

## **Tele-collaborative Projects in Brazilian Schools**

**Miriam Godoy Penteado<sup>1</sup>**  
**State University of São Paulo, Brazil**

### **ABSTRACT**

This paper discusses on the implementation of project work in secondary schools. A main idea of project work is to make students the centre of their learning processes. Project work opens possibilities for students to act in an investigative way. The focus here is on the use of Internet to support the communication among students working with a project in a mathematics classroom. It refers to the design and development of a project involving teachers and students from four Brazilian schools. Finally it makes some consideration on the school organisation, access to information and communication technology and the use of mathematics.

**Keywords:** *project work, mathematics education, problem-based learning, technology and education, tele-collaborative projects.*

### **INTRODUCTION**

In this paper I want to discuss an example from my work with teachers and students from public secondary schools in São Paulo State in Brazil. The focus is on the use of Internet to facilitate the collaboration among students working with a project.<sup>2</sup>

Tele-collaborative project is a way of integrating students of different schools in a virtual environment in order for them to collaborate on the topics they are developing. Internet makes it possible for students from different schools, different cities, and even different countries to work together. Our experience involves schools from the same city where the university is located as well as from other cities.

Our interest is to explore the possibilities and limitations within public schools for this type of educational approach aiming at teacher education for the use of technology. The schools do not have many computers available for educational use. There are even schools which have no access to Internet. In order to exploit the power of project work and use of technology, it is necessary to consider its implementation in the school environment.

As this work involves the use of information and communication technology (ICT) and project work I will start presenting the ideas related to these two topics as they directed the actions at the school.

### **PROJECT WORK AND THE USE OF ICT IN MATHEMATICS EDUCATION**

The main idea of project work is to make students the centre of their learning processes. They should not be only receivers of information delivered by the teacher. Project work opens possibilities for students to act in an investigative way. It is not a new idea, and it is well disseminated within the Brazilian educational setting: from primary school to university level (Cattai & Penteado, 2006).

Identifying the theme to be investigated is a very important step in this process. It is important that the students participate in the choice as they are the one who is going to do the investigation. Of course this implies a process of negotiation between the teacher and students.

To plan the tasks to be done during the investigation also includes negotiations. The teacher should not come with a pre-defined set of tasks. It is important to have an idea of what one wants as a final product of a project work and what resources are available, and then decide about the steps to be taken. The teacher acts as a supervisor providing orientation during the whole process. He or she is a very important element in the process but not the centre of it.

Project work implies a constant evaluation of what has been done in order to re-establish new routes if necessary. For example, a group plans some tasks in advance and during the period of collecting information it realises that they need to interview somebody or read some books, and so on. It is necessary to establish new tasks.

An investigation has almost no value if it is not become public. I mean that the results should be presented and made available to others. As a result of the project the students can organise a workshop for the outsiders, a homepage or a paper to be published in a journal. The result of a project should be useful for somebody and not only to fulfil a school requirement.

One of the challenges for those who suggest the idea of project work as a powerful educational action is to provide its implementation in the school. How to do this in the majority of our secondary schools where the students jump from a 50 minutes mathematics class to another 50 minutes history class and so on? The teachers are specialists in a discipline and do not feel comfortable working with other topics. How to think of project work in such educational structure? Is it possible to introduce the ideas of project work in such school?

I consider that it is possible and I am trying to start within disciplines. In the case I relate here mathematics is the elected discipline. We follow the idea of Skovsmose (2001) who suggests to introduce the problem based orientated approach through different steps in school mathematics.

Negotiation and investigation are two crucial attitudes in project work. However, it is important to recognize that it is not easy for a teacher and also for the students to assume such attitudes at once. It is well known that the mathematics teacher usually operates in a more comfortable way within what Skovsmose calls "tradition of exercises". In this paradigm the teacher is the centre of all the information and there is no room for doing investigation. It is necessary that one moves from this paradigm, where the work on given exercise is the main task, to another where the investigation becomes the main task. This other paradigm he calls "landscapes of investigation". The Table 1 synthesizes these ideas.

**Table 1:** *Different milieus of learning*

	Tradition of exercises	Landscapes of Investigation
References to pure mathematics	(1)	(2)
References to a semi-reality	(3)	(4)
Real-life references	(5)	(6)

For Skovsmose each cell of this table represents a *milieu of learning*. The number (6) is the one which presupposes the work with broader themes; let us say non mathematical themes. It is

what, in general, educators suggests for project work. The number (1) has no room for negotiation and investigation. It involves tasks as: Find the value of  $x$  in the equation  $10 = 2x + 5$ .

