UNIVERSITY OF SOUTHAMPTON

THE ROLE OF TEACHERS' INITIATIVE IN BUILDING A CULTURE OF INNOVATION: AN ETHNOGRAPHIC CASE STUDY

By Isabel Murta Branco

A thesis submitted for award

of Doctor of Philosophy

FACULTY OF SOCIAL SCIENCES

Research and Graduate school of Education

JULY 2002

UNIVERSITY OF SOUTHAMPTON

ABSTRACT

FACULTY OF EDUCATIONAL STUDIES

SCHOOL OF EDUCATION

Doctor of Philosophy

The role of teachers' initiative in building a culture of innovation:

An ethnographic case study

By Isabel Branco

This thesis examines the role of teachers' initiative in building a culture of innovation in one Portuguese vocational high school in Fine Arts and the relationship between the culture of innovation, teacher's leadership, school culture and the educational community. It also presents the impact of teachers' initiative on: (i) the changing curriculum; (ii) educational practices; (iii) professional development. The research took place in a context of Portuguese educational reform, which stressed change in educational practices and schools. The study was also located in a selected review of literature about change and culture.

The study took the form of an ethnographic case study, which characterised the culture of a group of teachers, involved in one mathematics educational project, eliciting their beliefs, values, norms and patterns of behaviour. It also examined the relationship between the culture of the project and the school culture as a dynamic process identifying values, beliefs and ideologies shared by people in the school. Methods included participation observation, semi-structured interviews, analysis of documents (both official and teacher's research reports) and artefacts produced by teachers and students. Data was analysed using a grounded theory approach and Schein's (1992) theoretical model of culture to analyse the subculture of the teachers' group.

Three main findings emerged from this cultural analysis. First, teachers did have the ability to generate an alternative curriculum to the dominant state model for teaching mathematics for Fine Arts students. This was underpinned by democratic values and focused on the process of students' learning rather than teacher-directed instruction. Secondly, this group of teachers formed a distinctive subculture in schools and took an active role in researching their own experience of changing classroom practice. Thirdly, the research demonstrated that it was not possible for this subculture to have major impact on the culture of the whole school. However the educational community (mathematics educators and state department) acknowledged the innovation, the state department subsequently including it in the national mathematics curriculum.

LIST OF APPENDICES

ACKNOWLEDEMENTS

I would like to thank all teachers, administrators and students that were participants in this study that were always available for more one interview or providing documents.

I would also like to thank my advisor – Helen Simons - for her support in difficult times when I have been in Southampton and her persistent work to correct my written papers.

I am grateful to Keith Jones for his support and initiative in organising the graduate students meetings where it was possible to interact about research and promoting the generation of ideas.

I would like to acknowledge to my friend Amanda Bryant for her always present and friendly support and her time spent in proofreading the final thesis, Corina Silveira for being available to share ideas and feelings and Cristina Ponte for providing me the opportunity to share ideas about the study.

I am grateful to my daughter for the time that I got from her, to my parents that always believed in me. Also, to my cousin that gave me all the support on the last stage of the thesis.

Finally, I wish to acknowledge Junta Nacional de Investigacao Cientifica (JNICT) for the financial support given to my research and the present thesis submitted.

Section I:

Chapter One: Introduction

The need for change - building the present and future in education

> Nowadays, change in school has become one of the main themes in educational politics, socio-educational intervention, and educational research. (Benavente, 1993; p.18).

Every day we are confronted by the need for change, the desire to improve or create alternatives to something that already exists but which is not adequate for our social and personal needs. Traditions are challenged and ways of thinking and acting, are questioned by social changes, new technologies, and economic markets, for example. The media accelerates the need and desire for changes in society, institutions or social roles and often plays a powerful role in creating images of change.

A strong movement towards educational reform has been taken up throughout Europe to help prepare youngsters for the changes in society. Since the eighties, many conferences have been held in the Western world under the label of "Education for the Future". And many debates held promoting images of the future and plans of action.

The research that is reported here was undertaken in Portugal, where there is general consensus regarding the need for change and innovation in education, although this consensus involves different motivations, concepts and goals. Professional teachers' associations claimed the need to change the curriculum, the conditions of teaching and the way in which teachers were trained. Parents' associations emphasised the need to improve the quality of teaching, physical conditions in school and modernise the technology and the resources available. Students' associations in university wanted a modified course curriculum and the financial support to abolish social discrimination in access to university. Change is also a goal in Portuguese educational reform, both in texts, and in the oral and written speeches on education delivered by administrators, educators, professional teachers' associations and researchers.

The political change that took place in Portugal in 1974 led to opportunities to modernise Portuguese society and created the need for social, educational and economic reforms. It has only been in the last fifteen years, that education has become a central platform of reform in Portugal as an attempt to ensure certain autonomy of schools faced with local community integration, and curricular adjustment to changes in society. The Portuguese Educational Reform Act introduced in 1989 aimed to change (i) the social role of the school; (ii) the students' and teachers' attitude towards knowledge; (iii) school management and resources. The main aspect of the reform in terms of policy was the provision of schooling to all Portuguese. Education became free and compulsory for all children from pre-school and grades 1 to 9, from ages 5 to 15. The state became responsible for the education of all the population living in Portuguese territory, including adults.

This reform movement, which on the whole was welcome, was a stimulus for change in education in the broad educational system. The reaction of the teachers however was mixed. Whilst there was resistance from some who felt that their rules and practices were being brought into question, others responded to the stimulus of reform by implementing educational projects in school.

Focus of the research

The focus of the research reported here was the role of educational projects, which were organised by a group of teachers interested in promoting change in Portuguese schools. The research was designed to explore the impact of the educational projects of groups of teachers, who have initiative and their own culture, on changing the educational practices and the school culture. An educational project may be understood as a formal or informal plan of action directed to solve problems and/or to create alternatives that express teachers' educational beliefs and their view of individual pupil and school needs. Change is defined here as a challenge to existing group or individual practices, beliefs and attitudes in the organisation of the institution which arise as a result of the action of a group or an individual. In this research change is understood as a creative selection, organisation and utilisation of resources that moves individual or group practices to another level of realisation.

It is the purpose of this study to:

- understand the motivations, beliefs and expectations of teachers who choose to become involved in group projects;
- identify factors that inhibit and stimulate project development;
- access the culture of the group of teachers that are involved in projects and the culture of the school;
- understand the role a project generated by teachers' initiative has in creating school climate and culture;
- analyse the relationship between teachers' professional curriculum and their motivations and expectations behind their participation in projects;
- analyse the relationship between the culture of a project created by teachers' initiative and school culture

Motivations and research questions

My interest in researching the impact of teachers' initiatives in school stemmed from concern about how innovation is developed in the context of Portuguese schools. These schools are rooted still in a centralised model despite outside efforts to force schools to be more integrated in the local community.

In Portugal we have been assisting teachers to take initiative in schools. Some teachers take decisions to change the methods of teaching, they build alternatives to the national curriculum, they create educational materials to use in classroom, they present plans to solve some school problems and generate resources. These initiatives take place outside of what a teacher is expected to do and teachers are seen as the main protagonists in change. Sometimes these teachers become very tired and upset, as their professionalism and innovations are not recognised by the school and by the educational system. Often their ideas are not disseminated. So the question is, do they really make a difference for students in education? In what conditions can innovation be promoted?
It was partly for this reason that I decided to investigate teachers' initiatives in school.

The motivation for developing this study came from three sources:
(a) my experience as a high school teacher - 1981/1986 - involved in curricular projects that developed an cross-curricular approach in class and in school;

(b) the results of three educational research studies in this field (Benavente, 1992; Branco & Cibele, 1992; Clemente, 1992). These studies make three particular points: first, teachers' images about their role changes as they act and react in their working environment by making sense of their own experience and projects; second, group or school projects that come from the initiative of teachers have been a *leitmotiv* of change as they introduce new models of teaching; third, new models of work (e.g.team work) among teachers influenced school organisation;

(c) the ideas developed by authors such as Barbier (1993), Benavente, (1992), Boutinet (1990) and Huberman (1989). These authors suggest that there are some teachers who distinguish themselves from the culture they belong to by the way they think, behave and act. They point out that some teachers, characterised as pioneers and innovators, are agents of change. Boutinet (1990) more specifically identifies four dimensions that support teachers' initiative and participation in projects:
(i) the vital need that is expressed by a constant willingness to participate, a rebellion against the injustice and a special need to survive;
(ii) the existential need that can be illustrated by specific and social motivations of teachers who participate in the project;
(iii) the pragmatic need that can be seen in the specific logic of action and beliefs;
(iv) and the cultural opportunity related to specific social and historical contexts.

These three sources provided me with a challenge to examine projects initiated by teachers and their effects in educational practices and curriculum.

Research questions

The basic research questions were:
1. In what ways do projects initiated by teachers play a role in the processes of changing the curriculum, pedagogical practices and school culture?
2. Do projects provide professional development for teachers? Do projects promote a teacher's understanding of the dynamics of the curriculum, decision-making processes and changes in the teaching culture?
3. What motivates teachers to become involved in projects aimed at transforming the school?

4. How does the school culture affect the development of teachers' projects and decision-making in the school?

Methodology approach

This thesis takes the form of a major ethnographic case study in a Portuguese vocational high school that specialised in Fine Arts. The study took place over two years from the beginning of 1995 and lasted until the end of 1996. The case study was focused on one project initiated by teachers, which was intended to change educational practices. The project was chosen according to a number of criteria based on the research problem and questions, and on the uniqueness of the curricular project, This had three main aspects. The first centred on students' learning and instructional processes, providing an alternative to the traditional Mathematics curriculum. The second was the introduction of an interdisciplinary approach for each art course (ceramics, cine-video, graphic design, interior design, textile, jewellery), to integrate knowledge of the different subjects and to introduce Mathematics in art projects. The third was the organisation of the interchange of educational materials, experiences, ideas, mathematics knowledge and experience of computers among mathematics teachers in a network perspective.

The case study was chosen for a number of reasons, which are detailed in chapter four. It had three main aims: to understand the meanings that this group of teachers gave to their educational experience; to understand the complexity of the interaction of the culture of this group of teachers and the school; to document the experience of the project over time

The group of teachers who were involved in a project was assumed to be a subculture in the context of the school culture as the group had different purposes, expressed different ways of thinking, and promoted an alternative curriculum introducing new materials and practices

The case study was ethnographic in its particular emphasis on eliciting and understanding the culture, beliefs, values, norms, patterns of behaviour and understanding this from the participant's point of view. In describing ethnography, Spradley (1980, p. 5) comments that it is the *"concern with the meaning of actions and*

events to the people we seek to understand. (...) These systems of meaning constitute their culture; ethnography always implies a theory of culture."

This ethnographic case study was supported by in-depth interviews and narrative portrayals of all the teachers involved the project. Methods adopted in the case study included semi-structured interviews, participant observation, document analysis (reflective teachers' reports and official documents), study of artefacts, and questionnaires.

Importance of the study

During recent years in Portugal, numerous innovative educational experiments have been carried out in varied fields and at different educational levels. The development of pedagogical projects by groups of teachers at different schools has led to the creation of opportunities where expectations, motivation, pedagogical objectives and efforts to solve problems identified in the educational practices and organisation of schools are brought together. Educational projects have provided opportunities to create new educational practices, the preparation of materials and the sharing of information, knowledge and experience. In this way these projects have contributed towards the transformation of the school insofar as they eliminate the discrepancy between what the school currently provides and the needs arising out of the technological, social, cultural and political evolution of society. However teachers have indicated some disappointment, as there has been little support from within the schools and from the state department.

Little guidance was offered by educational research in Portugal either, as educational research only started in the late eighties and only in the nineties did it come to have an important role in building an educational discourse. At the time this thesis began, no research had been conducted about teachers' initiative and the processes of change in the context of school.

Given the concerns that exist in Portugal with regard to teacher training and the development of schools to meet the changing needs of a society, studying the role that educational projects initiated by teachers play in the transformation of the school and educational practices is of particular importance. This study provides knowledge

concerning the process and conditions that promote school improvement defined as a need to respond to social evolution. Through eliciting and promoting understanding about how a culture of innovation was built and the role of teachers' initiative in changing educational practices, this research identifies the relevance of cultural codes in the process of school change and the conditions necessary for effective dissemination of innovative practices.

Thesis presentation

The remaining chapters of this study are organised in the following manner. The next chapter, Chapter Two - Portuguese Educational Reform, a context for change is divided into three parts, the change introduced by the Educational Reform Act of 1986, the implementation of change from the centre to the school and teachers` initiative in change.

The third chapter, presents a selected literature review divided into two main parts: change and culture. The first part explores the concept of change, different models of curriculum change and the resistance related to it; the second focuses upon the concept of culture, culture in education and subcultures of a school.

Chapter four presents the Research Methodology in which the case and justification for the ethnographic case study approach adopted is outlined, along with an account of how the research was conducted.
These four chapters complete the first section of the thesis

The following three chapters - Five, Six and Seven - present a cultural analysis of, respectively, the school, the project and the culture of the group. Raw data collected from interviews, observations and documents are used to illustrate the analysis. In Chapter Seven Schein`s (1992) three level model was applied to the analysis of the group culture. These three chapters complete section two of the thesis by presenting a descriptive analysis of school, group and project in the ethnographic case study.

Section three of this thesis furthers the cultural analysis in exploring the culture of innovation and change and is composed of three chapters:

Chapter Eight presents the life story of the leader of the group based on the meaning that she gave to her personal and professional experience.

Chapter Nine addresses the meaning that the project had for teachers involved in the project, for the students and the school, and the changes it made to the teachers' educational practices and professional development.

Chapter Ten explores the interaction between school culture and group culture.

The last Section Four, summarises the evidence related to the research questions, highlights the main findings relates them to theory and discusses some questions arising from the study. It is only one, final chapter –Chapter Eleven – which is divided into two main parts the first examines: (i) the role of teachers' initiatives and the meaning of change in the specific context of this study and in relation to other research in the field; (ii) the impact of their action; (iii) the teacher's profile and change and: (iv) the cultural relationship between a culture of innovation and community.

The second identifies the main findings and discusses change as a discourse of power in the context of globalisation and its role in creating a new identity of teachers.

Chapter Two - Portuguese Educational Reform

A context for change

This chapter locates the focus of the research in the social and educational changes that have taken place in Portugal since 1974. In particular it addresses: (i) the main changes introduced by the Portuguese Educational Reform Act; (ii) the changes promoted by the education department implementing the aims of the Act and; (iii) how these were recognised by educators and schools.

Changes in the Portuguese Educational Reform

> The reform can not be only a renovation of a educational system that is old.
> In the past last decades, the society has deeply changed: at social, political, economical levels. It has also changed in its scientific and technological dynamics, in ideological orientations and dominant culture.
> Education should adjust to the changes occurred and has to prepare the society and individuals for the new changes that will occur.
> (Document produced by the Committee for Portuguese Educational Reform- Proposta Global de Reforma; 1988; p.45)

In 1989, the Portuguese Government introduced a process of reform that aimed to change the educational system. The process in fact began further back in 1986 by the initiative of the Minister of Education at that time, Roberto Carneiro, and his team. Under this government well known university professors, representing the power of the different universities of the country, were involved in the process of reform, which led to the setting up of different area committees. These committees had the mission of preparing the national policy, promoting studies and programmes to implement the Portuguese Educational Reform Act. In 1987, the educational reform was presented to parliament and endorsed through law - Lei de Bases do Sistema Educativo. This became the reference point for all the subsequent policies and activities developed later by the Commitees.

The text of the reform responds to a number of concerns previously identified by researchers and educators. These include the need:

- to introduce innovation in the educational system as a process to create a dynamic of improvement;
- to change the system in areas such as organisation, resources, administration and management;
- to educate individuals in relation to the professional world where a dynamic of evolution in technology is recognised;
- to educate for democracy, reforming attitudes and ideologies that have been against economic, social, scientific and technological progress.

The changing historic and social context that compelled changes in education was following by an increase in public investment in education (1,5% in 1960; 1,7% in 1970; 3,8% in 1975; 4% in 1985; and 5,5% in 1992). In Portugal, the democratic revolution in 1974 and the end of the Portuguese empire in Africa accelerated social change. The access of children and youth to public education increased from 1,140, 000 in 1960 to 2, 290, 000 in 1994. For example, in secondary school in 1975, 82, 870 students were enrolled, compared with 291,758 in 1992. The percentage of students attaining academic achievement also increased from 22,446 in 1975 to 170,545 in 1992 (*statistical data in Barreto, 1996; Appendix A*). This increase has even more significance, as there was a demographic decrease related to birth-rate, indicating an investment in education for all.

