Towards a Pedagogy of Informatics

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Abstract

Developing a Pedagogy of Informatics[1] 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 interdisciplinary collaboration in the development of curricula and educational programs.

In this paper we discuss the challenges facing educators to incorporate informatics into the curriculum, and review a new educational program in Northeast Brazil. We will outline the *capacitation*[2] of teachers that occurred, and 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.

Keywords — informatics education, educative informatics.

1. Introduction

In recent years many Brazilian institutions have studied informatics and its application in education, science and technology, and gained more experience in its use. Despite differences in methodology and context most of these studies focused on the fundamental need to manage the technology and to explore its resources in order to improve the educative, productive and scientific process of knowledge generation in the Brazilian society. 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.

A closer look at computer usage in schools shows that 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 what we have called a *Pedagogy of Informatics* which takes into consideration the learning and teaching processes, the 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. Recent research in the US, Japan, Israel and some countries in the European community also shows this lack of focus on the *Pedagogy of Informatics* (Pelgrum & Plumb, 1991; Anderson, 1993; Lund & Wild, 1993; VISION TEST, 1990; Office of Technology Assessment, 1995).

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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.

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, and prepares them to be lifelong learners, explorers and integrators of learning and experience. A key factor is assisting schools to respond to these challenges is the production of resource materials suitable for use with students at all stages of the educational process. However to be effective, these materials must express didactically the basic educational concepts that will facilitate the processes of working, teaching, communicating, and learning (or even *'literacing'*, in a society such as Brazil's as it moves towards its informatization). (Costa Lima & Jurema, 1993)

2. A Project and Experience

A computer education program produced by ITECI, a Brazilian enterprise, and 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 trialed through an intensive course, and then successfully used for more than two years in eight Elementary and Middle Schools, with approximately 4,000 children and adolescents in the cities of Recife and Natal. 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 two 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.

Both students and teachers need to master the machine, but if these skills alone form the basis of the program, there is a risk that students and teachers will behave like parrots (mere repeaters) without understanding what they are doing. On the other hand students who conceptually understand the structure and functioning of computers and software in both historic and contemporary contexts, will be able to infer, take risks and face new challenges creatively. This program therefore

aimed to provide students (and teachers) with both the practical formation necessary for familiar and fluent use of computers and software, and the comprehension of how computers work and the part they play in our society.

ITECI took a multidisciplinary and cooperative approach to the development of the program by establishing a working team of professionals in the areas of informatics, cognitive psychology, education, visual programming (graphics), history, and a specialist in the production of didactic materials.

3. Foundations for developing a program based on the Pedagogy of Informatics

The multi-disicplinary team based the development of the program on a number of *foundational* premises, i.e.

* The interdisciplinary nature of informatics knowledge involves a range of subject areas and processes, including but not limited to mathematical, historical, linguistic, logical, conceptual, and graphic.

* 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 that any of the individuals possessed before (Vygotsky) (Veer & Valsiner, 1991).

* 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 their learning.

4. The program

The working team produced an *Introductory Informatics Course for Children and Adolescents* (Jurema & Costa Lima, 1993) which 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 to assist children and adolescents develop the abilities, understandings and values necessary to participate effectively in a society impregnated by computers and information technology. The K-12 focus also required that the multi-disciplinary aspect of school life be considered and promoted, and that informatics education be developed 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)

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

The program materials include a kit of didactic materials: text books (reference books for students and teachers), activity challenges for students, manuals of methodological orientation and educational programs for teachers, and a support kit of educational software.

The software developed are simple, requiring the teacher to explore the ideas they represent and integrate them into the learning program. The teachers' manual presents, besides suggestions for activities, some 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.

5. The role of the teacher

As they began the project, the working team knew that motivating teachers to find time to learn a different methodology and approach, was certainly one of the biggest challenge they would face. The *capacitation* of teachers is the key to the success of the program. If informatics is to become and 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 the develop the conceptual understanding and technical skill necessary to integrate the computer into their educational programs. Each teacher must also explore and *navigate* in the space provided by the activities and the software, in order to learn themselves, and to facilitate students' learning. In addition, as teachers face new challenges together, the *cooperative apprenticeship* in technology, represented by the computer can play a considerable role, offering teachers the opportunity for collaborative work across disciplines, as well as within particular disciplines.

The teacher capacitation program developed by the project aimed to assist teachers to become users and teachers of informatics, through understanding the philosophy, ideas and skills on which ITECI had based the program. 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*). At each monthly meeting the teachers discuss basic concepts of informatics, and ways of using informatics in schools, (both within disciplines and across disciplines). Every meeting is based on specific aspects or experiences brought up by the teachers themselves. The workshops include presentations by experts in specific areas (*3 hours*) and hands-on experience for participants (*3 hours*).

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