When one suggests that the teacher uses a project orientated approach with their students, this means in the majority of cases a jump from (1) to (6), as many mathematics teachers carry on their practice only in the milieu of learning (1).

Skovsmose suggests that in order to change the school mathematics it is not necessary to do this huge jump from (1) to (6) at once. Instead, one could think of a movement inside the tradition of exercises and outside it toward a landscape of investigation. For example, with a movement from (1) to (3) or (5) the teacher still works with pre-defined exercises but he or she brings new references to the classroom. The exercises could refer to broader themes.

On the other hand, a movement from (1) to (2) keeps the reference to core mathematics but open for investigations. For example: instead of asking the students to find the value of  $x$  in  $10 = 2x + 5$ , the teacher could ask them to investigate how the value of  $y$ , in the equation  $y = 2x + 5$ , changes as the value of  $x$  changes. For this they could use diagrams, graphical calculators or computer software. Furthermore, it could be considered what it could mean if 5 is changed to a different value, and what about if 2 is changed to a different value?

A movement from (3) to (4) means to include investigations in a situation which is invented by the teacher. Skovsmose exemplifies this with a horse race. They draw a racecourse on the blackboard. Two dices are thrown, the sum of the number of spots shown is calculated and this gives the position of each horse. This is registered in a table where it is possible to see which horse. The students have to make their bets. There is no real horse race but the teacher creates an environment where the students are invited to imagine and simulate their participation in a horse race. This involves a lot of mathematical content, negotiation and investigation.

Another possible movement is from (5) to (6). Let's say that the students are working in a milieu of learning (5) and the theme is "consume of water". The choice of the theme could be negotiated with the students in advance. Here the teacher suggests exercises with real data provided by the water company from the city. The teacher collects the data and provides all the information. To move toward the learning milieu (6) could mean to let the students plan what they would like to investigate with respect to the consumption of water and where and how to collect the data.

Skovsmose claims that project work in school mathematics need not only operates in a milieu of learning (6). The important thing, however, is to provide conditions for a movement across the different milieus.

There are many ways of introducing project work in school and ICT has an important role to play. Research claims that ICT may bring huge contributions to the teaching and learning. In the case of mathematics, the power and speed of computers – in particular for making graphs, tables, drawings and collecting data from the Internet – facilitate the exploration of many mathematical ideas and open possibilities for new methodologies as project work (see, for instance, Borba & Penteadó, 2001).

Experience shows that in order to use ICT in the school, teachers need to be open to changes which range from the physical organisation of the classroom to more complex issues as the epistemological ones including the production of new meaning for mathematical ideas (see, for instance Balacheff, 1998). ICT opens a door through which obsolescence, ephemerally and diversity easily enter the school. To follow this track is not easy. It requires, among many other things, familiarity with computers and software, a new eye for the mathematical content, and much attention to the students' thoughts while he or she is working at the computer. For example,

a student is investigating the graphic of  $y = \sin(kx)$  when  $k$  change. As it is very fast to construct graphics with a software, the student could try many different values for  $k$  and raise conjectures about  $y = \sin(kx)$  that the teacher has never thought before.

Project work and the use of ICT requires new roles for teacher and students in a milieu of learning. It was the need of understanding these new roles that moved us into the work I present here. My interest is to learn about teachers' understanding of this idea and how the school should be organised in order to provide condition for this work.

In what follows I present how we faced this challenge and the results we achieved.

## DESIGN AND DEVELOPMENT

In order to get started we set up the team which was in charge of carrying out the activities in the schools: four students from the university (future mathematics teachers), three mathematics teachers from the school and me. Teleduc<sup>3</sup> was the virtual environment used to support the interaction among the teachers as well among the students from the schools during the project work. A page of Teleduc is shown in the Figure 1.