Today, the state statistical data indicates, that although 100% of children are enrolled in primary school, adult illiteracy is still around 10%, including African *immigrants*. Only 7% of the active working population have a high level of education, even though the number of university students has increased ten times (270, 000 in 1994) compared with in 1960 (24, 000). Female students have more success (66%) in university courses than males. Repercussions can be seen with regard to admission to school teaching in the educational system. Also, the ratio of students to teachers has decreased, for example, in middle school, from 6. 8% in 1960 to 3. 9% in 1993-94.

The Portuguese Educational Reform was accelerated by the integration of Portugal into the European Community. This was a special historical moment that created the

opportunity for a reform that was already felt to be needed by the educational community. Professional associations had pointed out the need for curricular change for the last fifteen years. Studies oriented to assessing the needs of the educational system indicated the need for redefinition of existing resources and schools as well as the introduction of a new management model adjusted to school needs and to future challenges in society. Studies undertaken during the eighties indicated a high percentage of students under achieving. Changes were suggested to the curriculum aims, content, teaching/learning methods and student assessment, as well as the need to include in curriculum, the definition of competencies and knowledge for student attainment to enable them to adjust to the demands of society in the future.

The content of the reform represents a major change in the Portuguese educational system introducing modifications in curriculum, administration, structure and organisation of the educational system. These aspirations were translated into specific aims intended to change (i) the social role of the school promoting parent and community participation, (ii) the relationship of students and knowledge, (iii) the relationship among educational school community members - teachers and staff - with central administration (iv) management of schools and resources.

The Reform was conceptualised as an educational system based on the nine years of compulsory school education supported by the state (free tuition) from pre-school till 9th Grade (age 15 years old). Previously education was compulsory only for the 6th Grade (12 years old), and pre-school was not available through the state education system.

The structure of the new educational system is divided into pre-school, basic 1 to 9 grades (compulsory - 5 to 15 years), secondary school grades 10 to 12 (15 to 18 years old), university/colleges level, special education, and adult education.

The Portuguese Educational Reform was elaborated and implemented with the intention to provide education for each individual and prepare them for the society of the future. This basic education of nine years has the aim of preparing each individual to be an independent, original and creative thinker, able to question established knowledge, to

communicate, and gain competencies to solve problems and to take decisions in different situations.

> The reform of the educational system should be oriented by the need to educate for future challenges, as one of the great principles. The change should be understood, taught and applied.
> (Document produced by the Committee for Portuguese Educational Reform - Proposta Global de Reforma; 1988; p.25).

This reform also introduced a different model of political control and management in the educational system. In opposition to state centralisation of educational initiatives that did not extend to teaching methods, regional and local competition among schools was introduced oriented toward students` performance and school image of efficiency in relation to parents and community. Schools gained the autonomy to define their own programs and activities to manage their own resources and get investment from local business and community organisations. At the same time, with this reform, political control in the broader sense was extended to schools, teachers and students by evaluation and assessment procedures. In this model of local school management, parents and community members are involved in school control. Schools are not therefore controlled by the state as before, but by the image of efficiency that it gives to parents, community associations and business. This could have positive or negative effects in the long term, as schools would be dependent on existing resources, the initiative of the Head of School and local politics. Schools situated in rich areas would attract teachers and students by the conditions that they could provide for successful achievement, whilst schools in poor areas could become more depressed.

The national curriculum introduced by the reform emphasises the acquisition of competencies in oral and written communication in Portuguese and foreign languages, mathematics, sciences, new technology and social participation skills. This new national curriculum differentiates from the previous one in that it is knowledge centred and humanistic, based on an historical and cultural tradition, where literature, history, geography and philosophy are predominant. Although, the main frame is the national curriculum, pedagogical and financial autonomy was also introduced into the Portuguese school system and each school can integrate local history and specific goals in the curriculum, which should be expressed through the School Educational Project.

Community involvement in school autonomy is stressed and should be expressed by the ability to elaborate an educational project in which the main aims, intentions and plans of a school for three years are defined. This school project should be based on identified needs and the interests of school community members and the specific needs of students' education.

The social dimension of the school is emphasised in the Reform by the introduction of a curricular area that promotes cross-curricular projects of teachers and students - Area Escola - that is intended for school involvement in community problems and the local environment. The new curriculum also emphasises the development of social competencies introducing a specific program - Civic Education - to inform students about social and political organisation and the principles and rules for citizen participation. The principles of democracy are applied for students' participation in school and community. Some other changes are indicated in the text of reform such as:
- the integration of knowledge;
- the value of empirical knowledge;
- research methods.
All these dimensions are intended to be developed through the introduction of interactive methods of teaching and learning, ie. Work Project, Group Project and Independent Work. In Work Project the student designs a project that is realised by himself/herself. In Group Project a team of students designs, develops and makes a project.

Implementation of the Reform

The reform was implemented in different stages and times based on the policies that were created. In the first stage, decision-makers and policy-makers involved different groups in discussion. A period of debate began to discuss the reform projects and to accept suggestions from the educational community. The Reform implemented educational debates about educational goals and programs, in different educational institutions -School Administration, Educational Teachers Training, Professional Training, Educational Planning, and Media in School. Documents with the purposes of the reform and its projects were shared. Social community participation was promoted and the purposes were debated at universities, schools, educational departments, teachers unions, parents associations, professional associations and

political groups. Following these debates the area committees considered the responses and formulated policies.

In a second stage, a rational strategy was developed and a general plan designed. The school was considered the basic unit of reform to which everything should be addressed, but the model of implementation that was adopted was a top-down one characterised by;

- a sample of schools;
- educational training for teachers;
- experiment followed by state supervision;
- evaluation;
- adjustments and elaboration of educational materials;
- generalisation access the nation.

Effectively, schools and teachers were not involved in the evolution of the Reform, in a way that they could see the difference between what their practices were and what was expected to happen with the reform. In the process of dissemination and implementation policy-makers did not have in mind teachers' beliefs about education, their practices, the school cultural context and resources. The curricular reform was an example of the distance between the conceptualisation of reform undertaken by experts and the implementation process undertaken by schools.. Teachers did not have access to the expert thinking during the dissemination process. Since educational change depends on what teachers do and think (Sarason, 1971) and is a result of interaction which includes a modification of beliefs, values, and attitudes of participants in the process (Benavente, 1991, Simons, 1992), the intention of change was not always attained.

The educational community - teachers and researchers- saw the Portuguese Reform as an imposed change that privileged the coercive power of central administration (Benavente 1991; Canario 1991; Lima 1992). These authors consider that dominant strategies of the reform implementation did not involve the professionals of education - teachers and schools and this created resistance to the changes, as they felt reform was imposed.

Different authors, Benavente (1991), Canario (1991), Fennel (1990), (1992), and Simons (1992) support the idea that the introduction of innovations by the system can only be successful if teachers and schools recognise and accept the change that central agencies want to implement.

It remains to be seen if it is possible to promote a synthesis between the change originated by central educational department and the change promoted by schools and teachers. Should the initiative remain in schools? What should be stressed to adapt, to adjust for responding to the needs of constant change and improvement of educational practices? Will the school projects be a way of introducing change? Will they have enough power and resources to do so?

Teachers' initiative and change

At the same time, as the period of reform, in some schools, a minority of teachers individually or in small groups were trying to change their educational practice and introduce a dynamic of professional development. For this, they had elaborated new educational materials, promoted interdisciplinary experiences integrated knowledge, or organised school programs that integrated the community. Aware of the role of these initiatives, the state is now fostering the development of school projects. Financial support can be given and national dissemination of processes and products can occur if projects are chosen by the state agency.

These projects in the school institution break the routine and in general are limited by the demands of the national curriculum, the resistance of the school institution (Head of Department and School Board) and fellow teachers, insufficient resources that exist in the schools and the schools' internal organisation. Despite difficulties such as these some educators claim that these individual, group or school educational projects that come from teachers' initiatives have been a *leitmotiv* of change in school practices as these projects involve the participants (Benavente,1993). Research suggests that the involvement of teachers in projects leads to changes in teachers' beliefs and practices (Canario 1991). Branco & Cibele (1992) point out that projects developed by teachers in their schools have a special role in introducing new concepts, models of teaching,

dynamics involving students, parents and community and in the adoption of new policies.

Summary

> The professional training is very relevant for education.. The speed of technological development, which consequently changes the functional content of professions and the professional competencies, implies the need of a polyprofessional vocational training, at the first levels. It means to educate for a dynamic and evolutionary process, creating a capacity to adjust to new situations. (Document produced by the Committee for Portuguese Educational Reform – Proposta Global de Reforma; p. 26)

Since the Educational Reform Act of 1987, a moving process of constant adjustment has been developing. Change is seen in the main reform documents as a process of adjustment and improvement of the educational system towards preparing the individuals for the challenge of a future society. There has been a great concern to introduce innovation as the process to create a dynamic of adjustment towards the needs of performance in the professional world taking into account a society where the impact of technology is growing.

There is a transnational movement toward reform where a more general curriculum, instead of a specialised one is considered to prepare youth for future challenge in society. In the Portuguese educational system, as in other U.E. systems programs and strategies have been in demented for example PRODEP, SOCRATES, NONIO to stimulate innovation through the development of educational practices and materials using new technology. There is an intention to reinforce equality of opportunities for all students through access to European resources.

Reform documents also explicitly express democratic values through which "education is assured to all the Portuguese with respect to the value of freedom of learning and teaching" and by the emphasis given to participation of all the community through the educational structures that were created. Parents and the local community are encouraged to participate in the school. The responsibility of education is no more attributed to the state but to the social community. The school is addressed as the centre

of education and should be integrated into the local community. Individual success in the scenario includes social success.

In practice a central - rationalist model was implemented that treated schools as rational organisations that can be manipulated and changed. Teachers were perceived as adopters who should understand the value of what was intended to implement by the reformers. The role attributed to teachers in the reform was passive and the resistance of teachers was felt.

There was a gap, in other words between the intent of the school reform program and its implementation. Some educators relate this gap to the non-involvement of schools and teachers in educational reform and school change. Changes were introduced as policies to be implemented and each school interpreted and implemented these in different ways. The school then became the major focus of actual reform but for changes to happen at this level, the culture of the school, according to Popkewitz et al (1982), has a role in developing the innovation that is intended to be introduced.

> The school cultures did not change, but the innovations were changed by the cultures. Schools did not merely adapt the program, making modifications to reach the same goal, rather, they revised both technology and its espoused goals. Such revisions helped to conserve quite different institutional conditions in each of the schools a different style of work, conception of knowledge, and professional ideology was maintained. (Popkewitz et al (1982), In Johnson, 1990).

The various ways in which different authors have conceived the notion of culture and how schools change is reviewed in the next chapter.

Chapter Three - Change and Culture

Selected Literature Review

Change and culture are fundamental concepts used differently by people in the context of education. This chapter considers how these concepts have been viewed by various writers and proposes a definition that was adopted in supporting this research.

The main focuses of this chapter are: (i) change as a concept; (ii) educational change; (iii) curriculum change; (iv) processes of change; (v) resistance and values toward change; (vi) school change; (vii) culture; (viii) culture and education; (ix) school culture and subcultures.

In first part of this chapter I draw substantially from Blenkin, Edwards and Kelly (1992) as they provide a succinct and very useful summary of the main ideas about change.

Change as a concept

> Everything is in a state of flux, you cannot step twice into the same river
>
> Heracleitus

> We must learn to live with the realities of evolution and change, and to cope with the uncertainties they create.
>
> Nietzche

Since the Greeks, in western philosophy, the notion of impermanence of all aspects of the world has been defended. In response to this awareness there has been a constant search for underlying permanence, for some unchanging entity, rule or law that can give some certainty based on knowledge. Heracleitus defended the universal reason, the God. Meanwhile, Anaxagoras emphasised the mind and later Aristotle supported "a deus ex machina". For Plato, reason and rationality, was a basis for controlling the uncertain and generating true knowledge by the mind, in opposition to what the senses can offer. Kant and German Idealists argued that rationality is a source for true knowledge, which is characterised as perfect, true and certain. This assumption led to an acceptance of the

power of the mind, reason and rationality, with or without God that has and had impact not only in the scientific field, but also in the aesthetic, moral and political fields. It brought commitment to a concept of perfection that could be applied to all dimensions of human experience creating objective criteria that can demonstrate the validity of indisputable truth.

> Reason, or rationality, has been seen not only as enabling us to generate certain knowledge of the physical world but also as the source of indisputable "truth" in the area of social, moral and political life. (Blenkin, et. al., 1992; p. 3)

An alternative to this epistemological theory was empiricism, the main claim of which is that the human mind cannot create knowledge a priori and that what we know is what we comprehend through our senses. John Locke was a supporter of this theory *"no knowledge enters the mind except through the gates of the senses"* (in Blenkin et. al, (1992;p.4).

According to David Hume there is no way to acquire certainty or permanence that overcomes a state of flux or provides a secure basis for knowledge. Thus, the acceptance that the world is constantly changing should be assumed. In the last century, existentialists and the work of Charles Darwin accelerated the movement against theories of permanence. In the present century, it was Nietzsche who departed from the rationalists and metaphysic perspectives and introduced the idea that *we must learn to live with realities of evolution and change and to cope with the uncertainties they create* (in Blenkin, et al. 1992, p. 5).

Philosophers then have shifted the focus of their attentions from a search for eternal truths to embrace more mundane and pragmatic questions around social phenomena. Blenkin, et al. (1992) assert that today the search for knowledge has increased and a Socratic form of constant questioning has replaced the Platonic perspective of looking for certainty. Change is recognised as a natural phenomenon always present in life and in human existence. For these authors everything that is planned without reference to this fact, faces the possibility of failing and can inhibit, rather than promote, the quality of existence. Change became recognised as essential, a source of human existence and was applied to social phenomenon and to education.

A transformatory perspective is introduced by Doll (1989) who sees a difference between change as a natural sense of evolution that is incremental and cumulative from change that is promoted by a deliberate action of the individual. Change can be seen as a result of planned action in all fields from a number of perspectives: political, social, cultural, religious, moral and ethical. The distinction between the two main concepts of change, the *natural and cumulative* one and the *transformatory*, is recognised in the educational field, when there is a challenge in institutional organisation, group interactions, individual or group beliefs and attitudes, or educational practices caused by the individual and group action. It is the impact of this action that can be recognised as change and not the intention that conducts the action. The impact of the action can generate different attitudes in relation to what is valued by the group and the individual.

Educational change

> For years, politicians, professors, and much of the general public have been thundering for change in public education. Our society is changing, they say, and students must be equipped with different, more sophisticated skills and abilities. Students need to be able to think critically, they add, to reason, to use logic, to communicate, to work collaboratively and with a global focus. (Wasley, 1993; p.5)

One starting point for stimulating change in education is often cited in the educational literature as a direct result of the launching by the USSR in 1957 of the space satellite, Sputnik I (see, for instance, Norris, 1990). The Western countries wanted to be sure that they were not being left behind especially in technological developments and the space race. The need to respond to the changing economy implied reforms in education for preparing young people to live in a technological society. It was important not only to develop skills in students but also to help them to live with the changes that technology would bring to society regarding social, moral and cultural values. Forty-five years after, the discourse of politicians, professors, and the general public in Western countries is appealing for change in education emphasising the need to prepare students for the needs of society in the future. This is the case in the Portuguese Reform Act that was presented in chapter two.

Although change in education is valued by different sectors of society it does not have the same meaning for everybody. For some members of the public, it is possible to get an image of what will be changed in the future and plan what to do, assuming control of it. For others change is to solve the actual needs and problems of education. Yet for some others change involves reversing a process to gain more direction and control for maintaining the tradition. Despite these different views of change, it is possible to say that there is one idea that is common: change is a process that involves challenging the status quo, although there are different value positions taken to accomplish this. Ideas such as adjustment, improvement, transformation, modification, innovation, and renovation occur in different discourses. Adjustment, modification and renovation are used in educational discourse supporting the implicit theory that there is a natural evolution in society and there is a need for constant adaptation. Meanwhile, improvement is related to a developmental perspective and transformation to the action of rupture with tradition.

Fullan (1991) identified that one of the most crucial problems in educational change, is the lack of clear meaning about it *people do not have a clear, coherent sense of meaning about what educational change is for, what it is, and how it proceeds* (p.4)
According to this author, in promoting change *the what and the how* should be related.

