer/editors, graphic design persons, audio-visual persons,**
> ➢ **Programmers and producers must work together collaboratively, as a smoothly functioning team.**

The ideal workers for producing innovative materials for learning must have technical competence, sincere loyalty to their production team and to the institution, maturity in accepting constructive criticism of one's professional work, unswerving honesty and ethical behavior with regard to colleagues, equipment and tools, and an idealism that fuels productivity more than remuneration does.

It is very difficult to maintain a good rate of productivity in a university environment, and practically impossible in the environment of a governmental office, such as a ministry or state or municipal secretariat of education; although there are rare exceptions to this rule, in general it is best to contract work to small firms which exist for this function, or university laboratories which have a track record of meeting deadlines and staying within budget.

> ➢ **Do not take for granted, in the search for partnerships, the customary actors on the educational scenario: ministries of education and state secretariats of education are political bodies whose real function is to guarantee re-election; they have their own pet projects and tend to give substantial support only to those projects;**
> ➢ **schools in education in universities, if they are under a European influence in their thinking, will always support those projects which emphasize *reflection*, and will tend to disfavor those projects which emphasize the *hands-on, the practical, especially when involving the use of technology.***
> ➢ **commercial or industrial firms, which in developing countries give little credibility to the educational world, believing it to be perennially without funds to buy its products, hopelessly unpragmatic and unproductive; this credibility question also works in the reverse direction, with educators believing that all businessmen think only about profits and short-run gains.**
> ➢ **state and private postal and telephone companies, who ignore international treaties about the tax-free circulation of educational material such as slides, transparencies, cd-roms and software, taxing these objects as if they were all commercial in origin, and refusing to grant discounts for the educational use of teleconferencing facilities and other telecommunications platforms.**
> ➢ **teachers unions, whose almost exclusive obsession with improving teacher's salaries and benefits makes them forget their responsibility in maintaining teachers up-to-date in their knowledge and skills.**
> ➢ **syndicates of private school and university owners, whose concern with the profits and marketing of their own institutions causes them to forget their responsibility in supporting the creation of new didactic material.**
> ➢ **book publishers, whose inexperience with digital media and the nature of the use of on-line information sources, confines them to inflexible positions on the question of intellectual property and waivers or exemptions regarding royalty payments in the case of non-commercial, educational use of protected material.**

The "hand-holding" process of taking teachers out of the old educational paradigm and into the new one is long, arduous and constant. It is part of human nature to resist change; but many teachers seem to resist it so wholeheartedly that one is almost given to think that such resistance was learned in teachers' college. Always assume that the "hand-holding" process will take longer than you initially imagined.

The foreign language barrier in educational settings is more serious than most educators wish it were, and requires constant monitoring. We like to think that Spanish and Portuguese are so similar that our students can easily use multimedia products or Internet sites interchangeably in either language, but it's not that simple. The same holds true for Latin American students using information in English on North American sites: how can we feel confident that there is serious comprehension going on when we know how weak foreign language instruction is in our schools?

Prepare technological coordinators for schools. One of the principal differences in the successful adoption of new technologies in North American and South American schools is that the former have a long tradition of every school having its own technological coordinator, who is always a teacher of academic subjects but who enjoys helping his colleagues adequately use overhead projectors, slide projectors, film projectors, television sets, and videocassette players. Hence, when the computer comes among, it is merely another artefact, which can be used to help student understanding and accelerate student productivity, and not a career-threatening, alienating technology. The technology coordinator in a school is a facilitator, a problem-solver, a resource for both teacher and student. We need more of them.

Make learning fun. Taking the computer into the learning environment should never be done making the machine, and not the learning, the center of attention. In fact, my colleagues and I have come to the conclusion that "computer laboratories" in schools (that is, concentrating all the computers in special rooms) are actually counterproductive, creating a separation between the academic disciplines and the use of the computer. They also create fiefdoms, off-limits territories, instead of friendly, "walk-in anytime, learn and enjoy..." spaces. A separate room for the computer is only justifiable in the case of extremely expensive equipment for the creation and printing of graphic material. In all other cases, it is preferable to distribute at least 2 or 3 computers (with connection to the Internet) in every classroom, for teacher and student presentations, collaborative work and information searching. And, always, emphasize that learning and constructing new knowledge brings various kinds of satisfaction, even fun.

Do not succumb to the fallacy of requiring "the perfect solution". In a pluralistic society, we know that there are many roads to heaven. There is no perfect solution to the problem of introducing technology successfully into learning spaces. Just as we believe that every school, public or private, must have its own unique pedagogical proposal, so, too, every school or school district must work out its own strategy for migrating from outmoded practices in the teacher-student relationship to new ones based on the most recent conclusions of cognitive research and the goals for preparing future citizens for a world different from the one in which we were educated. Proceeding too cautiously could represent failing the student in this mission. Proceeding too quickly could represent possible mistakes in the adoption of pedagogic strategies and tactics or even mistakes in locking oneself into a technological *cul-de-sac* or financial nightmare. Good sense must prevail here.

There is increasingly less difference between what goes on in school and university classrooms and what goes on in the offices of corporations large and small, government offices, and non-governmental organizations. In a "knowledge society", everyone is involved in learning and then acting upon the knowledge gathered. Learning and work, from now on, will consist of the following activities: (a) identify problems, (b) search for

information to solve the problems, (c) filter the information found with criteria for relevance and pertinence, (d) draw conclusions that are valid and just, (e) communicate the conclusions to third parties in clear, succinct language. Knowing how to do these things well is what will determine personal professional survival in the future. Teaching students how to do them well is the most important mission of the educational institution. And the new communications technologies permit us to do them well in new and better ways.

And what is it that we *have not* learned at the School of the Future? I think that we've not yet learned how to give up the good fight, to accommodate ourselves when confronted with enormous obstacles like generalized resistance to change, or the lack of a steady flow of financial support for research and development activities, or the lack of agility on the part of large bureaucratic institutions with whom we regularly must deal. It's something I hope we never learn.

BIODATA AND CONTACT ADDRESSES of AUTHOR

Prof. Dr. Fredric M. LITTO
University of São Paulo and
President of Brazilian Association for Distance Education
São Paulo-BRASIL
Email: frmlitto@usp.br

Fredric Michael Litto, Professor of Communications in the School of Communications and Arts of the University of São Paulo from 1971 to 2003, was the Founder and Scientific Coordinator of the University´s research laboratory "The School of the Future," which he continues to direct, and, since 1995, is President of the Brazilian Association for Distance Education—ABED. He is a Member of the Editorial Boards of the British journal Education, Communication and Information, the Canadian journal International Review of Open and Distance Learning, and the American publications Journal on Advanced Technology in Education and American Journal of Distance Education. In 2003-2004 Professor Litto served on a working group of the World Bank creating a new area of financing for projects of distance learning in rural and isolated communities, and was also a consultant to the Commonwealth of Learning (Canada) in a project preparing distance-learning professionals in Mozambique.