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The Program of Educational Informatics MEP-FOD

A Contribution to the Development of Costa Rica

Omar Dengo Foundation
Education, Technology, and Development

Tel.: (506) 257-6263
Fax: (506) 222-1654
P. O. Box 1032-2050
San José, Costa Rica
http://www.fod.ac.cr

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The Vision

A vision, rather than an indeterminate aspiration, is a powerful conviction. A conviction that guides human acts toward new possibilities of development where the traditional is unable to reach and where known formulas face limits.

This was the light which in 1988 brightened the history of public education in Costa Rica with the Program for Educational Informatics of the Ministry of Public Education and the Omar Dengo Foundation (PIE MEP-FOD); a light which was fresh and full of enthusiasm, with the emotion which comes from risking the best seed of a small, simple society at a time when hopelessness was close at hand.

Because daring to create a Program of Educational Informatics at the national level, in a Latin American country, in the '80s, did not then seem like a possible path to development. The profound social and economic imbalances, which deepened and multiplied in the region at that time, caused it to be labeled "the lost decade," and they were, in fact, years in which the poorest suffered doubly.

It was then that in Costa Rica a fundamental decision was made: to invest in advancing and updating educational opportunities for children and adolescents by introducing educational digital technology as a learning tool in elementary and high schools. To this end, the Program of Educational Informatics MEP-FOD was created, which represents the beginning of an entirely new institutional mode for designing and implementing educational policy in the nation, integrating it with social, economic, and technological development.

Once again, the risk of hopelessness was confronted by acknowledging the right of all individuals, but especially of the younger generations, to opportunities for growth. Today, 14 years later, history has confirmed the wisdom of that initial vision, when investment in developing the abilities of younger generations was sprung upon the world as a strategic priority.

The powerful conviction that gave birth to the program still burns, confronting the constant challenges of updating, expansion, and innovation. Challenges which concomitantly are transformed into the educational vanguard of a country that believes in education as a pillar of development and foundation of equality, at the dawn of the twenty-first century.

The Program

The Program of Educational Informatics of the Ministry of Education and the Omar Dengo Foundation has been part of public schools in Costa Rica since 1988.

It constitutes an educational opportunity for students at elementary schools from kindergarten through sixth grade of Basic General Education throughout the country, as well as for the teachers who work in the program. This has been achieved by constructing and executing a pedagogical model for using educational digital technologies to foment specific learning processes in generations of young students. These learnings are associated with the development of abilities and skills such as reflective logical thinking, flexible use of knowledge and information, creative problem-solving, and cooperative tasks.

Making Costa Rican children the direct beneficiaries of the program constitutes recognition of their capacity and potential as individuals and as citizens who will be protagonists of social and cultural change. For this reason, every year the children have diverse options for demonstrating their potential, through a variety of activities such as the Children's Educational Informatics Conference, where projects developed during the year are presented, or through production of the Electronic Magazine.

Schools that work with children with few economic resources, whether in rural or urban contexts, are a priority for the program. The premise is that this population is very unlikely to have access to an opportunity like this through its own means. The objective is to achieve more equitable distribution of the benefits and positive effects made possible by education which is mediated by digital technologies in terms of improving the quality of life of the society as a whole.

The educational informatics laboratories become a space for generating change within the schools. The educational informatics tutor facilitates learning processes in which the young apprentices are the center of the educational process. At the same time, the teachers working in these schools are given support and training by program advisors who are trained for this purpose, as well as by national and international experts. Thus, the multiple participants in the educational process learn that technology is a resource for exploring the world around them, for self-expression, and for sharing with others, as well as for reflecting upon their own potential and life experience.

Because of its characteristics and objectives, the model of the PIE MEP-FOD has given special emphasis to continuous, updated, high-quality training for the teachers in the program. From its beginning up to the present, the PIE MEP-FOD has had the permanent collaboration of the University of Costa Rica,

the National University, the Massachusetts Institute of Technology (MIT), Harvard University, and the University of Río Grande del Sur in Brazil. Thus, one of its main achievements has been re-assessment of the importance of educators as mediators in learning processes, giving new value to their work and their potential as a crucial factor.

At the present time, numerous groups of program alumni are now university students. Some have also joined the work world. Although a series of evaluations have been done to identify the beneficial effects of the program in terms of the vocational choices made by young Costa Ricans, as well as in the generation of their self-image as subjects capable of taking greater advantage of opportunities, efforts are being made to identify major repercussions with greater clarity.