> The problem of meaning is one of how those involved in change can come to understand what it is that should change and how it can be best accomplished, while realizing that the what and how constantly interact and reshape each other." (Fullan, 1991; p.5).

When we are speaking about meaning it is important to contextualise it. Judging from the evidence of research of current change, the meaning that is built up from state reformers when a innovation is intended to be introduced, is not likely to be the same that schools, teachers, administrators and parents perceive. Some authors point out the impotency of school reform and educational change initiatives to create real change (Cuban, 1989, 1990; Kaestle, 1990; Rosenholtz, 1989; Sarason, 1971, 1990). According to Canário (1991), central reforms can produce formal changes but not substantial ones, as teachers are treated as consumers of administrators' prescriptions for change.

Implicit theories, beliefs and values about education, which are teachers' lenses for interpreting the innovation, are often not taken into account. Canario (1991) defends the view that innovation implies change of behaviours, attitudes, implicit theories of teachers and other members of the school community. Added to this, teachers' initiatives and innovations frequently are not seen to benefit the schools. Lise Damailly's empirical research (in Canario 1991) identified a crisis of identity in teacher innovators provoked by the school constraints that were imposed and by the lack of support given.

In recent years, in some Western countries a school-centred innovation model emerged, intending to decentralize practices such as in-service education of teachers, curriculum development, self-evaluation and action research. Hargreaves (1982) attributes the generic term school-centred innovation to those practices that *"are underpinned by a common ideology embodying the principles of participation, collaboration, democracy and diversity"*.

In a similar view within a democratic perspective Simons (1992) advocates placing educational change in the hands of teachers and schools, considering them the agents of innovation. Unlike many early external curriculum projects attempted to change classroom practice through changing the subject or a focus directly on pupils, she asserts that the school should be the main unit of change and teachers and pupil's achievement considered within it. For this author, changes introduced by policies can only be successfully implemented in the educational system if teachers and students are involved in the process of changing the school and professional culture. Power-coercive strategies of change fail, as they do not affect the basic attitudes of teachers.

Stenhouse, (1975), Elliot, (1998) Simons, (1992) all see change and innovation as impossible without teacher development. This view of change suggests that the teachers assume the role of a researchers to experiment with their teaching and the impact of this in the school.

Simons (1993) defines change as a shared and social activity in a professional community. Those who are responsible for its success should take a broad sense of ownership of the change. In the educational literature, change also needs to be

interpreted in the particular context of the school, the professional community and local institutions in relation to the values, beliefs and implicit theories of those within them (Gomes, 1993, Simons, 1993).

Some critics of the ideology of school-centred innovation emphasise the way that conflict between subject departments and different structures in school seem not to be taken into account as well as the conflict between different interest groups in the school and local community. Canário (1991), for instance, asserts that a conflictual process is inherent to the group and the institution where change is taking place. Holly and Wideen, (1986) stress the fact that innovations can endanger the cohesiveness of the overall school culture since innovations are representative of sub-cultures, interest groups and pluralistic values, all of which pull the school in several directions (in Dalton 1988; p.7)

Curriculum change

> A democratic curriculum, in Dewey's sense, must be open to the continuous evolution of knowledge and values; it must alert pupils to that continuous evolution; and it must invite challenge to whatever seems to be the prevailing orthodoxy in any sphere. (Blenkin & al, 1992; p. 22)

In relation to curriculum change, there are some common questions that educators address in respect of preparing students for life in a society that is in a constant process of change.

- What kind of preparation do pupils need if they are to be educated for a changing society? What kind of knowledge and processes are most appropriate to further education?

It is these kinds of questions that need to guide curriculum planning. Blenkin & al (1992) cite out three existing distinct types of models of curriculum planning.

(i) - a body of knowledge content and or/subjects, that is expected to be transmitted by teachers to students, using the most effective methods they think of;

(ii) - the results or the products designed as short-term objectives to attain some aims;

(iii) - the processes of education and the curriculum itself are a statement of the procedural principles.

Many critiques have been offered of the first and the second curriculum models. These include the fact that they fail to promote change, as they do not integrate the notion of adaptation towards the environment and the culture of the school. In the first case, the model implies a passive attitude toward a corpus of knowledge that exists simply to be absorbed. In the second case, the focus is on those skills and abilities that should be trained to enable the student to take a role in a society without being related to individual needs and abilities.

The third model of curriculum involves students in the process of learning, accessing knowledge and providing them with opportunities to deal with different situations, and it implies that the school creates conditions that promotes students` and teachers` participation..

Curriculum change can have different meanings. Stenhouse (1975) for instance distinguished curriculum innovation from curriculum renewal. For this author, curriculum innovation involves changes in the aims and values of curriculum and challenges the current thinking and classroom practice. Curriculum renewal is simply a matter of updating materials, of keeping pace with developments in knowledge and the techniques of teaching. Another distinction can be made between innovation and improvement. Improvement implies that there is an implicit sense of educational development: practices are not only new but also valued as qualitatively better than the ones before.

Three dimensions of change in curriculum are pointed out by Fullan (1982). These are the use of new materials, the use of new teaching approaches and the alteration of beliefs such as pedagogical assumptions and underlying theories. Further criteria is used by some authors for making a distinction about the effects of change. Simons (1993) and Blenkin & al (1992), for instance, distinguish between substantive change that affects the deeper structures of the curriculum and results in a reordering of categorical meanings, and superficial change that reorganises what already exists.

Processes of change

Blenkin & al (1992) offer a useful summary of theoretical perspectives for analysing change. These focus on the nature and processes of change, dissemination and explanations for how changes occur in educational institutions. They address six perspectives on change: the technological, the cultural, the micro political, the biographical, the structural and the socio-historical.

These different perspectives are differentiated by the focus that is assumed in analysis of the process of change. In the technological approach, the emphasis is on the applied strategies that are systematic and typified as a centre-periphery or empirical model. Schools are assumed to be rational organisations that are "readily manipulated and easily changed" and teachers are perceived as "rational adopters" who will readily recognise the value of what is intended to be implemented. The logic of technical rationality, as an epistemology of practice, derived from positivist philosophy, is present in this process of change.

> Thus, in an educational context, professional practice is directed towards the resolution of well-formed instrumental problems through the systematic application of the theories and techniques of the empirical sciences (Schon, 1983, 1987)

Drawn from the literature the major critiques of this model can be summarised as:
- the assumption that innovators and classroom practitioners construct practice in the same way;
- the idea there is an established hierarchy between innovators or policy-makers and teachers. In this perspective, innovators are considered to be inherently superior to classroom practitioners; the roles of practitioners are reduced to implement what comes from the centre;
- the disregard given to the system of meaning that already exists. Adverse reaction to innovation is typified with negative connotations such as resistance to change;
- curriculum is seen as a tangible product that can be planned and constructed independently of the context where it is applied;

- dissemination is seen as a technical problem of creating organisational structures and communication networks. These would facilitate the flow of the message, from the developers at the centre to the users at the periphery.

The cultural approach stresses the construction of meaning. Schools are seen as cultural entities, *"complex social organisations held together by a symbolic webbing rather than a formal system driven by goals, official roles, commands and rules"*. (Deal, 1990; p.7). The basic premise is *"innovation cannot be assimilated unless its meaning is shared"* (Marris, 1974, p.113)

> This approach examines the process of change within the sociocultural milieu of educational practice and one of its central concerns is the meaning of teaching to teachers and the origins of those meanings" (Feiman-Nemser and Floden, 1986, p.505)

According to Deal (1990) schools will become fundamentally different by correcting surface deficiencies and by recognising that transformation involves a *"collective renegotiation of historically anchored myths, metaphors and meanings"*.(p. 9)

The micro political approach is focused on the distribution and utilization of power in educational institutions. This becomes the crucial issue in attempting to understand the process of change. Curricular structures of schools not only express the conflict but may accentuate it. The Micro-Politics of the School (Ball, 1987) is a good example of this approach.

> The study of change is a central feature of the conflict approach, for change is to be expected if the social system is fragmented by divergent values and conflicting interest groups" (Ball, 1981, p. 14).

Dalton (1988) points out that differences of ideology and personality tend to be the main source of conflict in school departments. Whereas from a cultural perspective collaboration is perceived as a desirable end in itself, from a micro political perspective questions are raised concerning the ends and interests it serves. The pursuit of consensus and collegiality as democratic ideals has in this perspective to be recognized as practically and politically problematic, (Blenkin & al 1992).

The biographical approach emphasises the way in which change impinges upon the lives and careers of practitioners and how the two phenomena interact. It provides one explanation of teachers' hopes, aspirations, fears, commitments, beliefs and values. The research in this field intends to get inside teachers` heads to gain access to their thought processes in order to interpret the world from their points of view. Its analytical frameworks include personal construct and social interactionist theory.

The construction of a sense of reality and a sense of self by the individual is also developed in the context of the school that provides the normative beliefs and values. Substantive change in school destabilises the individual structures of meaning and, by implication, threatens the professional identities of teachers. Change can affect their career opportunities and aspirations and may undermine their ideological commitments.

For Blenkin & al (1992, p.60), the success of an innovation is dependent upon the material and psychological support that individuals and groups are given in constructing new sets of meaning. It is also however dependent upon the individual's disposition to lead with uncertainty which is inherent in the process of change. Innovation is synonymous with learning in this perspective and this process can include pain, depending upon how it is perceived and experienced by individuals

The structural perspective for analysing change is based on the assumption that *"the process of schooling is embedded in, and a reflection of, wider economic, social and political structures"* (in Blenkin, 1992, p. 60). Schools and education are seen as structures that reproduce the political ideology within a capitalist society. In this view, there is an element of structural determinism, which denies or minimizes the possibility of human agency. Hargreaves (1989) has applied this approach to a macro structural interpretation of educational change over the last decades.

For Flinders (1988) and Hargreaves (1990), teacher individualism can be explained by a highly pressed and constraining working environment. According to these authors, the individualistic culture of teachers may not be a pathological response to the uncertainties of their profession, as it is frequently assumed, but rather a strategy of resilience.

According to these authors the responsibility of a generation of a individualistic culture of teaching is seen to be related with:
- the imposition of an academic subject-based curriculum;
- an intensification of pressures and constraint upon the work of teachers which ties them more closely to the immediacy of the classroom;
- a reduction of in-service opportunities for extended reflection in exchange for short term programs of non-reflective training designed to equip teachers for the efficient delivery of policies determined elsewhere.

In this structural perspective teachers` identity derives from school structures. It is in relation to and through them that the micro politics of schools are often played out.

The sociohistorical perspective is addressed by Goodson (1981, 1983), in the examination of curriculum change through the understanding of its social and historical constructions. These and similar studies developed by Young, Benstein and Keddie, (in Young 1971) are rooted in the sociology of knowledge looking at how the society *"classifies, distributes, transmits and evaluates the educational knowledge (...) reflects both the distribution of power and the principle of social control"* (Young, 1971)

According to the French sociologist Moscovici (1982), conflict is always present in groups, in the individual, in institutions and in society. The conflict is a result of implementation of alternatives to the rules of the institution. For this author, conflict is the essential condition necessary to gain influence over a group or an institution as it generates a dynamic toward change. It is through the analysis of conflicts that change can be seen in different dimensions. Conflict, then is the leitmotiv for a dynamic school as an institution and as an organisation.

Change may also come through a rupture in the system as a result of a conflictual process that in some conditions introduces new dynamics and concepts. Wazlawick (1991) defends the point that innovation and change in an institution is a result of a conflict, whereas Carvalho (1991) and Baldridge (1971) indicate that the conflict is internal to the dynamic process of change.

Canário, (1991) also stresses that conflict is a way to change curriculum and school organisation and it is a result of an interactive relationship among different elements of the school community.

Resistance and values toward change

The motives that create resistance to change are seen by some authors such as Blenkin, Edwards and Kelly (1992) as a tendency of individuals and of organisations to maintain the status quo. Such conservatism, as it is often called, is based on the idea that change brings the deterioration of what is already certain, good and perfect. This attitude of pessimism can be identified in society at all levels and in many aspects of life. From the moral and ethical point of view change can be seen as an essential process for the human condition and world development or as a process in which all things become worse, i.e. respectively, a way to reach perfection (Marxist view) or calling for resistance (Platos` view).(in Blenkin et al. 1992)

A positive attitude can be identified towards change when there is a belief that relates it with development as a process that contributes to a perfect life. This attitude is also supported by the intellectual assumption that all changes can lead us to a perfect state. Hegel, for example, defends *an underlying rationality to all aspects of existence and developed it into a form of idealism* in assuming that change is a progression towards an ideal that is the same as a state of perfection (in Blenkin e al. 1992; p. 9). Hegel presents the process of change as a permanent conflict that is dialectic. It is through change that development happens. So change is considered good and a pathway to a state of perfection through a determinist process. Marxists do not consider social diversity and the role of the individual in the progress of human society. Rather they consider change as a result of an inevitable process where conjectural moments provoke ruptures - states of revolution - and changes are established.

Charles Darwin assumed evolution and introduced a scientific empirical explanation of change in terms of a constant adaptation to a constantly changing environment. The influence of his work in the human and social sciences consolidated by John Dewey who accepted the concept of evolution as a process of a constant adaptation, not

necessarily a development. Dewey sees change as something that occurs in a social context and it is recognised that individuals bring in knowledge and values. Thus, he advocated democratic conditions in society that present opportunities for change to occur and citizens who are responsive to participate.

The perspective that change implies a transformatory process in a context (Doll, (1989), also implies an active attitude of individuals and the acceptance of wisdom and freedom to challenge in education, in art, in aesthetics, in morals and in social and political life.

Taking into account the different perspectives of the process of change in education, resistance is seen as a problem that emerges as the innovation is developing. For the educators who focus on strategies of implementation of innovation, resistance is projected as a main determinant of failure. One way around this, according to Ponder and Doyle (1977), for example, is the use of teacher-proof materials for neutralising the reactions of *stone age obstructionists.*

According to the cultural perspective, resistance is based on the idea that there are some norms, which are not easily changeable what happens when these came into conflicts with new ones. Blenkin, et. al., (1992) identify this concept of resistance as *a lack of congruence between the existing school culture and the culture embedded in the change proposals*. (p. 46)

A further reason for resistance to change is the little credence given to formal educational theory by teachers who rely almost exclusively on practical classroom experience, as the main source of their professional knowledge (Hargreaves, 1984). Canário (1991), for example, suggests that the crisis of teachers' professional identity is in part derived from the way they are perceived by reformers as *rational adopters.* Teachers react negatively to plans or theories that come from outside whereas professional understanding might be enhanced better through procedures, which help teachers confront the norms embedded in their practice with processes of reflection.

Yet another view is offered by Marris (1974; p.8) who explains resistance to change as a psychological reaction to the loss of meaning. For this author, *there is a deep-seated impulse in all of us to defend the validity of what we have learned, for without it we*

would be helpless. During a period of change, central elements of the self can be threatened, creating feelings of uncertainty and anguish. The degree of threat depends on its connection to self-identity (Blenkin et. al., (1992; p56).

Resistance from teachers is further recognised as dependent on individual lack of required skills and a negative disposition toward change, as well as a poorly defined roles. According to Ball and Goodson (1985), resistance to change is found not in the culture of teaching but in the micro politics of schooling. Schools and departments within them are viewed as "arenas of struggle". In this perspective change is potentially seen as destabilised, leading to the rearrangement of the power relationships between individuals and groups.

Change and resistance can be seen as two faces of the same coin. Based on a transformative perspective, when we are acting towards a situation or a problem with the intention of change, at the same time we have an attitude of resistance toward the situation that provokes the motivation for change.

Change and resistance can be seen together if we consider the existence of certain anxiety toward something that is new. This anxiety generates a process of conflict between the traditional and the need for future challenge. Each school has its own norms and rules that include both profane and sacred ones. While, the profane can be changed the sacred one cannot be touched without a great aversion or a strong resistance.

