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AUTHOR   Jurema, Ana Christina L. A.; Lima, Maria Edite Costa;
              Dalmau, Mary C.; Filho, Merval Jurema
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ABSTRACT
              This paper explores the challenges facing educators to
incorporate "informatics"--computer education in the broad context of
information technology--into the curriculum for K-12 students, and
"capacitation" for teachers, the continuing professional education which
enables and empowers teachers to face these demands. The computer education
program based on this pedagogy of informatics has been used in more than 20
elementary and middle schools in Brazil for 3 years. The program objectives
are to: provide students with access to systematic knowledge about computers
and information technology; use computers and information technology as an
educational resource for students and school; and assist teachers to become
users and teachers of informatics through understanding the philosophy,
ideas, and skills on which the program is based. The program, "Introductory
Informatics Course for Children and Adolescents," was designed around three
themes: (1) foundations of informatics (history, functioning, and use of
computers); (2) informatics and society (social impact and vocational and
work market analysis); and (3) interest centers (workshops on many topics,
including, but not limited to, arts, games, literature, mathematics,
pedagogical support, library). The program includes textbooks for students
and teachers, family activities, Learning Activity Books for Teachers
(methodological orientation and educational programs), and educational
software. The ongoing teacher capacitation program includes coursework,
monthly teachers meetings, and end of semester workshops. (Contains 11
references.) (ND)

TOWARDS A PEDAGOGY OF INFORMATICS;

PREPARING EDUCATORS TO FACE THE CHALLENGE

by

Ana Cristina L.A. Jurema
Maria Edite Costa Lima
Mary C. Dalmau
Merval Jurema Filho

2

Towards a Pedagogy of Informatics[1]: *Preparing educators to face the challenge.*

Through this presentation, we will discuss the challenges facing educators to incorporate informatics into the curriculum, the *capacitation*[2] of teachers to face these challenges, and review a new educational program in Northeast Brazil. We will present a package of teaching and student materials which formed the basis of a course in informatics for K-12 students. These materials, which were developed in Portuguese, are currently being translated into English at the University of Oregon.

In Brazil (as in the USA), computers were introduced into educational programs for children with the "promise" or "belief" that through the computer students would learn more, read better, and work more creatively and cooperatively. However, the computer, reified in this way, has not corresponded to people's expectations of its potential in the learning and teaching situation. Recent research in the US, Japan, Israel and some countries in the European community shows the main focus of computer education in schools has been on computer skills, e.g. word processing or information management, and little attention has been given to developing a pedagogy which integrates the teaching of computer skills with an understanding of informatics and its place in our society. Little or no attention has been given to a Pedagogy of Informatics which takes into consideration learning and teaching processes, organization of curriculum, and reflection on people/machine relationships in learning and in the wider community, as well as developing children's ability to use computers competently. In addition, the responsibility for computer education and use in schools has been left in the hands of technical experts working from computer labs, rather than incorporated by classroom teachers into the curriculum (Pelgrum & Plumb, 1991; Anderson, 1993; Lund & Wild, 1993; VISION TEST, 1990; Office of Technology Assessment, 1995).

The challenge facing educators today is not just to use computers at school, but to use computer education and informatics to mediate improved social and learning relations in schools. The introduction of informatics into the curriculum can assist schools to change from a traditional way of teaching and learning, to one that provides students with an ever more cooperative apprenticeship in the learning and teaching process. One that prepares them to be lifelong learners, explorers and integrators of learning and experience. Key factors in assisting schools to respond to these challenges, are (1) the production of resource materials

which express didactically the basic educational concepts that will facilitate the processes of working, teaching, communicating, and learning, and (2) the capacitation of teachers (Costa Lima & Jurema, 1993).

Foundational premises for developing a program based on the Pedagogy of Informatics include:

♦ The interdisciplinary nature of informatics knowledge involves a range of subject areas and processes, including but not limited to, mathematics, history, linguistics, logic, concepts, and graphics.

♦ Learners are active participants, who in the course of their learning, structure their experience and knowledge (Piaget).

♦ The cooperative work of students and teachers creates a new cultural resource which is greater than the knowledge and understanding any of the individuals possessed before (Vygotsky).

♦ Approaches which are based on the social and cognitive reality of students will develop learning experiences that are challenging and open-ended, enjoyable and playful, cooperative and socializing.

♦ Computers are a means not an end. In the educative process they do not replace people, but assist them, in reorganizing interactions, thus reorganizing the teaching and learning process (and the play).

♦ The content of knowledge and its daily application are intrinsically related. Therefore teaching and learning programs in addition to providing information about computers and information technology, must be functionally constructed (authentic learning), and also challenge learners to reflect on social impacts and implications (i.e. the relations of people with the machine and with one another).

♦ Informatics in schools are not an appendix to the educative process, but an integrated element of the school curriculum which must enrich the teaching and learning situation.

♦ The capacitation of teachers is essential. An approach based on the pedagogy of informatics requires teachers to develop their own knowledge and understanding of informatics in our society, to rethink their roles and practices, and base their teaching on their students' curiosity and active involvement in learning.

Developing a Pedagogy of Informatics involves collaboration in learning at a number of levels, i.e. the collaboration of educators as they work together on the conceptual and operational changes required if they are to teach both about the computer and with the computer; the collaboration of students as they learn together through activity-based and challenging learning opportunities; the collaboration of schools and communities as they come to terms with the role of education and schooling in the information society; and

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[1] We have used the term *Informatics* (Information + automatics), because it places computer education in the broader context of information and technology.

