THINKING & BUILDING: PREPARING ON DUTY TEACHERS AND THROUGH INTERNET FOR THE APPLICATION OF TECHNOLOGIES IN PUBLIC SCHOOLS OF CURITIBA

04/2005

Eloína de Fátima Gomes dos Santos
Prefeitura Municipal de Curitiba
eloina@sme.curitiba.pr.gov.br

Marcos Flávio Rodrigues Paim
Laboratório de Estudos Cognitivos - UFRGS
marcospaim@uol.com.br

Category: A - Strategies and Policies

Educational Sector: 5 – General Continued Education

Nature of Work: B – Description of the Ongoing Project

Abstract
From the insertion of technology in the school it is raised a new challenge for the educational institutions: offer formation for the teachers in the area of technology. The courses available are usually very basic and deal with the use of operational systems, Internet, encyclopedias, wordprocessing and educational softwares.This way investments in the formation and the enhancement of technologies in the school are not estimuled due to the results gotten from the students. In Curitiba, the Municipal Secretary of Education has been enlarging the possibilities of use of technologies in shcools – going beyond the information science rooms with access to the Internet – making available kits of assembling and robotics "Robolab/Lego" and the software of programing for Logo language "Microworlds/LCSI". With a target-public of around 7000 teachers, a challenging question comes up: How to upgrade teachers, many of them feeling afraid of the use of technology, creating conditions for the use of such materials, desired and of acknowledged potential favorable to learning, in an effective way with the students? We will be giving in details solutions implemented and the results obtained from the triangle Lego/Logo/e-learning used in learning projects.

Key-words: e-learning, teacher's formation, robotics, logo language, constructivism, learning, learning projects.

1. Introduction

The implementation of technologies in schools brought a new challenge to the teacher's formation. Hernández (1998) highlights the difficulties found by teachers in the didatics transposition, having many difficulties in getting from their students the results of the received formation. In the case of technology in school, the situation is no different.. In the same article, the author has as a main concern the question of knowing how teachers learn. In an implementation of teacher's formation involving technology and learning, this is also a question strongly considered, especially inside of a constructivist perspective.

Looking forward to minimizing the difficulties of didatics transposition a course called "Thinking & Building" has been created. The course was designed so that the teacher – as a student in this course – would use the available technology in school – educational softwares, Lego, Internet - through the development of a learning project with their students. The course has a hybrid feature, having 90% of long distance activities using the Internet through a e-learning portal and 10% of in-class activities at a municipal center of formation of teachers. This makes sense if we take into consideration the structures of the schools in Curitiba and the fact of having all the teachers living in the same city, bringing then a highly signficant plus to the quality of the course, since the in-class activities are justifiable due to the local experience of teacher's formation.

This article aims to present the results and discuss several aspects of the implementation of a long distance course via Internet in the teacher's formation aimed to the use of technology in learning projects. In special, it is discussed the integration of technology in the curriculum, change of professional behavior and the design of courses for the formation of teachers who work in big cities.

2. Learning and Technology

It is easy to see, in Curitiba, that the constructivist education is the one which gets the most acceptance among the professionals of education, mainly when it concerns the use of technology. There are great amounts of specialized literature available – books, magazines and the Internet – which not only discuss theoretical aspects but also many case studies. However, despite the apropriate discourse, most teachers work based in instructional practices and they highlight the difficulty of implementing changes which meet the discourse. Summing up, according to the teachers,it is difficult to implement the constructivism in the day to day of a school, even if it offers better possibilities than the traditional exposure class.

It is also seen, in several formation courses, that few teachers went through practical experiences that would favour learning. Then, the course "Thinking & Building" offers the possiblity to the teacher to discovers things by learning through other more dynamics perspectives by using the technology to reach these discoveries. The aim here is to make the teacher play the role of the aprentice so that the relation towards the knowledge is changed.

Piaget (1996) calls attention to the dangers of basing the knowledge only on the teacher, which may happen in an educational model which does not need the intelectual contact among children, often understood as waste of time with deformation and mistakes. So, the course aims to change this situation

through the work with the mistakes inside the building perspective of knowledge.

The course "Thinking & Building" is directly compromised with the targets of Municipal Secretary of Education, concerning the implementation of technological projects in schools. The targets are:

• To prepare children to be, not mere users of technology,but mainly to be able to create, solve problems and use several types of technology in a rational and effective way;

• To incentive children to be creative, showing more pleasant alternatives of learning.