School change

Three models of school change can be identified in literature in relation to the distribution of power: autocratic, bureaucratic and democratic. In the first one, power is centralised in a state department, which emits rules, norms and values in respect to authority and includes state control by inspectors. Change is introduced from the top, frequently for politically motivated reasons to be accomplished, by the school, as a rule. The second one –bureaucratic – is based on a functionalist paradigm focused on rational and technical action and takes the form of a centre -periphery reform. A hierarchy of formal leaders, in relation to the pre-established aims and goals and resources available,

takes decision-making (Sanches, 1998). It is based on a strong leadership to ensure that the rules are accomplished and does not recognised teachers' initiative. In the third one –democratic – the school is seen as a community of learners (Freire, 1997, Senge, 1990) and decision-making is centred on the participation of the different elements of the school community. Teachers are potentially transformers if they assume the initiative. Change is seen as a collective process of creating meanings through interaction between teachers, students and the formal leaders in the context of school. Opportunities to share values, ideas and experiences about curriculum and students' needs are integrated in school organisation. In this model, process, content, pedagogy and school organisation are related and a spirit of shared responsibility and mutual accountability is valued Freire, (1997).The leadership is a result of socially constructed action in the school (Sanches, 1998).

Related to the democratic model, school self-evaluation can be seen as a process of implementing change in school as it takes into account the school culture, teachers as evaluators as is built, in Simon's concept at least, on an internal shared strategy of change, from the design of the evaluation to the conduct and communication and discussion of findings Simons (1998).

For Simons (1992: 1993), change and innovation are dependent on institutional and external support to teachers and schools involved in curricular change, as teachers cannot go through and sustain new practice without such support. Support for schools is needed to develop projects, to publish educational materials and to put in practice action research as a way to improve the curriculum and as an incentive to teachers' professional development.

> There can be no significant teacher development, and therefore no curriculum change, without institutional change. Institutional values act to frustrate, limit and neutralise teacher development. (Simons, 1993; p. 130)

For Dana (1992) the process of change begins with the redefinition of the teachers' role and the changes that take place in schools also have to be supported by school faculty and staff that should take into account school culture and subcultures.

Whilst many writers of innovation identity the factors that inhibit change, others focus on the conditions that facilitate change in institutions. In addition to the change in teacher's role and support for change mentioned above, Benavente (1991), Branco & Cibele (1992), Canário (1991), and Simons (1992) defend the point that change is easier to achieve in a school if the motivations of teachers and students are integrated into educational practices and a climate of self-confidence is promoted, as well as the provision of material resources. Change is facilitated by a process that emphasises students' autonomy, responsibility and creativity and an openness to experience and problem solving strategies. Benavente (1991) sees the process of change as dependent on:

- the dynamics and organizational climate;
- the symbolic universe of the professionals;
- uses and routines acquired;
- the nature of the educational practices;
- resources.

The key for educators who defend the democratic model to promote change is through the establishment of collaborative cultures, based on the principles of collegiality, openness and trust as schools cannot be improved without people working together (Lieberman, 1986; Lieberman and Miller, 1990; Saphier and King (1985) These authors pointed out that there is a need to create some conditions that stimulate a culture of collegiality in school. By collegiality is meant, the professional opportunities for the teachers to engage in dialogue, for sharing experience, knowledge, decision-making and educational materials, as well as for building knowledge with their partners.

In the process of change, there is a relationship between three dimensions: the individual, the group of teachers and the school context. The process is dynamic and not linear. The conditions mentioned above facilitate such a dynamic, as well as openness to experience, integration of teacher' motivations, support for divergent thinking and forms of flexibility in organisation, are pointed as essential to promote school change. School change is also interrelated with teachers' change of beliefs, attitudes and behaviours.

McLaughlin (1990) identified in a cultural context of a school some other factors that may be a stimulus for change such as: collaborative planning, sense of community, clear goals, and shared high expectations. These stimulate change in school organisation and management as well as empowerment of teachers in school.

Added to this are local expectations about what schools should be or do and not do, and what should be taught and learned by the students (Corbett, Firestone, and Rossman, 1987) further affects school culture and the way that change can happen.

Culture

> the nature of man is culture (...) man by his nature makes culture
> (Bernardi 1988, p.23)

Culture is a crucial concept that has frequently been applied to research and change in schools. This section of the literature review examines the concept of culture and subculture and the various ways in which it has been created and understood. It concludes with the statement of culture that is adopted in this research.

The first formulation of the concept of culture came from anthropology Edward B. Tylor at the end of XIX century. This author defined culture as a complex unity that includes knowledge, belief, art, moral, norms and all other capacities and routines acquired by man as a member of society (in Bernardi, 1988, p. 24). Ruth Benedict also recognised the utility of the concept seeing the expression *"of patterns of culture as coherent organisations of behaviour"*(in Bernardi, 1988, p. 38) .

This emphasis on patterns as a significant feature can also be seen in Deal and Kennedy's (1983) definition, which relies on Webster's New Collegiate Dictionary. They explain culture as " the integrated pattern of human behaviour that includes thought, speech, action, and artifact, and depends on man's capacity for learning and transmitting knowledge to succeeding generations" (p.4). Deal and Kennedy (1983) describe culture *"as an all-encompassing tapestry of meaning. Culture is the way we do things around here"* (p.5).

Johnson (1990, p.13) summarises Deal's essential elements of culture as:

-. shared values-shorthand slogans which may summarise deep-seated core values;

- .heroes-individuals who embody or represent core values;

- .rituals-repetitive behavioural repertoires in which values are exposed directly through implicit signals;

- ceremonies-episodic occasions in which the values and heroes are put on display, anointed, and celebrated;

- stories-concrete examples of values and heroes who triumph by following culturally prescribed ways;

- cultural network- a collection of informal priest/esses, gossips, and story tellers whose primary role is to reinforce and to protect the existing ways.

The anthropological literature has recognised the rational logic that moves each culture. The anthropological research has revealed the existence of systems of thinking, systems of relationships and systems of politics in all cultures. According to the American sociologist Parsons (1970), culture is "*composed of patterns of values, ideas and symbolic systems is the motivational input behind society, and education is the process by which individual members of societies are brought to "know", "command", and become "committed to" important elements of the cultural tradition of the society*"(in Burtonwood, 1986, p.201).

The culture of a society or a social group is made up of concepts, beliefs, and principles of action and organisation (Goodenough, 1976; in Spindler 1987). Values may be conceptualised as one of the four primary symbols of culture, the others being norms, beliefs and expressive symbols (Peterson, 1977; p.137-138). Trommmsdorff (1983:p.338) defined values as subjective generalised orientations of human beings, which under certain conditions can determine social behaviours.

The formation of values is an important component in cultural dynamics. Indeed, the construction of values is developed in a process of interaction with others (Zavalloni, 1980). Bernardi (1988: p. 36-39) argues that the values integrated in a system work as a coercive force that transforms values into rules. The norm is then what is established

and transmitted to others and can be seen in peoples' "normal" behaviour and patterns of behaviour in the context of a culture and a society. When the norms are established and constant through time, they become institutionalised and only become subject to change if the system of values is transformed.

Belief is another concept that is related to culture that deserves to be analysed. The concept of belief has been widely discussed by the cognitive anthropologists Eisenhardt, Cuthbert, Shrum, and Harding (1988); Green (1971); and Peper (1948). According to Webster`s New Collegiate Dictionary (1985), a belief is *a conviction of the truth of some statements or the reality of some being or phenomenon.* The notion of system is present when these authors see beliefs as conceptual units organised into systems that demarcate the environment into meaningful categories. A system of beliefs may be defined as a group of non -contradictory beliefs belonging to a person in a recognisable and specific context. From the point of view of the above cognitive anthropologists, belief systems exist within a professional group and the differences can be found in personal experience. Beliefs can be held differently, dependent on the personal degree of conviction or acceptance. Pepper (1948) points out that a belief is composed of three parts: (i) its content; (ii) the attitude toward it; (iii) and the ground of the belief.

A further point introduced by Smolioz (1981) is the concept of a personal cultural system, which can be seen as a result of a conscious human activity in selecting values from the group stock adjusting them to his/her own particular purposes and interests.

Different concepts of culture assert interaction as a process of formation, transformation and interpretation, as well as an idea of a organised system and a pattern of behaviour (Benedict, 1988; Parsons, 1970; Deal and Kennedy,1983).

In society, we can also note the existence of subcultures, which although belonging to the same social group and having some relations with the dominant culture, subcultures show differences in values which guide the patterns of behaviour. Society here is defined as a social group with some characteristics that are recognised by its members and others seen as distinct, living in a designated territory, that has its own language and tradition. In this case, culture is related to how people interpret the world around them by developing shared understandings. People learn collectively how to interpret what is

important and unimportant and how to behave in specific circumstances. Culture provides people with rules about how to operate in the world in which they live and work.

According to Van Maanen & Barley (1985; p. 33) culture can be understood as a set of solutions devised by a group of people to solve specific problems posed by situations they face in common. This perspective that stresses culture as a living historical product of a group-solving problem, can be applied to any group, neighbourhood, family, dance band, or organisation in a cultural sense.

Culture and education

The concept of culture used in education has been applied to the study of organisations such as schools (Beare et al 1989; Gomes, 1993). The traditional concept of organisation that separates organisation and structures from people working in them, such as teachers, staff and students, is rejected by these authors. Some recent studies have also attempted to understand why schools with the same structure and organisation really make a difference in the climate of work and in students' success. The vision of school as a dynamic corpus arose, where peoples' beliefs, thinking, attitudes, practices and relationships make a difference to the way that students learn and what they learn and how teachers develop their own knowledge, as well as to how the school relates to parents and to the community.

In the educational literature there is no one commonly accepted concept of culture. Perspectives about the concept of culture in education are explained by Deal & Peterson (1987) as different from those, which come from disciplines such as anthropology, sociology, and communication theories. In some cases, the concept of school culture is equated to school climate, ethos of a place or ethic, and is applied to characterise the feelings and content involved in all the relationships in the school or in a social setting (Purkey & Smith, 1983; Noddings, 1988, Wheeler, 1966, cited in Clemente, 1992, p.9). In other cases, it is viewed in terms of the symbolic value of shared experience or in terms of patterns of behaviour and symbolic interaction (Bolman & Deal, 1984, Kilmann, et al 1986, Ost & Ost, 1988, Peacock 1988,).

According to Wooten (1993), sharing meaning is interpreted as a group framework that is commonly and implicitly accepted and used to understand the group's experience. It implies that one sees the world as the other members of the group see, the world, using the same frame of reference.

Wilkins (1983) warns of superficial studies where only the overt manifestations are identified rather than an understanding of their underlying meaning. Only by focusing on underling assumptions and orientations of school can we understand the differences within school culture.

Schein's (1992) model of culture has been applied in education to study the dynamics of sub-culture. The author stresses the importance of studying the organisational, institutional and group culture to understand the dynamic of the institution to manage change across boundaries and to solve the breakdowns in intercultural communications. This author emphasises the importance of socialisation in the process of building culture. According to him, culture is a result of a process of group learning, which is influenced strongly by leadership. In his perspective *"organisational cultures are created in part by leaders, and one of the most decisive functions of leadership is the creation, the management, and some times the destruction of culture"* (p.5).

Schein (1992) has developed a model to analyse culture that integrates different levels referring to the degree to which the cultural phenomenon is visible to the observer. By visibility he means everything that one can see, hear, and feel when a new group meets. The levels of his model of culture are:

-artefacts, the visible organisational structures and processes, products of the group, rituals, ceremonies, patterns of behaviour, norms and rules in use;

- espoused values that are supported by plausible justifications and can be shared by the group;

- and basic underlying assumptions that are unconscious, beliefs, perceptions, thoughts, and feelings.

School culture and subcultures

One of the questions that the literature on school culture raises is whether we can see school culture as monolithic or monotypic. There is some controversy about this. Can we see shared values, beliefs, knowledge and practices in a school? Can students, faculty and staff involved in school be seen as different groups? Can they share common ideology and practices?

Bacharach (1993) argues that different interest groups of interest exist in schools. Each group is constituted by people who have some common goals and orientations towards the work of school education. The individuals that constitute the group identify themselves on the bases of their common responsibilities or concerns and their common beliefs and values and they distinguish themselves from others. Rossman (1988) points out that it is possible within the same school, for students, administration and faculty to hold different values and beliefs about the same common issues.

Stroempl, (1993) also argues that it is possible to have different subcultures in school organisations. Studies dealing with other disciplines such as business and communication have demonstrated that different functional groups of an organisation "*may hold different or conflicting values and beliefs about common issues* (Martin & Siehl, 1983; Van Maanen & Barley, 1985).

To consider a group a culture or a subculture we have to have a group which *"owns it"* ie, their understanding of shared norms, values and beliefs (Smircich, 1983; Spradley, 1979). Therefore we need to ask the question, what is a group?

According to Schein (1992), a group is a social unit of all sizes, either an organisation or a subunit of an organisation. Levine & Moreland (1991) say a group exists when three or more persons interact regularly to do something in common, share some values, beliefs and knowledge, present behaviours and products interdependently and have some relationship among them. For Bohannan (1963) and Goodenough (1971) a group, in a cultural sense, is a set of people who:

1. have been together long enough to have shared significant problems;

2. have had opportunities to solve those problems and to observe the effects of their attempted solution;

3. have had the opportunity to pass on those solutions to new members.

In order for a group to be recognised as having a separate culture, a group should be passing on to others, elements of its way of perceiving, thinking or feeling (Geetz, 1973). The way that they behave and act should be identified as different by the other groups in the setting in order to be considered a subculture in a school. Members of the group need to share the perception that they are different from the others because they perceive themselves and are perceived, as ideologically and in action, different from others.

According to Schein (1992) a group has its own culture in the sense of shared basic assumptions. These assumptions are learned by the group in solving its problems of external adaptation and internal integration. They are considered to be taught to new members as the correct way to perceive, think, and feel in relation to those problems.

Following Stroempl (1993) we can say that a group subculture exists when there is a coherence of assumptions and beliefs of the group and their practices and when there is a conviction of the leaders in presenting their beliefs to others and the way in which they translate this into practice with others.

Another question that is pertinent to this thesis is how does a group form in school? What makes a set of people belong to a group that plans and acts interdependently?

Benavente (1992), in one of her studies, found some individual reasons that may support the idea of forming a group such as: (i) the interest and enjoyment of working in a team, (ii) some feelings of dissatisfaction with what is dominant in school practice or with the beliefs and values of the school, (iii) the willingness to build alternatives, (iv) the desire to break routines and have challenging experiences. According to Bacharach (1993), in a micro political approach there are some social and political reasons for people belonging to a group such as: 1) the desire for power and social recognition; 2) the need to be protected by the group to be involved in a political activity; 3) the desire to acquire deep information to survive ideologically and in the context of the school.

Prosser's (1998) recent analysis points out two main perspectives about school culture that has influenced the research in school culture. In the perspective of managerialists, the school is a homogeneous entity that influences everyone in the same way and that can be manipulated in relation to educational effectiveness. An alternative view considers school culture as a result of the multiple interaction of individuals and groups. For this author, there *is a two-way interaction between school culture and sub-cultures*. From his point of view, to understand the relationship between subcultures in a school there is a need to identify which values and beliefs are maintained and which are in conflict or in harmony with each other.

School culture is an unseen, and unobservable force behind school activities, a unifying theme that provides meaning, direction, and mobilisation for school members. It has both concrete representation in the form of artifacts and behavioural norms, and sustained implicitly jargon, metaphors and rites. (Prosser, 1998)

According to Stroempl (1993), the common thread through most definitions point to school culture as the basis of knowledge, beliefs, values, and assumptions of its members (Deal, 1986; Kottampt, 1984; Deal & Peterson, 1987). This concept integrates the educational practices, the structure of the school, the formal and informal relationships between and among groups and school members, and the school and community. In this interpretation, the concept of culture is dynamic and integrates ways of regulation between school culture and community culture. For Stroempl, (1993), a school's culture *is predominantly a within-building phenomenon, though it is impacted by external influences*.

Deal (1987), Schein (1992) and Stroempl (1993) all use the same concept -school culture - but while the first author sees culture as something that is stable, the others perceive culture as a dynamic concept that is predominantly built within the institution but in relationship to the impact of external influences. Meanwhile, Prosser (1998) emphasises that culture is the result of multiple interactions.

Most of the above researchers agree that there are differences across school culture. Schein (1992) relates these differences to various factors such as: founder's leadership,

subsequent leadership values and beliefs of other organisational members, external environmental pressure and critical events, which can redesign history.
Different teachers' and staff cultures also affect school culture through the influence of family and social backgrounds.

As Nias claims (1989, p. 143) there is a need to undertake research into culture to provide *"empirical and conceptual accounts of school cultures that allow for micro political activity and internally initiated change"*. According to Prosser (1998), school culture research should focus on understanding how schooling is influenced and how this understanding can be used to improve the quality of education.