Indicators such as the country's attractiveness to companies dedicated to producing technology at a global level, such as INTEL, the design and production of software generated by businesses and professional Costa Ricans, as well as Costa Rica's place among those Latin American countries who are potential leaders in technological advances, as shown in the United Nations Human Development Report 2001, are signs which deserve a more holistic explanation, within a historical context. Thus, researchers from the Research Department of the Omar Dengo Foundation, in conjunction with the International Development Research Center from Canada, are presently developing a methodology for evaluating and measuring the social impact of digital technologies in projects and educational programs which will permit greater understanding of the dimensions of the contribution of the PIE MEP-FOD to the development of Costa Rican society. This methodology could be applied to other contexts in Latin America and the rest of the world.

Besides constituting a pioneering effort in Latin America, the PIE MEP-FOD represents a major contribution to the developing world. Its contribution should be seen not only in terms of being a necessary link between educational policies and strategies for social and economic development, but also in terms of the kind of technological appropriation required to confront the digital gap with viable proposals.

The program's contribution to national development is widely acknowledged. On December 20, 2001, the Legislative Assembly of Costa Rica, by means of Law No. 8207, decreed the Declaration of Public Usefulness of the Program of Educational Informatics MEP-FOD.

An Initiative with an Ambitious Goal

The Program of Educational Informatics MEP-FOD aims at contributing to improve the quality of the national educational system by providing learning environments which foment development of logical-mathematic thinking, the development of problem-solving abilities, expansion and strengthening of curricular topics in basic subjects, the development of creativity and expressiveness, technological fluency in exploring diverse contexts, and promotion of teamwork, both in school children and in teachers.

In order to make this wealth of opportunities possible, a powerful link is established among individual abilities, the learning environment, and the computer.

The Government, the Foundation, and the Communities: Fundamental Institutions of the PIE MEP-FOD

On the basis of a Cooperation Agreement with the Ministry of Public Education, the Omar Dengo Foundation serves as coordinator for the pedagogic proposals and management required by the program. These actions combine the efforts of the government, through the Ministry of Public Education (MEP), the schools, and the communities.

The MEP plays a principal role in this educational development, one which since the beginning of the program has provided participating schools with advisors and educational informatics tutors from the PIE MEP-FOD. After the first decade of implementation, the MEP has shared financial responsibility with the ODF to guarantee annual sustainability and periodic growth of its coverage.

The ODF is responsible for management of the program, for the training and monitoring of the educators, and for research and evaluation. During the first ten years of the PIE MEP-FOD, the Foundation concentrated its financial and academic efforts on achieving pedagogic and technological consolidation for the program.

The communities are responsible for generating the infrastructure necessary for the program to function in academic centers. To this end, they provide the classroom, which sometimes must be built, the wiring, the air conditioning, the furniture, and a security system. The communities make a tremendous effort in organizing and gathering resources, and they also play a major role in making a strong commitment to optimal use and preservation of those resources.

The schools which will benefit from program expansion are selected according to the following criteria: the interest shown on the part of the school to become part of the PIE MEP-FOD, the size of the school, the socio-economic condition of its students, the willingness of the community to provide the necessary infrastructure, and geographical location.

Theoretical Foundation of the Program

The Omar Dengo Foundation places great emphasis on enriching its different programs, which is manifested through the research and analysis of well-founded epistemological and pedagogical premises.

The Program of Educational Informatics MEP-FOD is strongly linked to the epistemological theories of Piaget and Vigotsky concerning social and cognitive development in individuals, and bases its pedagogical foundation on the constructionist theory of Dr. Seymour Papert.[1]

Constructionism is distinctive in that it studies how computers can provide opportunities or limit them in formal education contexts. It posits computer programming as an activity and a powerful resource for developing abilities such as learning to reason logically and creatively, learning to reflect upon one's own thinking, and learning to learn.

Pedagogical Orientation of the Program

The Omar Dengo Foundation has constructed a proposal for developing the abilities of students and teachers based on using the computer as an educational resource. Aware that it is not the computers which will achieve the desired success, the parameter for program activity centers on developing the abilities of the subjects, based on an innovative pedagogical proposal oriented toward a methodological strategy which focuses on project based learning, programming, interactive resolution of problems, learning by design, and collaborative work.

The Learning Environment and the Focus on Project Based Learning

Within the program context, the learning environment is understood as an organization where educators and students interact with computer elements to enhance opportunities for learning, socialization, and value formation.