2 Neologism for continuing professional development which enables and empowers teachers to action

interdisciplinary collaboration in the development of curricula and educational programs.

Methods and data sources

A computer education program[3] based on this emerging Pedagogy of Informatics has contributed to our knowledge about the use of computers and information technology in education. These materials were developed by a cooperative, multidisciplinary working team of professionals from the areas of informatics, cognitive psychology, education, visual programming (graphics), history, and production of didactic materials. They were trialed through an intensive course, and then successfully used for more than three years in over twenty elementary and middle schools with approximately 30,000 children and adolescents in the states of Pernambuco, Rio Grande do Norte, Ceará, Alagoas, and Sergipe. With some adaptations the course was also taught to a group of children with special needs (Jurema, Jurema & Longman, 1992). Our observations are based on the conceptual framework on which the program was based, the multidisciplinary and collaborative approach to the program development and implementation, and the follow-up evaluation of ITECI's methodology and courses.
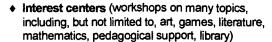
The program integrated three key objectives:

♦ Informatics education: to provide students with access to systemic knowledge about computers and information technology;

♦ Educative informatics: to use computers and information technology as an educational resource for students and schools.

♦ Capacitation of teachers: to assist teachers to become users and teachers of informatics, through understanding the philosophy, ideas and skills on which the program was based.

The program: *The Introductory Informatics Course for Children and Adolescents* (Jurema & Costa Lima, 1993) included both a methodology for teaching informatics to children and adolescents (K-12), and a series of teaching and learning programs across the age-range. It was designed (1) to assist children and adolescents develop the abilities, understandings and values necessary to participate effectively in a society impregnated by computers and information technology, and (2) to assist schools and teachers to develop informatics as an integrative element across the curriculum. The course was designed around three thematic nuclei:

♦ **Foundations of Informatics** (history, functioning and uses of the computer)

♦ **Informatics and Society** (social impact and vocational and work market analysis)

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[3] Produced by the *Institute of Technology in Informatics* (ITECI), a Brazilian enterprise

♦ **Interest centers** (workshops on many topics, including, but not limited to, art, games, literature, mathematics, pedagogical support, library)

The program materials include a kit of didactic materials: textbooks (*reference books for students and teachers*), Family Activities (*for students to share with their families at home*), Learning Activity Books for Teachers (*methodological orientation and educational programs*), and an educational Software Support Kit. The software developed are simple, requiring the teacher to explore the ideas they represent and integrate them into the learning program. The teachers' Learning Activity Books present, besides suggestions for activities, alternative suggestions about ways to work with students within each subject, and the integration of the program across the curriculum.

Collaborative processes are built into all activities of the program so that the cooperative and cognitive elements are intrinsically united, e.g. when children work in teams to create databases, they generate findings which have to be discussed, analyzed and communicated, and require their active involvement in the reasoning process.

Capacitation of teachers: The capacitation of teachers is the key to the success of the program. If informatics is to become an intrinsic component of schooling, it will not be enough for schools systems to merely "train computer experts". All teachers must be given the opportunity and the encouragement to develop the conceptual understanding and technical skill necessary to integrate the computer into their educational programs. The teacher capacitation program developed by this project assisted teachers to develop their own knowledge and understanding of Informatics in our society, to rethink their roles and practices, and base their teaching on their students' curiosity and active involvement in their learning. It is an ongoing process, including a practical course of micro-informatics (40 hours), monthly teacher meetings (3 hours), and end of semester workshops (6 hours).

Educational importance of the study

As stated above (p.1), computer education in schools has not lived up to the high expectations with which it was introduced. In many cases, the speed with which the technology is developing simply means teachers and schools get left further behind. This program, developing a Pedagogy of Informatics, has been successful in both the capacitation of teachers and in assisting students to conceptually understand the structure and functioning of computers and software in both historical and contemporary contexts, and be able to infer, take risks and face new challenges creatively. It is important that educators are given many opportunities to discuss and contribute to the emerging Pedagogy of Informatics, and to learn from successful programs such as this one.

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Ana Cristina L.A. Jurema is Professor at the Department of Theory and Foundations of Education at the Federal University of Alagoas (TFE/UFAL), Brazil.

ajurema@iteci.com.br
    http://www.iteci.com.br/~ajurema

Rua da Ninfas, 189 – Boa Vista

Edf. Mozart - apto. 902

Cep: 50070-050, Recife/PE, Brazil

Maria Edite Costa Lima is Teacher and Educational Director of the Computers at School Project (Projeto IPA), at the Institute of Technology in Informatics.

ipa@iteci.com.br

Projeto IPA – ITECI

Rua Real da Torre, 637 – Madalena

Cep:50610-000, Recife-PE, Brazil.

Voice: (55-81) 301-1600, Fax: (55-81) 301-1690.

Mary C. Dalmau is a PhD student at the Department of Educational Leadership, Technology and Administration, of the University of Oregon.

mary_dalmau@ccmail.uoregon.edu

Voice: (1-541) 346-0732   Fax: (1-541) 346-5517

Dr. Merval Jurema Filho is President of the Institute of Technology in Informatics - ITECI

merval@iteci.com.br
    http://www.iteci.com.br/~merval

Rua Real da Torre, 637 – Madalena

Cep: 50610-000, Recife-PE, Brazil.

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Ana Cristina L. A. Jurema / Professor

Organization/Address:
College of Education - DELTA
University of Oregon
Eugene, OR 97403-1215   USA

Telephone: (541) 484-5283

FAX: (541) 484-9670

E-Mail Address:
AJUREMA@OREGON.
UOREGON.EDU

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