Summary

The meaning attributed to innovation and the abilities of individuals to live with uncertainty generates attitudes toward change. These are dependent on the value toward change given by the individual, the group or the institution.

In this thesis, it is assumed that innovation in education implies a cultural change of the school as an identity in the context of local communities, curriculum, and teachers' implicit theories, beliefs and practices. Therefore change is a result of a planned action that is not impartial or neutral and it is generated through a process of social interaction and the sharing of values in the context of a particular institution.
The research conducted in this thesis, in focuses on the subculture of a group of teachers who aimed to change curriculum and educational practices in an vocational art school.

Given this focus, it is important to address::

- How is a culture of innovation developed in the school?
- How do teachers build changes in school?
- What do they mean by change?

Chapter Four - Research Methodology

This chapter presents (i) the research questions; (ii) the research approach; (iii) the research plan; (iv) selection of the project; (v) the researcher role; (vi) the subjectivity in research; (vii) the research methods (viii) the procedures of data collection; (ix) the procedures of data analysis; (x) the issues of validity in qualitative research; (xii) the decisions taken in reporting the study.

In this chapter, I record the research decisions and actions taken in the study. It is written largely in the first person to emphasise the conscious decisions I made.

Research questions

> Some people have the idea that naturalistic fieldwork is just keeping a sharp eye, being open to new impressions. (...) Perhaps the most difficult task of the researcher is to design good questions, research questions, that will direct the looking and the thinking enough and not too much. (Stake, 1995, pg.15)

In order to examine the impact of teachers initiative in changing curriculum, educational practices and the interactions with school culture, as well as, the meaning that these teachers give to their professional experience the following research key questions were addressed:

• What role do projects initiated by teachers play in the processes of changing the curriculum, pedagogical practices and school culture?

• What motivates teachers to become involved in projects intending to transform the school?

• Do projects provide professional development for teachers? Do projects promote teachers' understanding of the dynamics of the curriculum, decision-making processes and changes in the teaching culture?

•How does the school culture affect the development of teachers` projects and decision-making in the school?

These questions reflect and incorporate the role of the teacher as the central agent in reform and decision-making in a specific context and the school as the unit where change occurs.

Research approach

Case study (see, for example Merriam ,1988, Stake, 1995, Simons, 1980, 1996) seemed the most appropriate approach to the study of the phenomenon addressed in the research questions for several reasons. It enabled the researcher:
(i) to follow the development of the project over time;
(ii) to access the interaction within and between groups of teachers and students and between them and the school;
(iii) to understand the meanings that teachers gave to their educational experience;
(iv) to document the interrelationship between teachers' thinking and acting;
(v) to relate the different sources of evidence such as documents, artefacts, narratives, observations and interviews;
(vi) to explore and explain of the complexity of group culture and change;
(vii) to document effects in context.

The case can be simple or specific, for example a case of one teacher, a programme, a class, or it can be complex and abstract such as, in this case, the study of the relationship within the project group and between this and the school during the development of a project that came from teachers' initiative. The case is always a single and well-defined entity. It can be similar to other cases, but it is always distinct and particular (Stake, 1995).

> When we want to study something, that has value by itself, we should choose a case study (Ludke and Andre, 1986).

Although Smith (in Stake, 1995; p.2) said that a case study is a "bounded system", it can happen that boundaries may shift. This case study was initially defined by the

boundaries of the project initiated by teachers of one high school. It is particular by the emphasis given to eliciting and understanding the culture, beliefs, values, norms and patterns of behaviour of the group of teachers. It is particular and distinct from others as it allows an understanding of:

- the motivations, beliefs and expectations of teachers who chose to become involved in group projects;
- factors that inhibit and stimulate project development;
- the culture of the group of teachers who are involved in projects and the culture of the school;
- the role a project generated by teachers' initiative has in creating school climate and culture;
- the relationship between teachers' professional curriculum and their motivations and expectations to participate in projects;
- the relationship between the culture of a project of teachers' initiative and school culture.

While a case study can incorporate a range of methods, both qualitative and quantitative, the case study approach adopted in this study is qualitative or naturalistic. Naturalistic, as defined by Bogdan & Bicklen, (1982); and Kemmis, in Simons, (1987), means that data is collected in the context in which events occur, and through observing people behaving, talking, listening, manipulating resources, elaborating artefacts, and so on (Guba, 1978; Wolf, 1979). The support for this naturalistic, qualitative approach is derived from the idea that human behaviour is significantly influenced by the context in which it takes place and by the feelings, thoughts and behaviour of individuals. The literature on phenomenology points out that it is almost impossible to understand human behaviour without understanding the ways in which individuals interpret their thoughts, feelings and actions (Wilson, 1977).

Ethnographic case study

> The essential core of ethnography is this concern with the meaning of actions and events to the people we seek to understand. Some of these meanings are directly expressed in language; many are taken for granted and communicated only indirectly through world and action. But in every

> society people make constant use of these complex meaning systems to organise their behaviour, to understand themselves and others, and to make sense out of the world in which they live. These systems of meaning constitute their culture; ethnography always implies a theory of culture. (Spradley, 1980; p. 5)

It is particularly apt to describe the case study promoted here as an ethnographic case study as the purpose was to characterise the culture of a group of teachers in the context of one Portuguese high school. This includes the identification of teachers` beliefs about curriculum and instruction and the common frame of reference that related to their behaviour and their actions. For example, the ways in which they organised themselves, interactions in classroom and the school and the selection and production of classroom materials.

Ethnography is seen by Spindler (1987) as an approach that looks for behavioural patterns and cultural knowledge from the "native's point of view, which means that both the behaviour and explanation must be recorded as carefully and systematically as possible, using note taking, tape recorder and cameras. Ethnography initially stemmed from the discipline of anthropology. Hence the use of the word 'native' in much of the literature. In this approach we look for behavioural patterns and 'native' cultural knowledge. Natives are people in situations anywhere - including children and youth in schools - not just people who live in remote jungles or cosy peasant villages.

The ethnographic case study facilitated access to teachers' meanings about their actions in the context of the development of the project, their activities in classrooms and in the school. It examined the relationship between the culture of the project and the school culture as a dynamic process. It identified values, beliefs and ideologies shared by people in the school, and by the project group and explored the interaction between school groups in their educational practices, organisation, discourses and artefacts.

Individual biographical profiles

Part of the process of understanding the culture is understanding the role of the individual within it. The focus of this research is on the meanings and understandings teachers give to their personal and professional experience and how they are related to their current professional decisions now and in the past. This led to the adoption of a biographical approach (Kelchtemans, 1993) for part of the research. The focus on professional life history involved an oral and written narrative where the experiences were located and developed in time and space.

> Teachers' actual thinking and acting constitutes one moment, a fragment in a continuous process of assigning meaning to the perceived and experiential reality (Kelchtemans, 1993; p. 444)

During teachers' personal and professional lives they develop a personal conception of themselves as teachers and a subjective educational theory that consists of a personal system of knowledge and beliefs about their job (Bullough et al. (1991), Kelchtemans, 1993, O'Hanlon, 1993, in Elliot). These biographical sketches were comprised from interviews, observation of actions and teachers' own narrative accounts. The biographical interviews also allowed the researcher to access teachers' beliefs and images about teaching, knowledge, the discipline that they teach, and provided insights about themselves as teachers and as people.

Research methods

The predominant methods utilised in ethnographic case study are participant observation, interviews and document analysis (Hammesley, 1983, Spradley, 1980). These were all adopted in this case study to varying degrees.

Observations. The social interaction of participants was accessed by observations as well as by the analysis of the ways in which particular environmental contexts imposed restraints. Direct observation and participant observation covered the events and their context in real time. The researcher was aware of the fact that her presence could affect the way in which people relate to each other.

Participant observation involves spending a great deal of time in the field and implies a high ability on the part of the researcher to keep in mind the internal and external position in such a way that she can develop insights about what is happening. Yin (1994) synthesised some of the main problems produced by participant observation during research.

> First, the investigator has less ability to work as an external observer and may, at times, have to assume positions or advocacy roles contrary to the interests of good scientific practices. Second, the participant-observer is likely to follow a commonly known phenomenon and become a supporter of the group or organisation being studied, if such support did not already exist. Third, the participant role may simply require too much attention relative to the observer role. The participant-observer may not have sufficient time to take notes or to raise questions about events from different perspectives, as a good observer might. (Yin, 1994; p. 89).

Participant observation implies a constant interpretation by the researcher. What is observed is simultaneously examined in its meaning and redirects observation. New questions also arise. Sometimes early questions are changed by the researcher when they are found to be too broad as the focus of the research narrows.

Often, the information was collected in the flux of an informal talk and within the continuity of participant observation. Sometimes the most meaningful data was obtained not through the questions asked to the participants but through the questions that they asked me. Following Zelditch (1962), participant and direct observation included informal talk and the interviews were used more to catch narratives, events, and practices.

Informal talk occurs naturally and is inherent in observation. I paid special attention to not making assumptions about what was observed without including the participant's point view, (Patton, 1990).

Sometimes in participant observation, feelings about the impact of the project are shared between the researcher and the teachers. Far from this being considered a barrier or a source of bias it is useful to generate understanding.

> Feelings are not something to repress. Rather, if treated correctly, they can be an important aid in doing qualitative research. (Bogdan and Bicklen, 1982; p.132)

The value of observation as a method is to gain a perception of how things work in a particular setting, to study how people act, behave, interact, express feelings, emotions and thoughts. In this study, observation was relevant to understanding the processes used in educational practices that is to say the innovation, the moments of frustration in the project group, the climate and the dynamics developed, how each teacher gave meaning to the educational materials that they conceptualised and the interactions among teachers and teachers and students. In summary, this method allowed me first to understand the context within which the project was developed and provided a holistic perspective. Secondly, it allowed me to adopt an inductive approach to analysis. Thirdly, it allowed me to integrate and relate data collected in interviews with observational data giving me some tips to follow and some parameters that I would not via any other method. Fourthly, it provided to me with an opportunity to move beyond teachers` perceptions about the project and students.

The change in behaviour of the participants in the setting that is observed is the major limitation of this method. Initially, the researcher is a stranger in the setting and may alter the relationship and the behaviour of participants. Time and familiarity will bring a more empathetic and trusting relationship between participants and researcher and this may overcome the limitations of this method. In this study the observation of teachers and students in class was initially disturbed by this factor but after three or four days everybody became accustomed to the researchers' presence.

Interviews are one of the most common and powerful methods we use to try to understand our fellow human beings (Fontana & Frey, in Denzin 1994; p. 361). In this study, reflexive interviewing was developed in opposition to a standardised format schedule. Guides for interviews were developed as a list of questions or issues that should be addressed by the researcher, (Patton, 1990). The fundamental principle of qualitative interviewing applied in this research was to provide a framework within which respondents could express their own understanding in their own terms

The format of the interviews implied above was different from structured or unstructured ones. In the first case, a standardised interview is developed with very precise questions and a respondent is expected to give a more focused answer. In the second case, the interview questions are open-ended without requiring the interviewee to provide a specific piece of information. In this case, interviews were developed as a natural conversation in a straight inter-relationship between the researcher and the interviewees. (Patton, 1990; Hammersley, 1983). My decision to use the interview guide was related to the aims of the study, which were intended to document teachers` meanings about their experience and access their culture. Having an interview guide provides the opportunity to interact with a focus, but also allows individual perspectives and experiences to emerge.

Artefacts. According to Goetz et LeCompte (1984), artefacts provide evidence for the topics that researchers address because they are manifestations of beliefs and behaviours.
Objects from teachers' classrooms were described in context and related to their use, and so were added to the process of analysis, offering ideas, which stimulated further questions. Materials produced by teachers and students also provided evidence of the culture of the educational project as it developed.

Documents in the form of project plans and reports were important to: (i) provide specific details about the project; (ii) allow the researcher to make inferences about aims of the project and implicit theories of the group; (iii) help the generation of questions that encouraged the researcher to inquire further; (iv) confirm information and augment evidence from other sources.

The research plan

This section discusses the plan and the structure of the research. It is important to state at the outset that the design of this research was developed in an ongoing process integrating and incorporating interpretative ideas rather than presenting a "fait accompli" (Wolcott, 1995). Mainly, it was defined as a process of conceptualising from the study's aims and the research questions, to understand the complexity of change and constraints to innovation, in the context of a Portuguese high school. Initial questions were modified in the light of experience in the field.

This case study was structured in three stages. The first stage was the selection and definition of the problem, designing the study, selecting the project and negotiating with the teachers and the school with regards to data gathering. The second stage was data collection and analysis in a continuous process of interpreting the phenomenon, generating questions for further field visits and keeping a reflexive diary about the process. The third stage was generating a substantive theory from an interpretation of the meanings addressed by the participants in the study and examining this theory in the logic of other theories, thus aiming to construct a possible interpretation of the phenomenon. The first stage is described here in the following paragraph, the second one in procedures and the third one will be addressed in the following chapters where the findings and the discussion are presented.

During the first stage, the questions and the plan of action devised to obtain the information needed were addressed. I collected information about schools that had been involved with projects initiated by teachers. I inquired through the Portuguese Institute of Education (IIE) an institution which promotes innovation in schools and supports financially some of the projects submitted by groups of teachers that intend to change curriculum, what projects they had promoted. It was sometimes difficult to match the correspondence between what was written and the reality of projects. Sometimes the written projects analysed were clear in intentions but there was no correspondence in their development. One of the reasons pointed out by the teachers was the lack of knowledge and experience about how to run projects.

Initially six projects were selected in different high schools in Lisbon. All of them presented a plan to create alternatives to the curriculum structured in different disciplines. A small pilot study that included these six projects was developed and I spent three months visiting these schools finally choosing one to be part of the research.

At that time in those schools I also piloted the interview schedule and classroom observation schedule guide. The pilot study helped develop the selection criteria for the case study. It also showed me that the projects initiated by teachers in a curricular area were guided by different motivations: to solve a problem, to experiment with a method or an educational material, to use modern technology in teaching and learning; or to create teamwork in the school. Such projects also involved the study, design, and practice of curricular alternative models. All had the intention of changing educational practice.

Selection of the project

In this ethnographic case study, a criterion-based selection (Goetz et LeCompte,1984) was used to choose the project. I established in advance a list of attributes that the unit for study must possess based on the research problem and questions, and, following Wolcott (1973), on the identification of empirical and theoretical factors considered to affect the research problem and questions. However, after locating some alternatives one was chosen that had most of the attributes and also a willingness to be part of the research and the School Board acceptance.

The project was selected according to the nature and the uniqueness of the curricular project, which was developed by the initiative of a group of mathematics teachers. It was believed that this project could provide an understanding about the processes of change in educational practices and teachers' professional development.

> The first criterion should be to maximise what we can learn. Given our purposes, which cases are likely to lead us to understandings, to assertion, perhaps even to modifying of generalisation. (Stake, 1995; p. 4)

The project was in the process of being developed and its aims covered three dimensions considered by a theory of change as relevant to introduce change in school: curriculum, teaching and learning practices and professional development. The high school in which the project located is a very particular one, due to its long tradition in arts and crafts (see chapter 5). Some factors, which were taken into account in choosing the project included:

- a project that was intended to introduce innovation;
- a project that aimed to create alternatives to a traditional disciplinary curriculum presenting cross-curricula issues, a new method of teaching and learning and a different way of organising resources, space, and time for educational activities;
- a project that was initiated by a group of teachers recognised as leaders in introducing innovation in the school;
- a project that intended to relate the curriculum dimension with other dimensions considered relevant to the implementation of change such as teachers' development and methods of work among teachers (team work).

Selection criteria also included the attitude of the school and its teachers toward the research study. This group of teachers agreed to be studied as they thought that this study could also be a stimulus for reflecting on their practice. In the first contacts they clearly stated that they expected to receive materials that could be useful for their project and the curricular development they intended to carry out.

The project chosen focused on an alternative to curriculum and practices in a mathematics classroom. This project of a group of teachers clearly expressed the intention to change the students` attitudes and beliefs about mathematics, to increase academic achievement in this discipline. It also wanted to promote a cross-curricular approach.

The participants in this research were the teachers and the students involved in the educational project chosen. The Pedagogic Board and other teachers, not involved in the project, were also a source of information.

In this study, the researcher sampled project and not persons per se. The aim was gathering data about what teachers do or do not do in terms of action/interaction and its

variations; the meanings that they attributed to it; the range of conditions that gave rise to their action or interaction and its variations; how conditions changed or stayed the same over time and with what impact; and also the consequences of either actual or failed action or strategies never acted on. For Strauss and Corbin (1990; p.177).