The learning environment is enriched by focusing on projects because this methodological strategy promotes collaborative work through the concept of production companies or groups of children producers who:

[1] Mathematician and psychologist, creator of the programming language Logo, and Director of the Epistemology and Learning Group of the Massachusetts Institute of Technology.

- Join together on the basis of common interests, such as topic-based and program elements. These students are not necessarily in the same grade, same class, or same school.

- Research with diverse resources and use the computer to document a content area related to their interests.

- Articulate their understanding through projects developed with a computer system made available in their classrooms or in educational informatics laboratories.

This environment facilitates natural integration of different disciplines, which is more meaningful for students and more effective for the professor, and promotes student exchanges concerning their experiences and projects, thus expanding the range of participants and creating opportunities for intellectual leadership for the students, while fomenting a paradigm shift, from centering knowledge on the educator to the student.

In this learning environment a series of characteristics stand out which constitute axes of innovation:

- The creation of digital products which represent the thinking of their authors.

- The contrast between the information a student already has on a topic and the information obtained from reference sources, which transcends curricular content.

- Self-knowledge in terms of the kinds of thinking and problem-resolution used by each person.

- Learning by design, learning from experience, learning from errors, learning to learn, and learning over middle- and long-term.

Technological Resources for Pedagogical Innovation

The PIE MEP-FOD employs a series of technological resources to enrich the learning environment:

- **A programming tool**, as a handle for optimizing the organization of ideas, exploration, design, creation and learning through projects, which are initially built in the mental structures of the children and are then transformed into concrete constructions based on the electronic designs

which the children program while establishing enjoyable communication with the computer.

- **A set of productivity tools**, which consists of word processor, electronic sheet, and document editor, available as resource options which open possibilities for innovative treatment of the curricular topics introduced by the teacher.

- **A Learning Network**, which foments the exchange and dissemination of ideas and productions utilizing new digital technologies in such a way that students and teachers participate in interactive processes of knowledge construction.

- **A digital library**, which aims at enriching the content of the projects, expanding traditional reference sources, and strengthening learning frameworks.

Modalities of Attention of the Program of Educational Informatics MEP-FOD

Since its beginning, the Program has endeavored to guide its growth based on criteria of a social nature, benefiting schools in marginal urban and rural areas, and thus successfully working on behalf of equality and closing the gap of opportunities. The growth of its coverage and the diversification of school characteristics have resulted in the PIE MEP-FOD attending students through two different modalities:

Educational Informatics Laboratories: These are installed in schools with a student body between 81 and 1200, where there are one or two educational informatics laboratories, which include basic equipment of 10 or 19 multimedia work stations connected by a network to a server, printer, scanner, electronic mail access, and Internet services. Each school in this modality also has an educational informatics tutor; a teacher specialized in this field, who receives continuous training from the program. The children go to the laboratory, accompanied by their regular teacher, for two periods each week (1 hour and 10 minutes), one from the Spanish program and the other from Mathematics. In this context, the students do not receive lessons in computer science, but rather enjoy the spaces developed with the support of computational tools, which integrate the teacher, educational informatics tutor, and the students.

Educational Informatics in the Classroom: The Costa Rican educational system extends its services to the farthest communities in national territory, interconnecting a vast network of single-teacher or multi-level schools. These schools have student bodies between 10 and 80 and one- or two-room

installations, where one or two teachers are responsible for working simultaneously with different school levels. The experience of the PIE MEP-FOD in these schools began in 1998, with installation of basic equipment consisting of 1 to 4 interconnected computers (depending on the size of the student body), printer, scanner, electronic mail access, and Internet services where connection is possible. In this multi-grade context, the computer is a permanent resource for complementing learning processes in the school. The methodological orientation proposed aims at a holistic approach to curricular disciplines and exploration of other areas of interest to the children.

The number of workstations in each of the modalities is defined according to the student population of each school and the average number of students per group. One laboratory should be sufficient to handle entire groups when divided into pairs, with one pair of students per computer.

The Professional Team of the Program of Educational Informatics MEP-FOD

The program structure is based on a team of professionals whose common objective is to propose and research innovative ways to re-envision the social function of schools and educators. To this end, the program has an Advisory Team composed of educators who specialize in educational informatics, with vast knowledge of digital technologies, cognition, learning, evaluation, epistemology, and research.