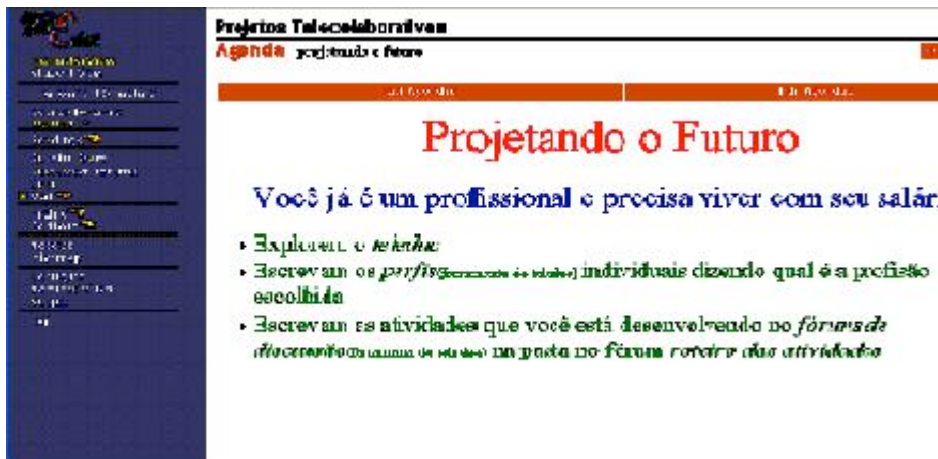


Figure 1: A page from Teleduc

We used three months in the first semester to plan the activities which would be carried out with the students in the schools in the second semester.<sup>4</sup> We started having weekly meeting to discuss the main steps to be taken during the process and struggled with such questions: (a) Should it be an extra school activity or should it be a curricular one? (b) Should it involve the whole class or should it be a voluntary based activity? (c) How to make the choice of the problem or theme to be investigated? (d) What kind of orientation and guidelines to offer to the students during the project? (e) What is the more adequate virtual environment to use? (f) Where do the students get access to Internet if their school did not provide it?

During the year 2004 and 2005 we have been working in this way with a number of schools. In 2004, we worked with three schools from the same city and developed a project on the themes "Consume of Water" and another one on "The Olympic Games". The first project involved 25 students (14-15 years old) and the second one involved around 50 students (11-15 years old). In 2005, we involved around 70 students from four schools, including one from another city than the

one where the university is located. We developed a project titled "Planning your future" which was based on the following situation: You are adult and have to afford living by yourself. What profession would you like to have? What do you need in order to have a good life? How do you expect your future to be?

It is important to say that the team did not elaborate any specific procedure to be followed with respect to all the students. The team discussed possibilities, and it knew that the working condition in the school would be essential for the decisions to be made. There were projects involving the whole class as there were projects that involved only a group of students in a voluntary based participation.

In general, during the project work each group of students together with their teacher established the following phases: (1) getting started with Teleduc and integrating with the others participants; (2) making sense of the project theme and planning the tasks to be completed; (3) searching for information in the Internet, books, newspaper, etc; (4) organising the data; (5) reflecting on the theme – writing an essay and participating in a web chat.

Many students were not familiar with computers what made it necessary to spend more time in the first phase. They did not know how to navigate in the Internet and they did not have an e-mail address. The majority of students were very excited in participating in activities using computer. Who was more familiar helped those who were not.

For the teachers, the activities were very time demanding as they were not familiar with the use of Internet for collaborating with students. They found they need more opportunities to participate in teacher development programs in order to organise pedagogical activities taking advantage of virtual environments.

In what follow I bring more details of the project "Planning your future" making a brief presentation of two schools.

### **The school A**

This school is located next to the university and receive students from a poor neighbourhood. It has a room with 10 computers connected to the Internet. The teachers receive strong support from the head to use this computer room. Ten students (12-14 years old) participated in the project which was developed during ten meetings. They used Internet only in the school as they did not have access at home. They were not familiar with Teleduc but in the first meeting they learning how to operate with it. At the end of each meeting they wrote some notes in the Teleduc. They decide for the following professions: mathematics teacher, engineer, journalist, owner of a clothes shop, biologist, veterinary and actor. They used the Internet to get information about the salary and where to be educated. After this each one produced a table with his or her planning for the expenses during a month (Table 2). This was an individual task. There was much discussion for doing this planning. Thus, one claimed that the budget for electricity was all too high, while another one found that it was too low with respect to cloths, and so on. They had to decide how much to spend with each item. After comparing their costs with their salary, they had to do many modifications on the initial plan. It is interesting to observe that during this investigation many of them changed their choice or decided for two different professions: one for providing the money for their life and the other one for pleasure.