> the aim of theoretical sampling is to sample events, incidents and so forth, that are indicative of categories, their properties, and dimensions, so that you can develop and conceptually relate them.

Researcher role

My aim as a researcher was to assume the role of a "discoverer", open to receive information, to understand processes and meanings, and to generate questions in order to make "the unknown familiar" and "the familiar unknown" (Bogdan and Biklen, 1982). I went to the school, my field of research, with the purpose to observe:
(i) project teachers' meetings; teachers, students and their interactions within the class and school;
(ii) the flow of information in the school;
(iii) the general activities of the school including the physical aspects;
(iv) the relationships established between students and staff.

Some of my activities in the school were to follow teachers` conversations in the teachers' room, observing the interrelationships between them, how the information was exchanged, what was relevant for them in their conversations with each other or in groups, how they grouped themselves informally and formally, and what announcements were posted by them or by the School Board. I took notes afterwards and sometimes photographs to document school activities. Often teachers did not feel that I was a stranger. They recognised me as an equal high school teacher but with an additional role. They saw me as an external element to their school life because I was engaged in academic work. I established an informal relationship with the teachers in the school. In project meetings and activities I observed but also participated by raising questions and debating issues. Sometimes teachers asked me questions to help them to solve some problems. They gave me all the material that they produced and the external materials that they dealt with.

Initially, I integrated myself into school life, looking for elements that could allow me to describe the school and the project. I was more interested in questions of what, how, when and why than in factual aspects. Some time afterwards, I became interested in sharing my experience with teachers and discussing what was happening in the classroom and in the school. I was looking for the meanings that the group of teachers gave to their educational practices and to the interactions that were established in the classroom and in the school. I was involved in the research as a moderate participant as I sought to maintain a balance between being an insider and a outsider. Although I participated in some project and school activities I did not join in class educational activity. My role can be differentiated from the other three types of participant observer: active participant where the researcher seeks to do what other people are doing in an attempt to learn the same behaviour; passive participant where the researcher is present at the scene of action but does not participate or interact with other people to any great extent; non participant, where the observer has no involvement with the people or activities studied (Spradley 1980; p.60).

Subjectivity in research

> Subjectivity is not a badge of honor, something earned like a merit badge and paraded around on special occasions for all to see. Whatever the substance of one's persuasions at a given point, one's subjectivity is like a garment that cannot be removed. It is insistently present in both the research and non-research aspects of our life. (Peshkin, 1988)

The debate about subjectivity in research has taken a shift from the dyad objectivity view that subjectivity is to be avoided and controlled for bias, to the view that subjectivity should be celebrated as a means to understand the complexity of human behaviour and actions.

According to some authors, subjectivity is seen as an unique, useful, personal quality of a researcher (see for example,. Krieger, 1985; Peshkin, 1986, 1988; Rubin, 1981; Smith, 1980), while for others (Eisner, 1990; Guba, 1990a; Reinharz, 1983; Roman and Apple, 1990) subjectivity is an attribute that marks the interaction between researchers and

their research participants. These two positions see subjectivity as an interrelation quality that the researcher can deal with in a reflexive way. In contrast, when subjectivity is seen as distortion and bias, the literature offers advice on how to control it in research. Le Compte (1987), formed in the tradition of the Chicago School, sees a researcher's personal bias in the education history, social class, sex and ethnicity. Professional biases are evident in the identification of the researcher with a specific research focus, the choice of an intellectual paradigm and from the impact of people and opportunities in one professional life. This author stresses the need to "discipline the subjectivity by ethnography of mind" by describing a practice for determining conscious and unconscious sources of bias.

In this study, as a participant observer, I kept a journal about the research to increase my introspectiveness, thus making me "explicitly aware of things that others take for granted" (Spradley, 1980; p. 58). In this, I addressed my assumptions as well as the reflective process of thinking about participants, the project, the data, methodology, and my role.

Initially, at the same time that I was designing the study, I addressed my thoughts, ideas and feelings about the research questions, the approach that I chose, my role in the research and the way I would relate to participants. Here is an example from my research journal:

> I am interested in innovation and change and not in resistance? Why? Why do I choose to look for innovators and pioneers and not for teachers that resist change? And why am I not trying to understand the processes of resistance instead the processes of change? Why am I interested in teachers initiative?
>
> I have to say that I am always interested in challenging processes, in transformatory action toward the statuo quo, in creating alternatives in the school, in educational practices. I always admire creative people that are oriented to intervene in education with values that stress collaboration, and participation.
>
> Why am I in the aims of the study, trying to understand? Am I more interested in the processes in themselves than in the product? The process of understanding promotes also the change of ideas and assumptions...

> Thus if I am valuing the behaviour of innovators and change itself I have tendency to forget the resistance, the frustration ...How am I going to deal with it during the research process? (Notes from the diary of the researcher - September 94)

Applying all these questions to my research, I made some decisions when selecting the reading. I began to look also for literature that addressed resistance. In the interviews I tried, through the questions and the episodes presented to teachers, to give them the opportunity to present "the good and the bad points or experiences". But in this research I had to handle a situation that never had happened before:

> Today, during this second (individual) interview with Maria I felt shocked at one moment when I identified myself with the expressed images of Maria about herself, to be a teacher, education and the way that teachers should intervene in school and her intrinsic motivation to put in practice her ideas. I felt a relief when I thought that the interview was taped. It was the first time that I had to deal with strong emotions in field work. (November, 1995)

From this situation I gained some insights into the relevance of images guiding professional decision-making and action. Some further questions were generated from that moment and registered to explore them in the future. At the same time, I decided to maintain an attentive eye on myself as the researcher keeping the journal up, using taped and written information to cross-reference with my written register. I also included other information from teachers` with Rubin (1981) from the symbolic interactionist tradition, which asserts in discussing the subjective dimension. The only way we can be trapped by our subjectivity is when we are out of awareness (in Le Compte & al 1992; p.708).

Research procedures

First steps in fieldwork. I presented the purpose and procedures of this research to the Portuguese school and to the teachers who were involved in it. I informed the participants about the research plan, the research goals and procedures for collecting and recording data *(Appendix B)*. A guarantee of confidentiality and anonymity of

personal data was given to the participants and a confidential relationship developed which was based upon the acceptance of their different roles between researcher and participants.

The pilot study already referred to provided feedback to redefine the research questions, the aims of the study and helped to plan the research *(Appendix C)*. The open-ended nature of this qualitative research allowed changes in design. During the first stage, for instance, I found, I need to reshape the study in relation to dimensions in the school examining the sources that could give a portrait of school culture. These included characterisations of the structure, organisation, sources of dynamics and conflicts and the aspirations, perceptions and images of the school leaders about the school.

Data collection

Having analysed the pilot study, my decision was to choose only one project in one high school and to follow its development for approximately two years. This option was based on the intention of maximising what would be possible to learn about innovation and change from this particular school

Data was collected in the school, through the methods described above, between the beginning of 1995 and lasted until the end of 1996. The intention was to understand the range of perspectives present in school and how teachers perceived the project. I looked for key informants, teachers and students who were particularly insightful about events in the school and had a greater experience in the school setting. These key informants were teachers who were recognised by others in the school as people with more information, experience or ability to think reflexively (Bodgan and Biklen, 1982)

In this research people ie. teachers, are referred to as participants and not only informants because in an important sense they were participants providing an opportunity to extend the research ideas and introduce new ones. This research is firmly supported by the democratic tradition (Simons, 1987) in the way that participants were treated, in sharing perceptions with them, involving them in contributing to the study and receiving their comments on the accuracy, fairness and reliance of reports.

Observations. The observations of classes, project meetings, Pedagogic Board, and activities developed in the school were complemented by interviews with the leader of projects in the high school and with some good informants, eg. teachers who were recognised by others. These privileged informants, with whom I dealt very often, allowed me to fully participate in the life of the school, to ask questions that arose during observations, to provide reflections about what was happening, and introduced me to some other informants.

In this study, observations were guided by an intention to identify participants' meanings. They took place in different situations in the school community: (a) in interaction with school demands; (b) with educational materials; (c) with their peers. The researcher looked for the meanings that participants - teachers involved in the project - gave to their experiences and actions in the past, both as teachers and as students, and also their actions in the classroom. What participants did, how they reacted to each other and to the educational materials, revealed a style of interpretation that includes the social meaning that they attribute to it.

I prepared a guide for the observation of school and mathematics classes, which included provide context to the meanings given by participants (*Appendix D)*. As an example, teachers and students spoke informally about the school as a prison or a hospital and the way this affected their relationship with the school. A more detailed observation about the physical environment of the school helped to understand their motives for having these images.

Observations centred on project activities: meetings and mathematics classes.
Seven observations of the Pedagogic Board and five observations of the department of mathematics meetings were also useful to characterise the impact of the project on the school culture.

Classes of the five mathematics teachers were observed and some video taped to record:
- the interactions between teacher and students and between students;
- the attitudes of students toward the mathematics educational material and resources presented.
- the emphases in teachers' classroom practice.

In the final stage of the research, I stepped back from my role as a participant to create distance as an observer and to attempt to get a wider viewpoint before leaving the field. Most of the time I took my field notes at the end of the observation and sometimes I described entire episodes.

Interviews. These were conducted with the five teachers involved in the project, twenty seven teachers who belonged to Pedagogic Board of Herculano school, School Board and students of five classes involved in the project. Focus group interviews were conducted with the group of teachers in January 1995, when the research began, and at the end of 1996. Two group interviews were conducted with these teachers, which focused on the meanings of their professional and curricular experience during the project development. In both instances the interviews lasted around sixty minutes and took place in the teachers' office room. *(Appendix E)* contains the interview guides.

In the first individual interview, each of the five teachers had the opportunity to frame their career and personal experiences into a story that was meaningful to them in the physical, institutional environment of the school as well as in the social, cultural and interpersonal context of their life.

The second interview guide addressed how participants related themselves to the learning process as teachers and students. In the latter part of this second interview, some episodes were presented to teachers in order to identify their beliefs about mathematics and teaching and learning. Episodes were short educational real stories taken from observation. This interview was also intended to clarify the responses given to the first interview and the issues that were collected during the observations in the classroom.

These outline protocols – interview guides and episodes - helped to make data collection somewhat systematic for each respondent without losing the flexibility and naturalness of relating the interview to the particular individual. The wording and the sequencing of the questions were adapted to the specific respondents in the context of each interview. Sometimes follow-up questions were used when the researcher felt the need to gain a better understanding of the topic.

Two semi-structured face-to-face interviews were conducted with each of the five teachers, one in February 1995 and another in January 1996. In the first interview, the focus was on their educational experience as a student or as a teacher, their beliefs, their individual motivations, their expectations of involvement in a project, the images that they had about themselves as a teacher, the discipline that they teach, the project with which they were involved, and about themselves as persons. The second addressed how participants related themselves to the learning process as teachers and students. In the second part of this interview, some episodes were presented to teachers in order to identify their beliefs about mathematics and teaching and learning. This interview was also intended to clarify the responses given to the first interview and the issues collected from the observation of their action.

Two interviews that lasted forty five minutes were conducted with six students, considered reliable informants, of each of the five classes involved in the project; one at the beginning of the school year and the other in May, shortly before the end of term. In the first, the intention was to identify students` images, beliefs, attitudes and past experience related to mathematics. In the second, the interview was oriented to identify the impact of the project and the meanings that students gave to their experience with mathematics during the time that they were involved in the project. The selection of students was undertaken by each teacher and the researcher based on observations concerned with attitudes and images about mathematics, and the ability to communicate.

One individual interview of sixty minutes was developed with twenty-seven teachers of Pedagogic Board and the School Board. This interview attempted to characterise some of the main aspects of school culture and to identify the impact of the project in the school. This interview provided an opportunity also for collecting data on rules, beliefs, values, personal theories, images, and plans of action.

All interviews were audio taped by a micro voice-activated cassette recorder and, one day after, they were mapped. Cognitive mapping was used to display the amount of data that was gathered as a suitable method of managing the evidence produced by the semi-structure interviews. Eden, Jones and Sims (1983) describe it as a "modelling technique,

which intends to portray ideas, beliefs, values and attitudes and their relationship one to another in a form which is amenable to study and analysis". I constructed a visual map of one page representing the information and knowledge of each individual using a process of interpreting the data at the same time. This allowed me to gain a picture of the relationship that can exist between elements presented by participants and at the same time the analytic notes of the researcher.

The interviews that were most relevant to my key questions were also transcribed. Written field notes were taken during interviews. The field notes also contained ideas, reflections, strategies which occurred, and "interpretative asides".

Records were maintained in the form of written memos, interview tape transcripts and video film, in order to help control subjectivity and facilitate the researcher's understanding and interpretation of the data. The time between the first and second interview was used to transcribe and to organise the next interview. Interview transcripts were returned to participants to check for accuracy and the computer files were anonymous.

Narratives. Teachers' oral and written reflections about the project development, their activity, students performance and professional development were collected and analysed.

Documents Any documents that were used and produced by the school as School Project and Internal Policies were examined. Some documents usually produced by teachers, i.e. mathematics materials, plans, reports, letters, papers presented, articles for the journal of education etc. provided an opportunity to identify values, conceptions, school rules, and plans of action.

Artefacts. Examples of artefacts that served this study were pictures of students' activities, student work, teachers` work, papers, objects and educational materials that were used during the classroom activities.

Questionnaires. Observations and interviews were the main mode of data collection but questionnaires also proved useful to:

(a) access the background of the five teachers and seventy students;
(b) provide information about the teachers` personal and professional curriculum,
(c) the history of the educational project;
(d) the impact of the project on students' learning processes.

One questionnaire was given to the teachers to access their personal and professional curriculum vitae. Two questionnaires were given to the students. The first was to identify their academic background and difficulties at school, the second was to identify the impact of the project.

Projective task This was also used with students to identify the image and attitude that they had about mathematics and learning mathematics. It was used at the beginning and the end of the school year after students became involved in the project.

Data analysis

Although the most intensive period of data analysis occurred in the later stages of the research, data analysis was an ongoing part of the research done inductively during the process of collecting data. Participants' social knowledge and constructs were used to generate questions and substantive theory (Bogdan and Biklen, 1982) and helped to organise the structure of the research. Theory that came up in this study was grounded in the data derived from the phenomenon investigated, in a inductive process, Glaser and Strauss (1967). The advantage of this approach was the understanding it provided and the new questions and concepts which emerged along the way.

Data analysis was not assumed to be only a cerebral activity as it involves the researcher as a whole person (Oakley, 1994). Although, Charmaz (1990) discusses the role of the researcher as passive when grounded theory is used in the early stages "as the reality" of the setting emerges from the data collected. In this study it was assumed that creativity and intuition was present during the overall process of data collection and analysis providing ongoing process insights and questions.

This study therefore adopted ongoing interpretation avoiding the concerns of causality with regards to what is observed or heard. Blumer (1969) points out:

> Human group life is a vast process of defining to others what to do and of interpreting their definitions; through this process people come to fit their activities to one another and to form their own individual conduct. (...) By virtue of symbolic interaction, human group life is necessarily a formative process and not a mere arena for the expression of pre-existing factors (p. 10)

The formal analysis took place in eleven stages (see next page) utilising data from the following: documents produced by the teachers involved in the project, their narratives about their professional development, artefacts and educational material for classroom activities, interviews maps, written transcripts of interviews, notes taken from observations of School Board meetings, classroom activities, team meetings, informal talks, video tapes and questionnaires formed the data basis for the analysis. I divided the data material in two analysis units that I analysed at different times. The first unit included the data related to the project and the teachers involved in it. The second unit included data related to the school culture and the impact of the project in the school.

The joint process of collecting and analysing data followed the principle of theoretical saturation defined by Glaser and Strauss (1967). When a category was identified in the process of analysing, I used this in looking for more data until the same idea emerged again in different times, in the sense that nothing new was added to this category.

> When saturation occurs, the analyst will usually find that some gap in his theory, especially in his major categories, is almost, if not completely filled. In trying to reach saturation he maximizes differences in his groups in order to maximize the varieties of data bearing on a category, and thereby develops as many diverse properties of the category as possible. (p. 62)

First, I analysed some documents about the project in order to identify teachers' motivations, expectations and beliefs as well as the goals of analysis of the project and its plan of action. This formed a basis for an elaboration of the interview guides and the observations.