The Advisory Team, provided by the Ministry of Public Education, is in charge of the training and monitoring in the schools through activities related to documentation, systematization, research, and evaluation that permit modification and development of the different areas of the program.

In its functioning, the program is supported by the program areas of the Omar Dengo Foundation, which include: educational informatics, professional development of educators, educational innovation, online learning, digital technologies for all, robotics and learning by design, educational projects, research and evaluation, informatics, telecommunications, and technical support.

The alliance of different professional groups has allowed the weaving of a network of connections which are the foundation for continuous quantitative and qualitative growth.

Professional Development

Continuous training of the teachers of the PIE MEP-FOD constitutes one of its principal characteristics, as well as one of the keys to guaranteeing qualitative growth. Based on a modern vision of formation, training, and updating

processes, the idea is to help modify teacher praxis in order to achieve learning situations which manifest an educational paradigm of a constructionist nature with a strong tendency for strengthening and developing the intellectual and social abilities of the educators.

The role and professional development of the educator are crucial to the Program for Educational Informatics MEP-FOD. To this end, the Omar Dengo Foundation has initiated a system of formation and support for the educator which is characterized by the following:

- **Fomenting of academic programs:** These are initiatives taken by the Omar Dengo Foundation with national and international educational institutions to foment high levels of professional development.

- **Annual training sessions:** This is a strategy of the PIE MEP-FOD to consolidate an educational culture which contributes to enriching the program proposal by renewed learning's on the part of educators and productive application of the same with the students.

- **Pedagogical monitoring in schools:** This is defined as a strategy of purposeful accompaniment which the advisors provide for teachers and students to support, observe, and document the informatics-related activity generated by the schools.

- **National Teachers' Conference of the PIE MEP-FOD:** This is a space for sharing experiences in pedagogical innovation, methodology, and evaluation in which the program proposal for benefiting from informatic and telematic resources is a major factor. This event takes place every two years, beginning in 1988 with the First Encounter of Tutors of the Program of Educational Informatics.

At the beginning of the program, the training of leaders and work teams was handled by personnel from the Media Laboratory of the Massachusetts Institute of Technology. Since then, the design and development of teacher training has been the task of the Omar Dengo Foundation and the PIE MEP-FOD, which, while sometimes including international specialists, has always remained essentially concerned with the national context and the needs of the educators in the Program.

Initiatives for Children's Enrichment

Children's Educational Informatics Conference

For a large sector of teachers and students in Costa Rican public schools, the use of computers is no longer foreign, but rather has become a tangible

opportunity for holistic learning. In this context, since 1989 the Children's Educational Informatics Conference is a space for exchanging learning and for personal enrichment in which hundreds of students participate and where they find opportunities for personal development through novel experiences, aimed at expanding their academic activities and knowledge in a space where their creative work can be projected to the national community, thus enriching both social and cultural frameworks (www.fod.ac.cr/congreso-infantil/).

Summer Camps for Programming and Creativity

In 2001, in order to enhance mastery of technological resources and learning through projects, the Program of Educational Informatics MEP-FOD initiated this mode of workshops for students, based on the experiences of the summer schools held from 1989 through 1994. In these camps, children interested in this learning activity use technology extensively and invest 40 hours of their vacation in participating for one week in this initiative, which allows them to investigate areas of their interests.

Research and Development Projects

"New Millennium" Electronic Magazine: In the area of the Learning Network, this project, which began in 1994, foments children's use of telematic resources to edit an electronic magazine which is published on the Internet. The Electronic Magazine is characterized by the students who form part of the Editorial Board interacting through the Learning Network by utilizing electronic mail and chat as tools for meeting, making decisions, and setting up the edition of the magazine to be published. Visit us at: www.fod.ac.cr/revista.

The Pedagogical Coordination of the Learning Network is in charge of dissemination of the project for subscription by interested parties, of designing and developing training for students and teachers, and of evaluating the quality of the process.

Bridges: This research study, initiated in 1999 in 10 single-teacher schools, examines new pedagogical options for handling curriculum on the basis of intensive use of informatics, telecommunications, and robotic technology. The teachers in this project participate in training modules designed by advisors of the Program for Educational Informatics MEP-FOD, scholars of the Omar Dengo Foundation, and specialists from the Media Laboratory of the Massachusetts Institute of Technology. These training modules are directed towards providing a group of strategies for holistic handling of the scholastic program of the Basic General Education.