• Efficiency in learning of contextualized scientific concepts suiting the learners' needs.

• Development of collaborative attitudes, challenging the apprentices to think in alternative solutions from the construction done in teams.

3. Learning Projects

Making research projects in the school makes room to the creation of possibilities for the construction/production of meaningful knowledge for the students.

Proposing the teachers to act as learners working in a porject, we make it possible that new situations are outlived. We try to integrate the work with projects into a non-linear way in the organization of the knowledge, making use of several competences such as planning, analysing, synthesis and reflection. Even the idea of a project implies the development of themes which comprehend the interrelation among knowledges of different areas of knowledge considering the apprentice's previous experiences and knowledges.

"From his previous knowledge, the apprentice is going to move, interact with the unknown, or with new situations, to own the specific knowledge – either in science, arts, traditional culture or in the culture in transformation" (Fagundes, 1999, p.16).

Concerns referring to the research must be generated by the author of the project, by whom is motivated to respond them. So, in a learning project students must be allowed to stablish their own research questions. If it is not like that, we then have a teaching project. (Fagundes, 1999, p.17).

Resnick (2004), stands out reasons to create projects to offer rich learning opportunities:

• By creating activities we turn children into active players, giving them sense of control over the learning process plus personal involvement, contrasting with the activities in the traditonal schools in which the teacher's goal is "transmit" new information for the students.

• The creation of activities is often interdisciplinary, grouping concepts of arts, math and science.

• To create activities to encourage the pluralistic thinking, avoiding the dichotomy right/wrong, that prevails in most school activities involving science and math, in degeneration of multiple strategies and possible solutions.

• A context for reflection is created when activities are created. Children's constructions serve as external shades of their internal mental models – giving them the opportunity to reflect about (and then revise and amplify) their internal models of the world.

- By creating activities, children are encouraged to put themselves "into somebody else's shoes", because they need to realize how others will understand and use their constructions.

Such possibilities are worked by the instructors of the course that direct the teachers on how to apply and evaluate them during the implementation of the project in the school. Work orientation occur alongside the technological support.

4. Logo and Lego – powerful resources

Since 1970's the Logo Language has been available for use in research centers and in schools, even though computers had little processing capacity. In the beginning there was an environment with programing possibilities and geometrical drawings done by a 'turtle' (sometimes in the shape of a triangle) in the center of the computer screen with a few colors (usually connected to a Tv set). Nowadays, Logo has evoluted and it is available in softwares which integrate multimedia, becoming very attractive to the demand of current users.

But, the concept of Logo is not restrict only to a computer program. To Seymour Papert (1999) Logo is the sum of a programing language with an educational philosophy. Its purpose is translated in the term "Constructionism" used to refer to everything related to doing things, specially with "learning by doing".

Concerning to Papert's learning by doing it, there is an exchange relation between the subject and the environment, then, the construction of the knowledge depends on the viability of such exchanges. Maraschin & Nevado (1994) in researchs involving Logo's learning environment, under epistemology genetic's orientation, point out that knowledge has a sense of organization, structure and explanation from what was experienced. In this concept, knowledge is constructed from the subject's action over the object of knowledge.

According to constructionist's principles, Valente (1993) says that Logo intends to rescue learning processes in which there is an environment where knowledge is not given to the child, but where the child, interacting with objects of this environment, then, can develop other concepts. He highlights that, among the aspects to be emphasized, there are the learning process control and the possibility of learning by doing.

The learning process control must be on the apprentice's hands not on the teacher's hands. It is expected, inside the constructionism, that the child proposes the problems or projects to be developed by using Logo.

Concerning the possibility of learning by doing it, Valente (1993, p.19) states:

"...it gives the child the chance of learning by doing it, then, 'teachgin the turtle ' to solve a problem. The fact that the aprentice having to express the resolution of a problem according to the programming language, it makes that the program becomes a precise and formal description of this resolution; this program can be checked through its execution; the result of the execution allows the student a comparison among his/her original ideas with the product of the program and by doing it, the aprentice can analyse his/her ideas and the applicated basis; finally, if there is something wrong, the student can "purify" the program and identify the origin of the mistake."

For Valente (1993), an interesting possibility is the description of the child's process of thinking defined by the program produced by him/her. Due to

the given results, through the analysis and correction of the mistake, the child has the opportunity to understand the concept involved in the resolution of the problem. In activities involving Logo, it is possible to reflect, understand and purify the learning process in a very explicit way.