Secondly, I analysed the individual and group interviews through the cognitive mapping process (Northcott, 1996). During the time that I was collecting data I listened to the

interviews and mapped them, identifying some categories and raising some questions that guided the next interviews, observations or the collection of documents. I read the field notes and produced a summary and comments. I typed verbatim transcripts from audio tapes for each interview that contained substantial data relating to aims emerging categories..

Thirdly, I used data memos to record the reflections that came to my mind while I was making the observations and listening to or transcribing the interviews. These memos constituted an ongoing process of analysis.

Fourthly, the analysis of the questionnaire given to teachers and students provided elements that together with the interview data allowed me to write the biography of each teacher and student interviewed. These elements were related to their action in the classroom.

Fifthly, I read the interview transcripts several times and devised categories by looking for regularities and patterns in the teachers` responses to questions. At the same time, along with the process of analysis, I wrote my interpretative thoughts in the form of memos. The analysis of the interviews allowed me to identify the implicit theories of teachers, their values and some rules that oriented their practice.

Sixth, I developed axial coding using one category at a time. Strauss (1987) defines axial coding as a process of intense analysis conducted around one category at a time that provides cumulative knowledge about relationships between that category and other categories. This was applied to interviews, documents, teachers` narratives and all the data that were collected and registered about the teachers and the project. This allowed me to cross reference emerging values, implicit theories, and rules that oriented teachers` practice.

Seventh, I developed a systematic coding in relation to the core categories. The core category is the main theme or concern of participants involved in the study (Strauss, 1987).

Eighth, I distributed the different parts of the data into folders. Each folder contained one category.

Ninth, the analysis of notes from classroom observations and the video recordings was related to the interviews and sometimes enlarged the categories and meanings. Sometimes it provided insights that allowed me to organise different observations or collect documents, helping to saturate the data.

Tenth, I cross-referenced my analysis of some teachers artefacts used in class with the analysis of two researchers whom I asked to provide a further opinion.

Finally, I reviewed and reorganised all the data collected in the process of research and generated a revision utilising the Schein's schema noted in chapter 3 in respect to the group and the project. The purpose of using Schein's model was to analyse the culture of the group at different levels - artefacts, values, underlying assumptions - ranging from the visible to the invisible *(Appendix E)*. A more extensive comprehension of the levels and its articulation as culture was addressed in chapter three.
The reports of the analysis were given to participants for comment on their relevance and fairness to the data.

Validity

Qualitative research, like any form of research, aims to provide valid knowledge and a reliable picture of social reality but its claims to validity are often different from those in other research paradigms. The question of validity in qualitative studies has been a main issue of debate as this concept was developed primarily in relation to a positivist paradigm. Three main controversial perspectives are addressed.

Erickson (1986) emphasises the need to meet criteria of quality that includes clarity, appropriateness and usefulness to potential audiences (p.153), while Lincoln and Guba (1985) assert that validity in naturalistic inquiry is the process of demonstrating that the findings that come from the researchers` interpretation of data are credible to those who provided the data. In their perspective, naturalistic inquiry is intended to reconstruct the points of view of participants to confirm that the researcher represents them fairly and

specific techniques for ensuring consistency and rigour were applied. These include a prolonged involvement with those being studied, the systematic use of many sources of data in collecting and analysing that allow the researcher to consider different angles and perspectives, and techniques for respondents` review of researcher findings. Lincoln and Guba also attribute to the potential users of research the role of determining whether the context in which they are interested is similar to the one from which the findings are derived. To accomplish this the researcher presents a "thick description."

A very different position towards this validity is adopted by a critical approach to educational research, which intends to change the relations of power in research through democratisation applied to research design and production (Roman, 1989; Roman and Apple, 1990). In Roman's perspective valid research must use a methodology that:
(i) resonates with the lived experiences of the research group;
(ii) enables members of the group to comprehend and transform their experiences of subordination;
(iii) reduces the divide between the researcher's intellectual work and group members' ordinary ways of describing and understanding their experiences;
(iv) allows the researchers` prior theoretical and political commitments to be informed and transformed by understandings derived from the group's experiences (in Le Compte & al 1992)

In this study validity was achieved in a number of ways to the long time - one year and half- that the researcher was involved in the field with the participants, and also by:
(i) the researcher's access to data and triangulation from various sources;
(ii) the use of a diary where the researcher's subjectivity was addressed by registering thoughts, feelings and decisions and monitoring how they affected the research
(iii) attaining clarity and consistency between research questions, approaches and methods used in collecting and analysing data;
(iv) the evidence given in the study for the findings and conclusions.
(v) the use of a data base to integrate the different information that is distinctive of ethnographic research;
(vi) achieving consistency between research questions, data obtained from different sources and the conclusions addressed (Yin, 1994; p.98).

The use of different data sources and methods for data collection at different times - observations, documents, interviews, questionnaires, teachers' narratives and artefacts helped to reinforce the validity of the data collected in offering the possibility of triangulating the data. Triangulation is particularly useful to prevent:

> The investigator from accepting too readily the validity of initial impressions; it enhances the scope, density, and clarity of constructs developed during the course of the investigation (Glaser and Strauss 1967). It also assists in correcting biases that occur when the ethnographer is the only observer of the phenomenon under investigation (in Goetz & LeCompte, 1984: pg.11).

Respondent validation was applied in this research by presenting the analysis to the teachers involved in the project for their comments on the fairness of the data represented. These teachers also commented on the classroom episodes. Their comments were included in the refining of the theory of their experience and helped to originate new questions. A further process of validation was to ask two experienced researchers to participate in document analysis and artefacts elaborated by teachers and students and cross check the interpretation I was making.

With regard to external validity, it was not the intention of the researcher to formally generalise from this case study. The main concern was to understand the processes of curriculum change and not to prove a theory. The extent to which this research can be seen as successful depends upon the degree to which the beliefs, values and ideologies shared by the group of teachers are clearly elicited and described in context allowing other educators to recognise aspects of the relationship of school culture and group culture in their schools. In this sense, it is close to the kind of generalization described by Stake (1978) as naturalistic through a careful process of documenting the phenomena under consideration in the context in which it occurred.

> Often... the situation is one in which there is a need for generalisation about that particular case or generalisation to a similar case rather than generalisation to a population of cases. Then the demands for typicality and representativeness yield to needs for assurance that the target case is properly described. As readers recognise similarities to cases of interest to them, they establish the basis for naturalistic generalisation (p. 7).

Reporting qualitative data

Having experienced participant observation, inquired through interviews, examined documents and artefacts, and analysed in an ongoing process I then had to take the decision about how to present the data.

Interpreting Wolcott (1994) on the different ways of addressing the data, I made the decision to report the cultural analysis about the project, the group of teachers and the school in section two and the interpretation about the main issues of the research in section three. In writing section two, I used the raw data to present informants' stories but essentially to illustrate the key points of analysis of the group, the project and the school. I extend beyond a descriptive account where data is often said to speak for itself, to identifying relationships among categories and, through the application of Schein's model, to present the culture of the group of teachers involved in the project. Hence the account of the group is itself part of the analysis.

In section three of this thesis, the interpretation of the main issues of the analysis is presented. These include the role of leadership in building a culture of innovation, the interaction between the culture of teaching brought into the high school and the culture of school, as well as the meaning of change in the context of the project, school and the Portuguese mathematics educational community.

In the following chapters, which report the cultural analysis of the school, the project and the group of teachers, are addressed with names that do not correspond to the real ones, in order to preserve the confidentiality of the participants.

Section II - Cultural analysis

Section Two of this thesis describes and analyses the school, the project, and the team of teachers who comprise the initiative group. The three chapters of this section intend to provide the reader with "a cultural picture" of the project, the team and the school in the context in which the study took place. Much of the material of these chapters is derived from the analysis undertaken and described in the early methodology chapter. Quotations from episodes registered, interviews and documents produced by teachers and/or school members are provided to support the text. The three chapters of this section aim to present the culture of innovation of one group of mathematics teachers in the cultural context of one Portuguese high school. This section also provides understanding about the meaning that is given to change by this group of teachers.

Chapter Five: Herculano High school

> Culture lies within the control of those who participate in them; leaders and the members together make their own school.
> Webb and Vulliamy 1996, p. 456 quoting Nias

This chapter presents a description and analysis of the school where the research was constructed. In this study, the school is not seen as an unified entity but as a result of a social construction where dynamics occur through the confrontation of individual cultures, group cultures and the external culture dependent on the different areas of the established power structure. It is assumed that each school builds its own culture based on its members, especially, through the leadership, the story of the institution, professional abilities and competencies, resistance to the dominant culture, interest groups and their logic of action and their relationships with power.

Knowing the school

Arriving at the Herculano High School, which I already knew, as I was a teacher in this school seven years ago, I entered an environment space that was familiar but at the same time different from that I had registered in my memory. The school climate was now friendly than before. The school had became an artistic school and students seemed to have more opportunity to participate. My first reaction was to question myself about what had changed. I was gaining a new perspective from the point of view of a researcher instead of a teacher.

I accepted that I was seeing through new lenses and also that things would not be the same as before. Things move naturally in the flux of change. This has been recognized, and even embraced, as an essential part of the world and of the human condition along as the source of what gives value to individual human existence (Blenkin, Edwards and Kelly 1992; p.7)

The time that I had been out of the school gave me the distance that allowed me to be a participant observer with an implied dual role - of being inside the situation yet outside of it, and to gain an analytical perspective.

The physical space

Herculano school occupies a whole block and is situated on one of Lisbon's seven hills. In 1934 this school was settled in the centre of the city before moving to the current huge building. Students likened the layout of the school, which was built in the seventies, to that of a "hospital" or "prison", pointing to the long, dark corridors off which the classrooms, laboratories and art workshops are located. The snack bar, canteen, gymnasium, washrooms and Students Association room are located on the

opposite side to the classrooms and are connected by a corridor. There are no areas where students and teachers leaving the classrooms can congregate. Students gather together at the stairwell at the entrance to the school, in the hall and outside in the open air.

The brick building has an air of sadness about it, with parts of its exterior neglected. The original paintwork was blue, although this has faded over the thirty or so years that have since passed. The interior of the school has recently been redecorated. The original "dirty green" colour has given way to white, which provides the inside of the building with more light. Concern with the upkeep of the premises is relatively recent. Until the end of the eighties, this merely involved the repair of broken or damaged items - provided the cost was not too high. Now, however, areas are being improved and "humanised", with works of art created by teachers and students on display. Examples of work produced in the ceramics, sculpture and metalwork workshops are to be seen in the entrance, the hall leading to the School Board and the corridors. About two years ago, an exhibition gallery for recognised artists was opened, which includes some of the school's teaching staff and work created by students that is deemed to be of artistic merit. The School Board at the time expressed its desire to renovate one particular area of the school every year so that, little by little, it would become more welcoming and adapted to the needs of the students and teachers. It recognised that there was still a lot to be done, but little could be achieved with the funding received from the Ministry of Education.

> Over recent years the school has improved a good deal in physical terms; it has slowly got better, despite its factory-like appearance. I have never felt comfortable in the teachers' room. The school lacks comfort and organisation - there's no bar in the teachers' room. (PPt - teacher of language department)

There are many students and teachers who feel that, although improvements to the school have been made to its physical appearance, there is still a need for more comfortable areas. The images used by the teachers to describe the school - "factory", "prison", "hospital" - underscore not only the layout of the building but also the way it is experienced and the relationship that is established with it. All these images point to the school areas as being impersonal, cold, melancholy and uncomfortable.

During the nineties, those in charge at the school began equipping the various art sectors and departments, followed by renovation of the workshops, classrooms, laboratories, canteen, corridors and toilets. Over the next few years they plan to renovate the outdoor areas, which are very run down. Situated in a privileged zone overlooking the river, these could be turned into sports or recreational areas, or open workshops. The areas and equipment given over to physical education and sports are outdated and in a poor state of repair, revealing the school's disregard for this activity.
Several teachers have commented on the fact that the school has only recently begun to give thought to the physical comfort of the students and the upkeep of the areas and spaces where they spend their breaks.

The school's relationship with the surrounding area

The school is located in a privileged area in terms of landscape as it overlooks the river Tagus. At the same time, it is situated "metaphorically speaking between three worlds and three ways of life": Old Lisbon, with its quarters, alleyways and courtyards, a run-down estate; and a modern residential complex. Due to its location, the school acts as a border between very different residential areas. These can be characterised as follows:
(i) areas where commerce and services are the main economic activities, with well-rooted sports and cultural activities;
(ii) areas with high unemployment, black market activities, drug trafficking and consequent delinquency;
(iii) the modern residential area, which includes a commercial and recreational area and is mostly occupied by self-employed professionals. (Educational Plan document, p.14)
The fact that the school's students and teachers, and the school itself, do not have roots in this area of the capital is one of the reasons why there is no special relationship with the surrounding community. Students are attracted to the school essentially because of the specific education it provides, the pedagogical and technical suitability of the courses and its former image of prestige. Most of the teachers teaching here choose to do so because of their interest in working in the area of arts and with students that have a vocation toward arts and because of their desire to identify culturally and professionally with their peers. Whether the school is located close to their area of

residence has not played a decisive role in their choice, as it is often the case at other schools in the city.

Other factors that have limited ties with the community, - other agencies, entities and associations in the area - include the school's internal crises towards the end of the seventies and eighties, during which it was made part of a unified school system with the same status as all other schools; the defensive attitude of arts professionals and other teachers, who were outraged at the model imposed by the structural reform of the Ministry of Education; the individualism, the "looking after number one" attitude and the secrecy that characterised the school's closed attitude.

During the nineties, interaction with other institutions became a necessity and the school broadened its horizons a little more and established contacts with professionals and business, European arts schools, another specialised arts school in Oporto, Soares dos Reis, Lisbon City Council and S. João Parish Council. Concern over the safety of students and their property has led to the School Board, the body responsible for Herculano school, taking joint measures with the Ministry of Education, the Home Office and the Parents' Association.

Artistic Education at Herculano High School

This school has considerable experience and a long tradition related to the development of arts and crafts in Portugal. It was founded in 1934, a result of the merger of two old schools of ceramic and applied art. Until 1974, it was a school that prepared professionals in the ornamental arts and provided access to a high level of artistic education, especially in painting and sculpture.

In 1993, during the Portuguese reform (edict nº 684/93, dated 21st July), new courses were created and old ones reorganised. Today, the new curricula are geared towards high school students preparing for higher education generally (General Arts) and six courses for professional activity. In 1993/94, the following courses were organised and implemented:

a) Art and Audio-Visual Communication Technologies;

b) Art and Graphic Communication Technologies;

c) Jewellery and Metalworking Art and Techniques;

d) Ceramics Art and Design;

e) Textile Art and Design;

f) Art and Design of Furniture;

g) General Arts 1;

h) General Arts 2.

After taking and passing written examinations, all 12th Grade students who finish the three years of these courses are awarded a high school certificate. The first five courses lead to a professional education and a professional certificate (Level III). The general courses aim to prepare students for higher education in the arts field: e.g. architecture, design, painting, sculpture, cinema and so on *(Appendix G)*. The syllabuses of all these courses are divided into three parts:

(i) general;

(ii) specific;

(iii) artistic and technical training.

The school offers two different educational programs: one during the day as described above, with nine hundred and twenty five students, ages ranging from 15 to 20 years old; the other, the evening course, is aimed at adult education with three hundred and seventy nine students. The teaching is based on a system of self-contained units covering the following courses:

- General Arts;
- Art and Audio-Visual Communication Technologies;
- Art and Graphic Communication Technologies;
- Art and Design of Furniture.

Slightly more than half of the day students (550) are enrolled in technological courses and attend classes during the day. The school is staffed by 206 teachers, little over fifty percent (115) are arts teachers.

The prestige enjoyed by the school in the past, in the field of decorative arts, is still an important reference for those working and studying here. Recognised Portuguese artists

who attended and taught at the school have helped lend it a certain status. The fact that the school was given the status of a specialised arts school in 1993 fulfilled the hopes of its teaching staff.

> In 1993, as a result of the Education System Law in Principle and legislation establishing the general bases of the organisation of art education, Herculano School had one of its greatest hopes realised with the granting of the status of Specialised Arts School (draft Educational Plan document).