**Table 2:** Plan of costs per month (Reais)

Products for cleaning the house	25,00
supermarket	250,00
Electricity	50,00
Water	25,00
Gás	14,00
Cloths	150,00
Transport	350,00
Personal objects	50,00
Rent of the house	350,00
Telephone	50,00

### **The school B**

It is a school located in the city center. There was a room with eight computers without access to Internet. Here there were two groups: the first one involved ten students and the other one involved a whole class of 40 students. The first group was based on a voluntary participation, while the second one was based on compulsory participation following a suggestion of the head of the school. It was necessary to divide the second group into three sub-groups in order to use the computer room. However, it was not easy for the teacher to manage these sub-groups in different rooms. It was necessary to have the support of students from the university.

Many students from this school worked during the day and went to the school in the evening. In "Planning your Future" none of them chose their current profession as the one they wanted for their future. They were 18-24 years old and had no familiarity with computers. Because of the greater number of students the teacher needed to provide more specific tasks. It is important to remind that the students were obliged to participate in the project and many of them did not show interest in it. This was a difficulty for the teacher. This was not the case for the other group of students from the same school. They worked very interested during 12 meetings in a voluntary participation. The investigation on the professions was made at home and those who did not have access to Internet at home used printed material offered by the teacher (Figure 2 give us an example). The material to be available was prepared for the students in the computer room and the teacher published it in the Teleduc as there was no access to Internet in the school. During the planning of the life costs the students used electronic worksheet and word processor. They also used mathematics in order to estimate their costs and their salary. In several cases the salary was not enough for the life they were planning. They had to do modification. Some of them preferred to reduce their costs others preferred to choose a profession with a higher salary.

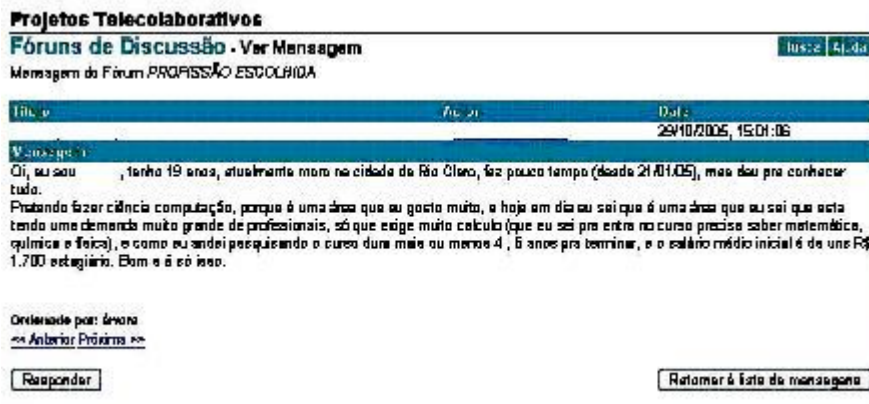


Figure 2: Example of the use of a Forum<sup>5</sup>

### The face to face meeting

A general meeting concluded the project, and it happened at the university. All the students from the four different schools were invited. Many of them had never been at the university before and they were very excited. Each group together with their teacher made a presentation using power point. They told about how the project was developed in their school. Those who were attending the presentation could raise questions. This is one way of making project work public.

### FINAL CONSIDERATION

In this paper I have presented an experience of using Internet as a support for project work in secondary school. It has been told as the activities were carried out and the difficulties that were faced.

Considering the milieus of learning presented in the figure 1, I would say that in the first year, 2004, the teachers operated in a safer way as many tasks fitted more the tradition of exercises with reference to real-life situation. They operated within the milieu of learning number (5). On the other hand, in 2005, there was an attempt to move toward the number (6) choosing a more real-life situation.

Both experiences happened within the discipline of mathematics. It was not possible to get teachers from other subjects involved in the project. However, I consider that it is a possible start for those who want to introduce project work in the school.

The problem-based approach made it possible for the students to reflect on mathematics differently from what they are used to do when the teacher only offers a milieu of learning with reference to core mathematics. In the project “planning your future”, for example, the students had to make decisions about whether they should buy or rent a house and how to get enough money for this. There was a very important mathematical reflection which involved the notion of rate, profit, bank saving account and loss and benefits of each possible choice. They planned strategies for saving money in order to get what they considered important for having a comfortable life. They also made estimation about the salary of each profession they would like to take and what kind of life they could afford with such a salary.

Considering the kind of participation it seems that in the voluntary based participation the students were more engaged in the project than those who had to join the project because this was the task for all the students in a mathematics classroom. This re-enforces that it is necessary to think of introducing modification in the school organisation that provide more condition for the students to be grouped according to their interest.