Pedagogical Robotics: How do things work? Why do things happen the way they do? These are the key questions that guide the learning processes in the Robotics Exploration Rooms of the Program of Educational Informatics MEP-FOD.

This experience takes place in an academic context and aims at generating, within a framework of projects, a scientific-technological culture in which students develop products of personal importance which involve the programming and building of structures which are associated with simulation of industrial or technological processes or with the recreation of sites or events related to their socio-cultural environment. The basic elements for this construction are LEGO blocks, activators, (motors, lights, sirens), sensors (light, touch, rotation, temperature), and other complementary materials. For programming resources, languages are used whose roots derive from LOGO and LabView, such as Yellow Brick, Control Lab, Robolab, and Lego Engineer.

The project is developed through voluntary participation of the schools, where students attend the Robotics Exploration Rooms during 10 weekly sessions beyond their regular school schedule. Each group participates in a workshop for eight weeks, sufficient time to enhance their abilities for design, construction, programming, and cooperative learning.

Children as Mediators: In order to take full advantage of the technological resource already installed, in 1998 this project was initiated in the schools that participate in the "Educational Informatics in the Classroom" modality. The idea is that students and their teachers constitute a team to study options for taking maximum advantage of computers as a learning tool which benefits the scholastic community.

This project is completely voluntary on the part of the schools and participants and provides interested students with an annual 40-hour training workshop, which takes place during vacation time. Among its achievements are the strong social and pedagogical impact on the participants and the leadership acquired by the children in their academic context by means of the computer. Some of these children have practically taken over computer-based activity and act as mediators for their classmates.

The Ability to Deliberate: This research-action project, begun in 2001, is directed toward fomenting both development of the ability to reason and the civic participation of children in Costa Rica. It aims at strengthening democracy and renewing leadership through participation of the younger generations as a requisite for confronting the serious economic and socio-cultural problems of poverty-stricken sectors and those at high risk of exclusion.

The project is a joint, inter-institutional undertaking of the Omar Dengo Foundation, Harvard University, and the Project State of the Nation of Costa Rica, who are in charge of its implementation. It also has the support and advice of institutions such as the Inter-American Institute of Human Rights and the National Electoral Tribunal of Costa Rica.

Achievements of the Program of Educational Informatics MEP-FOD

- Participation of more than a million young Costa Ricans during its first decade of activities, a substantial accomplishment in a country with a population of 3,943,204, according to the Population and Housing Census of 2000.

- Integration of educational informatics services for a whole group of one-teacher schools which are geographically distant and which attend native, rural, and socio-economically isolated populations.

- Consolidation of a system of professional development for teachers, based on the follow-up, design, execution, and annual evaluation of a continuous plan for formation and training.

- Creation of a system of academic formation in the field of educational informatics at the master's, licentiate, and bachelor's levels. Educational informatics tutors have a higher academic level than that of their counterparts in other areas of specialization.

- Consolidation of a culture of continuous learning among teachers related to educational informatics.

- Creation and strengthening of a telecommunications infrastructure (Learning Network) that benefits students and teachers by facilitating access to information sources and digital publishing, as well as fomenting and facilitating administrative management of the program.

- Expansion of learning options for the adult population, after school hours, which has made it possible to take full advantage of technological infrastructure and to provide the working forces of the nation with opportunities for updating.

Study Results

According to evaluations carried out by the Program for Educational Informatics PIE MEP-FOD, its major achievements are:

- Ample benefits to the self-esteem of teachers, children, and adolescents.

- Increased school registration and decreased absenteeism in schools which offer this option.

- Interest in the exploration of technological spheres, based on natural, intelligent interaction with a variety of mediums and programs which are available in the universal context.

- Strengthening of a technological platform at the service of public education which encompasses an impressive collection of multimedia workstations, servers, scanners, videoconference cameras, printers, resources for telematic connections, and robotics equipment.

The Future of the Program of Educational Informatics MEP-FOD

The Program has the following short and middle-term goals:

- Progressively universalize coverage of educational informatics services to all students of the nation in such a way that increasing the number of beneficiaries does not affect the quality of the pedagogical proposal.

- Expand the coverage of educational services and diversify them by means of consolidation of the telematic projects EDUNET and Advanced Internet, which reach schools through the Learning Network of the Omar Dengo Foundation.

- Increase experience in pedagogical robotics, which at the present time is found in 25 public schools and through which it is possible to document new ways of learning, especially in the fields of physics, engineering, technology, and aesthetic design.

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