Many educators, despite the interest in applying the Logo philosophy have great difficulties and they need to be prepared so that their interventions favour the learning of a new environment. We believe that the best way is to do it as a group with a project with the students.

It is valuable to mention some possibilities shown by the use of Logo language observed in researchs (Fagundes & Maraschin, 1992, p.20) performed at Laboratory of Cognitive Studies (LEC/UFRGS):
- Increase of the capacity of attention and concentration.
- Possibility of manipulating the representation of knowledge.
- Improvement of activity of coordenation inferenciais.
- Change of attitude when facing the mistake.
- Possibility of projection in the turtle and in the computer of feelings and fantasies about his/her learning.

There "windows" to other technologies in the Logo language. One of them is the robotics.

With the resource of the well known Lego assembling bricks associated with the use of small eletrical engines, pulleys, axles and gears connected to a small computer (called RCX) the classical Logo turtle has gotten a concrete shape.

Learning projects that use the programming language Logo and Lego materials, including robotics, allow a singular integration of these technologies with the knowledges worked in the school making it possible the recreation/simulation in the shape and working.

Skills for the development of the creativity, investigation and problem solving permeate all the time the activities developed in the use of this material.

Robotics kits are available for public municipal schools in Curitiba and they allow students to assemble and disassemble machines and prototypes and, connected to a computer, they can have their movements programmed turning them into robots. Besides this, they give the possibility of construction of new objects that can be reused in new and several projects, which give more freedom so that the students can create and experiment several possible solutions. By building objects with Lego the student/designer goes adding, calculating and using concepts of several areas of knowledge in a very entertaining way, but effective from the learning point of view.

It is offered to the student, a far more motivating and awaken school of the curiosity and the willing to learn.

Integrating technologies, specially Lego with the Logo Language, the activities developed in "Thinking & Building" aim to create conditions so that teachers understand and use the educational potencial of the toys in their projects. The teacher also has the opportunity to work aspects concerning the evaluation process, including activities such as playing, which contribute significantly to the development and learning, specially in the case of children.

5. Internet for learning – still something new

For most teachers participating in the "Thinking & Building" course the Internet is a brand new environment for knowledges. More than 90% of the participants interviewed had never done a long distance course via Internet or even participated of any virtual forum.

Most have already used the Internet, specially the e-mail and for research purposes. Passive way kind of use. What is intended to be offered in the course was well defined by Levy (1999, p.127) as a virtual community:

"A virtual comunity is built based on similarity of interests, knowledges, mutual projects, in a cooperative or exchange process, independently of geographical matters and institutional connections".

Some concepts are fundamental so that activities conducted in an e-learning environment produce effective results. One of them is the cooperation that Piaget (1973, p.105-106) defines as follows:

"Summing up, to cooperate in the action to operate in common, set by new operations (qualitative or metrical) of correspondence, reciprocity or complementar, the operations executed by each of the partners. It happens like that with every concrete collaboration: select together objects according to their qualities, to build with many peoplea topographic scheme, etc. and to coordinate the operations of each partner in only one operational system, which acts even the cooperative ones constitute the integrating operations."

During the interaction in the courses (in different groups), moments of cooperation are observed. They occur in the forums via Internet and in the programming activities in Logo and assembling of robots and prototypes.

6. Structure and Course Functioning "Thinking & Building"

This section is aimed to present the basic structure of the course, which has been suffered minor alterations, specially the ones requested by participants, which may result in meaningful improvements in the final result.

6.1. General Aim of the Course

to give opportunity to the teacher a theoretical-practical work with different tehnologies (educational softwares, robotics, Logo language and Internet) to the development of learning projects with students.

6.2. Drawing of the Course

the graphic interfaces of the e-learning environment do not always offer the necessary facilities to beginners or the ones with no experience at all. Due to difficulties with the use of the virtual environment, many students do not participate as much as they want and some even give up the courses. When designing the course "Thinking & Building", having pilot-experiments as basis, and the success of the course depending on the interaction in the e-learning environment, it was decided to have the physical presence of the students, at least once, to avoid this kind of problem.

First basic orientations are also given and tutors are introduced, further contacts and orientations occur through the Internet, using the e-learning environment.