Another point to be highlighted is the public presentation done by the students during the face-to-face meeting at the end of the project. This generated some anxiety which is seemed as very positive aspect in their learning process. They presented their own production. What was produced in the classroom did not stay only in the teacher's hands. It became public for an audience outside their own school. I consider this as very important aspect of project work in the school.

Related to the use of Internet, there are still many restrictions. It is difficult to face the technical limitations in the school environment. However, there are signs that it is necessary to insist in this direction as the students showed great interest in using Internet, either for searching for information or for making it available their own voice and interest for others beyond their school environment.

Especially those students with no access to computer at home raised their self esteem. They commented that they now came to know what Internet is and how to search for information. They also referred to the opportunity of making notes in the Teleduc that people outside the school could read.

We cannot close our eyes for what is happening outside the walls of the school. The whole world is connected and through the Internet one can learn what is happened the other side of the planet using for this only few seconds. Our students know that. Beyond the creation of new learning environment the use of ICT in the school promotes the digital inclusion for those who can not have this at home. In fact, I find this digital inclusion to be a very important element of project work which includes the ICT as a main element.

In the same way it is important to consider the role of the teacher as the supervisor of project work. Although the idea of project work is well disseminated at Brazilian schools, it is still a challenge for many teachers to implement it in their teaching practice. What does it mean to be a teacher who has to design e-learning environment? What should be considered in their education? To drive towards this route implies to leave a *comfort zone* in order to enter a *risk zone* (Penteado, 2001). The teacher must give away the control of predictable situations and come to operate within uncertain situations. A risk zone is characterized as an unpredictable situation where teachers have to be open to negotiate with students about issues they are not sure about, maybe not even familiar with. They have to make decisions about topics that they did not learn in their pre-service training. Many questions about the mathematical content that the teacher never thought of before are raised by the students when they are working with project work and computers. I find that risks are not to be avoided. They include educational potentials for both learning and teaching. However it is necessary to organise in-service teacher education program related to this.

I finalize with the suggestion of continuity of work in the school in order to better understand the complexity of the learning possibilities when innovation like project work and ICT are proposed.



## ENDNOTES

- 1 My acknowledgments to Maria Dirlene da Silva Cattai, Adriana Ribeiro Lannes, Denival Biotto Filho, Rodrigo Montenegro Reis Silva, Jader Franco Góes and Ronaldo Rouvher Guedes Silva who followed the projects in the different schools.
- 2 This is part of a project titled "Possibilities and limitations of Project work in mathematics education" in collaboration with Professor Ole Skovsmose from Aalborg University.
- 3 <http://teleduc.nied.unicamp.br/teleduc/>
- 4 The academic year in Brazil starts in February. The first semester is from February to June and the second one is from August to December.
- 5 The text says: My name is ..., I am 19, and I moved to Rio Claro this year. I intend to study Computer Science because it is an area that I like much, and nowadays it has a great demand for professionals. But it requires a lot of calculus (to be accepted in this course you must know mathematics, chemistry and physics). In my investigation I found it takes 4 or 5 years of study and the average salary is 1700 reais for the beginners. Well, this is all.

## REFERENCES

- Balacheff, N. (1998), Construction of Meaning and Teacher Control of Learning, in J.D. Tinsley & D.C. Johnson (Eds.), Information and Communications Technologies in School Mathematics, IFIP Conference TCS/WG3.1, Chapman and Hall, London, 111-120.
- Borba, M.C. & Penteado, M.G. (2001), Informática e educação matemática. Belo Horizonte: Autêntica.
- Cattai, M. D. S. & Penteado, M.G. (2006), Trabalho com projetos na Escola: a experiência dos professores de matemática. Anais do VIII Encontro Paulista de Educação Matemática. p. 1-10. 2006.
- Penteado, M. G. – Computer-based learning environments: risks and uncertainties for teachers. Ways of Knowing, Vol. I, no. 2 Autumn, p. 23–35.
- Skovsmose, O. (2001), Landscapes of Investigation. ZDM Vol. 33 (4), p.123-132.

---

Copyright for articles published in this journal is retained by the authors, with first publication rights granted to the journal. By virtue of their appearance in this open access journal, articles are free to use, with proper attribution, in educational and other non-commercial settings.

Original article at: <http://ijedict.dec.uwi.edu//viewarticle.php?id=251>