Tutors, just like their students, are teachers from Municipal Secretary of Education, but having experience in the use of technologies in schools and in course of continued formation. They are acquainted with the reality of the apprentices.

The "digital" mode - distance – has raised as a necessity to reach a larger number of professionals, once there were previously in-class courses with similar purposes.

The course, as said before, is presented in two stages (in-class and distant), 2-month duration, 108 hours:

a) Presencial Stage

Presentation of the project and exploitation/getting to know stage concerning the technologies used.

Module 1: Web teaching, cadastro, getting used to this environment (4h).

Module 2: Experiment of materials and activities related to the robotics kits and tutoring on the project that will be done at school (4h).

Module 3: Logo Language Workshop (4h).

Final Module: experience exchange, comments on works developed in the schools. A poster is presented on this date, according to orientations posted in the Web-teaching, which remains in exposition at the place of the final presentation (4h).

b) Distance Stage

During th course, the teacher must send to the project:

76 hours aplication of projects with students.

4 hours interaction in the virtual environment of Web teaching.

4 hours independent studies.

4 hours elaboration of the project summary.

4 hours poster designing (final result of the project).

6.3.   Course Content

The content of the course covers: technology and education, constructivist education, development of projects, educational robotics, Logo language, Internet and virtual environment Web teaching.

6.4. E-Learning Software

the environment for distant education used is the Webteaching, which can be acessed from a educational portal of Municipal Secretary of Education. Made in Brazil,the Webteaching offers basic tools such as: *chat*, forum, search, file replacer posted by administrators, *upload* area for students and detailed statistics of participation.

6.5. Teacher Support

Teacher is visited by the tutor, for support (including participation in the school activities) and project follow-up. On-line turns are offered, via *chat*, so that the participants can clear out doubts concerning the content of the course.

Besides the turns, the Webteaching has a structure that allows the exchange of ideas through a forum and by sending e-mails for the teacher or the colleagues.

7. Acquired results from the implementation of the course

a) Teachers

the profile of the professionals is heterogeneous. Initial stage teachers are participating – 6-year-old students – until the end of junior high (8th grade) attending 14-year-old students.

More than 90% of the teachers have never been part of a course like this. Few have participated of any forum through the Internet.

b) Data on the participation on the Internet

Time variation on-line was significant. We had students with 54 accesses and 23 hours de permanence in the environment of the course, even students with 14 accesses and 5 hours de permanenece. Most students stay, in average, between 7 and12 hours with 90 accesses to the environment.

c) Attendance done

The course has had 4 editions attending a total de 225 teachers and approximately 7000 students.

d) one of the projects that were accomplished

Partial report sent by a participant of the course (teacher Karin, CEI Bela Vista do Paraíso, 9/10 year old students):

Project Theme: Housing Evolution Through Time

Issues investigated refer to the kinds of housing, the reason of different kinds of housing (social contrasts), why they variate from region to region and the evolution of housing through time. Several areas of the knowledge will be involved through this assignmen like: Portuguese (Reading, production, linguistic analysis of different types of texts and books in the literature concerning the theme), Mathematics (measures, proportion), History (evolution of housing through time, life conditions, contrasts and social problems), Science (natural fenomena, temperature), Geography (Regions and kinds of houses, weather, topography).

The following resources were used to develop the project:

> *Software Microworld – Lego Cases – Computer – Internet – Power Point – Didatics and Litterature Books.*
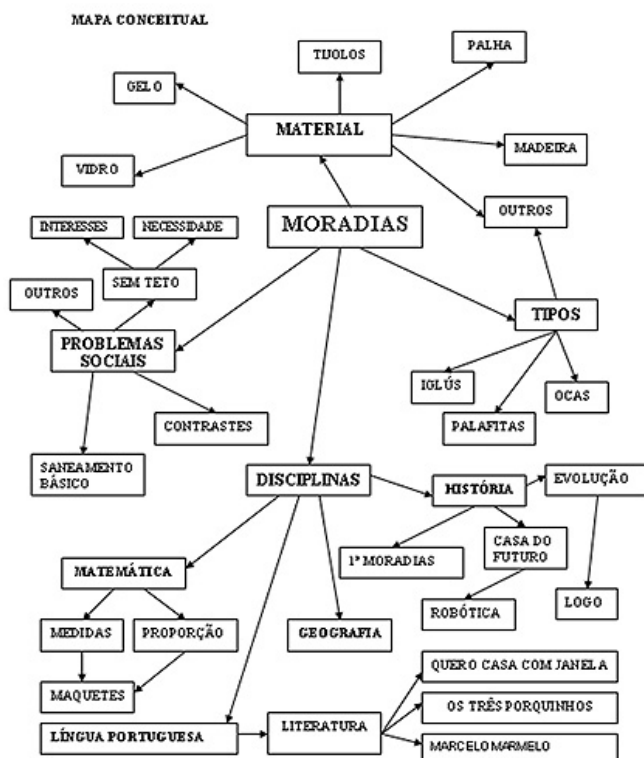
Fig.1 – Conceptual Map created by the teacher and students.

Students researched about the theme during the development of the work, observed the feed back of the school, its constructions and adopted solutions by the population when the property was irregular. They also got excited when building houses with different kinds of materials and maquettes. They also got excited when doing the maquette/blueprint of the "house of future" using Lego cases.

The participation in the forum of the Project Thinking and Building, through questions, the research done with the materials sent by the team from Educational Technologies of Municipal Secretary of Education and also through the Internet, helped us solve the problems that came up.All in all, we have perceived the richness of the work when we used technology as a tool and we intend to continue with the project once we see the students with such a great enthusiasm.

9. Consideration

Several aspects must be taken into consideration in the implementation of the education done by distance, specially regarding the formation of teachers who work in public schools. The situation in Brazil is that schools are usually located in periferic and distant regions of big cities. These teachers have problems such as: transportation (but there is the possibility of some in-class encounters), available time and access to technological resources – like the Internet for example, which is fundamental to the formation via e-learning.

Participants, from courses which require their presence in a regular basis and that also work with, hardly implement projects with students when the course is over.

Before these conditions, we see that hybrid courses such as "Thinking & Building" offer distinguished possibilities so that teachers are in charge of these technologies and make every day use in the schools where they work, trying by themselves new learning situations. The course suffers changes along the way and these changes are based on the needs which are raised by the participants. When perceiving that this distant learning course offers a flexibility, different from the regular courses, participants feel comfortable to propose and, they often see their proposals implemented. This makes them far more commited and it is possible to see a large number of participants concluding the course and putting the proposals into practice. The tutor's visit is aan aspect that must be highglighted. It brings many contributions that influenciate the success of the course directly: guiding the path of the project, helping to solve administrative difficulties regarding access to resources (time changes, content flexibility), quality of tutoring (suitable to a known reality) and the students's self-steem (who feel their work is given a value).

Due to this diversity of actions, trying to create conditions for a better formation of teachers through technologies, mainly by the use of Internet in the construction of proper solutions to their reality, the search for the courses has been more and more often. The quality of education has improved significantly in the schools that were beneficiated.

We hope that the discussions presented in this article may contribute for the improvement of use of the technology in the school, concerning mainly about the quality, but also considering the need for expansion, making use of the only way which allows continuity throughout time, the formation of teachers.

References

FAGUNDES, L. Aprendizes do Futuro: As Inovações Começaram! PROINFO/SEED/MEC, Brasília, 1999.

FAGUNDES, L.; MARASCHIN, C. A linguagem Logo como instrumento terapêutico das dificuldades de aprendizagem: Possibilidades e limites. Psicologia: Reflexão e Crítica, Porto Alegre, UFRGS, v. 5, n. 1, 1992.

HERNÁNDEZ, F. A importância de saber como os docentes aprendem. Revista Pátio, Porto Alegre, Artmed, ano I, n. 4, 1998.

LÉVY, P. Cibercultura. São Paulo: Editora 34, 1999.

MARASCHIN, C.; NEVADO, R. O paradigma Epistemológico e o Ambiente de Aprendizagem Logo. Informática na Escola: Pesquisas e Experiências. MEC, Brasília, 1994.

PAPERT, S. Logo Philosophy and Implementation. LCSI, 1999.

PIAGET, Jean. Estudos Sociológicos. Rio de Janeiro: Forense, 1973. PIAGET, J.O Trabalho por Equipes na Escola. Revista Psicopedagogia, São Paulo,USP, 1996.

RESNICK, M. Technologies for Lifelong Kindergarten. Disponível em: < http://llk.media.mit.edu/papers/archive/llk/index.html >. Acessado em Setembro de 2004.

VALENTE, J. Computadores e Conhecimento: Repensando a Educação. Campinas:Nied/Unicamp, 1993.