Students wishing to attend the school are motivated towards technical-artistic practice and experience and are attracted by the idea of a different school, one that is less academic and geared to a greater degree towards the arts. The expectations of new students in terms of teaching standards are high and the school does not always live up to them. Although teachers and students are divided when it comes to the preparation provided by the school, there is a general feeling that the training received is adequate and that students will be prepared for their professional lives. Some students recognise that the most important asset provided by the school is professional discipline. Much graphic design, audio-visual and furniture companies seek out students from the school and a minority become public figures.

> Students may not master state-of-the-art technology because the school does not possess the resources and equipment in this area, but their work reveals maturity and study, they have read, they have seen a lot of films. All this enriches students of this school in relation to others where students graduate in six months. There are former students that have excelled in this field (teacher of technology PTd).

Many of the teachers were students at the school when it was still known as the School of Decorative Arts. The image they portray when speaking of the past is of a school that was different from the others, with few students following arts courses (Painting, Sculpture, Ceramics, Furniture, Lithography, etc.) and where teaching was based on the master-apprentice approach. The master - the name that is given to a professional of arts and crafts - possessed practical knowledge acquired during his professional life and the student wanted to emulate him. This approach was carried out in an atmosphere of

professional - but not academic - discipline. There was a family-like atmosphere at the school, and many stories are told about teachers that they knew.

The students

To speak of the young students that attend this school means talking about who they are, where they come from, the problems they have, how they relate to the practical and theoretical aspects of their courses, how they interact and, most importantly, their experience of the school.

Students wishing to attend this school have completed their high school education and are seeking practical contact with art, the acquisition of skills and techniques that can help them carry out projects and start their professional activity. Generally speaking, they are young people who do not enjoy routine, they seek ways of expressing themselves through the creative arts, and they seek situations, which stimulate creativity and the "space" to be themselves. They appreciate teachers who are firm, who respect others and make others respect them, but who are at the same time kind and good-natured, communicative, patient and who stimulate them to work, as they recognise that often they do not pay the attention that they should. The variety of teaching strategies is appreciated by the students, as is anything involving practical work.

Great esteem is placed by these young adults on the informality and social interaction between students, and between students and teachers. Meetings between students and teachers in the school's bar or in the café, are common. Sitting around a table talking, is something which sets this school apart from others. Students sometimes even attend exhibitions in galleries and museums with the more available teachers. Although rather dilapidated, the schools outside areas are taken full advantage of during breaks, with students simply enjoying the sunshine, playing the bongos, juggling and chatting.

The students come from different geographical areas. Approximately, 50% live in Lisbon, the remainder in the surrounding districts. There are also students from other parts of the country that have left their family behind in order to attend the school. A

study undertaken shows that the average time taken by students to reach school and vice-versa is around 55 minutes. 15% of students, however, take ninety minutes and 6% approximately 12 minutes. The socio-economic stratum of the students is varied; students from financially well-off, well-educated families attend the school, as do the children of intellectuals and artists, and others from less favoured backgrounds, the members of their family often only having received primary school education. To overcome students' financial difficulties, the school has a socio-economic support system - SASE - that has received around 100 requests for support over recent years. Students believe that the funding provided is insufficient, however, to meet the art course expenses, the materials for which are very expensive. Economic difficulties, besides cultural background, access to funding and the art world, working habits and methods, all have repercussions on the performance/success of the students.

Academic results from 1995/96 indicate that Mathematics, Foreign Languages and the History of Art are the stumbling blocks for students at the school. 23% of 10th Grade students and 34% of 12th Grade students fail these subjects. Many of these underachiever students were enrolled in technological courses.

Perhaps because the right to be different is recognised at this school, perhaps because the atmosphere here is open and tolerant, perhaps as a result of the teaching of practical arts classes, the school is sought out by many students with learning or social integration problems, ethnic minorities and others with hearing difficulties. Hence the great heterogeneity of the student population.

The Faculty

The 206 teachers at the school are comprised of educational professionals who are teachers of traditional subjects and artistic and technological professionals including artists and crafts masters. Seventy percent of teachers in school are female while most of the males are technological professionals.

This professional divide does in fact have repercussions on their life at the school, on the relationships they forge with the institution and on knowledge. What is favoured by some - theoretical knowledge, linked to written and oral communication - is denigrated

by others who favour the practical understanding gained from experimenting and having contact with specific materials and equipment. Experiences, styles and knowledge are all very different, which means that discussing curricular and pedagogical matters is a complicated affair. Traditionally, the apprentice student learning from the master's steps still has an influence on the way in which certain arts workshops function. There is an underlying conflict between the "pedagogical or academic" teachers, as they are called, and those that teach special techniques. This conflict came into being after the school was included in the unified educational system in 1975, which instituted specific qualifications for the teaching of subjects by primary and secondary school teachers, with no reference to masters of arts and crafts who also teach in this school. Later, at the end of the eighties, in the light of the persistence of teachers of special techniques at the school, representing around 29% of its teaching staff, the Ministry of Education recognised the services that had been rendered by them and gave permanent posts to teachers with more than 10 years' experience. More than just a question of career, however, this is a cultural issue and has to do with ways of thinking, being and acting. Whilst academic teachers place an emphasis on theory, written work, reading, exercises, tests and organisation, others stress the importance of work carried out in the workshop, techniques' experimenting, practical exercises and "open door" workshops.

The voices of the artists and masters (professional of arts):

> When I was a teacher at Herculano, when classes began I used to tell my students that if anyone wanted to go out dating or go to the cinema then for them to go because they wouldn't be missed, but those that stayed would have to work and work hard or they'd be out. Those that stayed really did get down to work while I took the chance to paint. And at the end I'd offer my work to the students. Some of them still talk to me about it! (Teacher-master of ceramics)

> Open to all aesthetic and cultural trends, Herculano (despite attempts to bureaucratise the school and bring it into line with other secondary schools) is still - and will certainly continue to be - a place where young people who appreciate and want to develop their creativity are given the chance to cultivate their right to be different, to do research and improve their skills, becoming artists able to exercise a profession. (Teacher-master of textiles)

The heterogeneity of the teaching staff leads to a clash of subcultures. This is seen as enriching by many teachers as it means that students come into contact with a wide range of models. Yet it is also seen as a weakness as it leads to division and an "each to his own" approach.

> The school's strength and weakness resides in this heterogeneity. If, on the one hand, it is enriching and leads to a multiform dynamism, on the other it leads to an "encapsulation" of the different areas, resulting in poor participation and involvement in the building of alternatives and answers to the problems and aspirations of the school. (Educational Plan PE)

Non-teaching staff

At the school, 51 employees carry out different functions to support the school. 14 work in the administrative department, 28 are "auxiliares de educação" providing support for teachers and students in the various areas of the school. The professional situation of the 51 members of the non teaching staff is quite varied; 35 are permanent employees at the school, organised hierarchically by responsibility. This provides them with a certain economic security, unlike the remaining members of staff who were admitted to the school around four years ago and are on renewable annual contracts.

Generally speaking the education level of the non-teaching staff is low. Given this and their lack of specific training, the helpers are given little regard and little respect by teaching staff and students alike. Their day-to-day work involves cleaning, opening classrooms, distributing support material, checking teacher absences, selling stationery material and photocopying. Legislation does not clearly cover the position of helper and the result is that they carry out a variety of tasks that have little to do with assisting the education of the young people attending the school.

The relational space

The general atmosphere at the school is calm if compared to the majority of secondary schools where the cries and games of the younger students (12-15) tend to cause a certain racket. At this school, the students are aged between 15 and 20. During the

breaks between lessons, signalled by a bell that rings every fifty minutes, the students sit quietly on the floor; there are few benches and informality and physical proximity are more important than the cold floor. The students make themselves heard through the Students Association and at the meetings of class representatives. The Parents Association has contacts with those responsible for the school in 1995 to improve physical conditions at the school, the food and areas for extracurricular activities.

A panel of coloured tiles produced by teachers and students hangs over the glassed entrance door to the school, inscribed with a phrase that has become the school's motto: "Herculano School, I love you". This phrase was scribbled on and rubbed off the school walls and entrance gate so many times that it was finally adopted as a symbol of the way students feel about the school. From the informal contact and interviews with students over the year and a half I spent at the school as a participating observer, it was clear that they felt at ease at the school, and that they enjoyed being there, despite the fact that they recognised that there were and still are a lot of things that could be improved. They frequently compared the school with others they had attended and said they felt happy there, because they "felt free" to be themselves and were accepted in spite of their red or blue hair, their unusual or even exotic clothes, their tastes and their juggling or percussive music. They recognised that they had met fellow students with similar tastes there and had forged many close friendships, even with certain teachers. They stressed the informal atmosphere of the place and the close way in which the teachers interacted with the students; they would often spend their break sitting at a table in the café chatting to a teacher.

When teachers and students speak of the school, the positive aspects they mention are the tolerant, happy, relaxed atmosphere, the sense of mutual help, the acceptance of an individual's desire to be and act differently, and, to a lesser extent, to think differently. Some of the teachers at the school have pointed out that, unlike other schools, there is no standardised behaviour, which gives the impression of freedom to do what one wants. At the same time, individualism and creativity are cultivated as specific characteristic of the students studying art. Those at the school do not possess a sense of collaboration and rarely do circumstances lead them to work as a team. "Empathy", shared interests and ideas, is what leads students to form groups.

> This is a school where the emphasis is placed on "the freedom to be oneself". It is a school that gives teachers and students the opportunity to be themselves. There is no set pattern of behaviour. People can act well or badly depending on what they are in reality - they can do their worst or their best. The atmosphere is not one of control, people feel no social pressure regarding their behaviour. But all this has a price. It is a school in which you can invest everything or nothing.
>
> The school is characterised by its artistic atmosphere, in other words, an atmosphere geared towards art as an option. The people here are inherently individualistic. They are essentially creative people. Creation is an act that has a very high degree of individuality and a very high degree of originality about it, and this is reflected in the motto "the artist does not wish to belong to the flock".
>
> What characterises the school is the existence of circumstances that lead people to act in a certain way. The group exists as an objective and then each person goes his or her own way. The same thing happens with the students. The students that are here have chosen this course, they are not very collaborative and team work oriented. Take the Students Association, for example, which can mobilise the whole school for a campaign but cannot then mobilise the students to put the programme into practice, only 2 or three remain in the Association. The moment of the campaign is an event (posters, slides, exhibitions, music, paper, slogans). (Teacher of Art History- PHn)

It is a school where there are no obvious conflicts, where, in fact, teacher-student, student-student and teacher-teacher relations are not strained. For teachers and students connected with the arts, the school is seen as a place that provides professional and cultural identification.

> Students act differently from those at other schools. In the past this was even more so, more noticeable perhaps. The students are at ease when dealing with teachers (which is a very positive factor). This really is the right school for anyone wanting to get into the Arts. It is a school where there are no serious discipline problems. (PPt)

The right to be different, acceptance of others and the openness to various cultural trends are aspects that have been adopted by the whole school. In the educational plan currently under discussion, the school is characterised as a place where young people can develop their imagination and creative and critical capacity.

> By remaining open to various cultural trends, Herculano School today continues to be a place where young people can develop their imagination and creative and critical capacity, and where they have the chance to cultivate the right to be different and attain the skills they need to become art and technological professionals able to exercise a profession (Educational Plan doc 2 PE).

Nevertheless, students and teachers do not always feel that the necessary dynamism exists to stimulate creativity.

School management

> "...any existing model depends on the cultural context and is the product of a historical evolution, the result of a game of strength determined by conflicts created by antagonistic interests." (Afonso, 1993; p.13)

In order to understand the organisation and management of Herculano School, the adopted model for schools and long Portuguese tradition in this area need to be examined.

The democratic management model in force in the majority of Portuguese schools, and consequently at the Herculano School, -Decree-Law nº 769-A/76 - was implemented in Portuguese schools in the wake of the April 1974 revolution. This model introduced the election of teachers to form a team of three or five - depending on whether the number of students is above or below 1000 - which make up the School Board and they hold their post for a period of two years, through they may be elected in later years for other mandates. The election of the five teachers that make up the School Board is carried out by the whole of the school's teaching staff, and this replaces the traditional director or head at secondary schools. Prior to 1974, nominees for the position of headmaster were politically trusted individuals belonging to the only political party - National Union - that was in power for forty-eight years, and were nominated by the Education Department. The introduction of the democratic participation of teachers in electing the school board was imposed on official policy by a spontaneous movement led by teachers

New model management. In 1992, during the introduction of administrative reform in education, a new experimental model was introduced which made a distinction between administration and management, creating two bodies, the School Board and the Management Board. The School Board defines the school's educational policies, approves the annual plan of activities, the budget, internal norms, and oversees their execution, while the Management Board has executive functions and deals with the day-to-day management of the school. This model implies the constitution of a school board, which takes control away from the teachers at the school, introduces new members into the management, such as the representatives of parents and local figures, implying a greater interaction with the community. The implementation of this model met with great resistance on the part of teachers as it reduced their influence in the running of the school, giving way to parents and figures from the local community, with six teachers out of a group of thirteen. It also introduced the position of executive director, which was seen by the unions in a pejorative way as a specialised manager.

> With the task of running and implementing regulations and objectives decided by people totally cut off from the everyday realities of school life" (in Afonso, FENPROF, 1991b).

Feeling of losing power. Given the resistance of teachers, it was left to the criteria of each school to opt for either the democratic management model or the model based on the school board. There has never been in-depth discussion at Herculano School on the new management model. The school's directors have done nothing more than distribute the official guidelines to the members of the Pedagogical Board, but neither those in charge at the school nor the teachers have shown any interest in discussing the proposal. The comments made by the Pedagogical Board are indicative of the fear that elements outside the school will be allowed to have a say in its management, essentially a feeling of losing power.

The long tradition of political and administrative centralisation, in which the majority of schools are public and administered by central government, in which larger or lesser decisions are made by the departments of the state, has meant that schools have difficulty in acting autonomously. Legislation introduced (Decree-Law nº 43/89, February 3rd) covers the pedagogical and financial autonomy of schools and gives each

one the opportunity to define its identity and plan of action through its Educational Plan *(see Appendix H)* This school began drawing up its Educational Plan in 1995, three years after the first educational plans had appeared at the school.

Structure

This Portuguese high school is structured in the same way as others of the same level of education. It comprises a School Board of five teachers, two students elected in school students' meetings and one person from the school's staff. This School Board is responsible for solving school problems, for organising, managing and executing the national policies, and the guidelines established by the Pedagogical Board. It must also answer to and collaborate with the educational state department.

There exists a good deal of legislation governing the functions of the School Board. Edict nº 667/77 for instance, focuses on its procedural norms and competencies.

> Comply with the legal norms, regulations and decisions in force, resolving issues that are of their jurisdiction and passing others on to the respective departments at the Ministry of Education; provide inspection and pedagogical departments with all the help they require.

There is a contradiction in the content of the different policies regarding the role of the School Board, with two models in question: one intended to centralise, another to give autonomy. Some policies, such as the above, address the rules and procedures that the School Board should follow. The law in principle, on the other hand, the legislation governing the autonomy of schools, is about initiative, recognising the active participation of the school as a community.

Teachers who see the school as more than just a place where students receive instruction regard the School Board that has been in power over the last few years as slow to act and not fully aware of the need to modernise the school, afraid to make the school more outward looking, slow in finding solutions to curricular and organisational change that would offer an education that helps integrate the student in professional life or continue with his studies. For many students, the School Board is a "closed door" which ignores

their proposals and initiatives and hides behind bureaucracy. A large part of the school community is kept uninformed and sees the action of the School Board as the simple day-to-day management of school affairs, with no established educational objectives orienting their action and leading to an improvement in the education provided by the school. The School Board appears to want to "raise" the intermediate structures through elections, but there is a void in relation to its programme of action. The emphasis placed on the bureaucratic logic of accounting for its actions and answering to higher structures appears to prevent members of the community from effectively participating.

The President of the School Board is the school's hierarchical and disciplinary authority, presiding over meetings of the School Board and Pedagogical Board, signing mail, establishing ties with the Parents' Association and so on, and is accountable to the Ministry of Education for the organisation and smooth running of the school. At the school in question, everybody respects the President, not only because of what he represents but also as a colleague recognised as a competent professional, a fair, sensible figure who stands up for his colleagues. He frequently acts as an arbitrator when disputes arise and has already been investigated by higher instances as a result of complaints from teachers unhappy with the policy followed by the School Board concerning the protection given to teachers. His ties with unions in favour of "equal work, equal pay" are not in keeping with the position he holds.

The Pedagogical Board (PB) is the entity at the school that is responsible for educational activity. It is made up of the President and Secretary of the School Board, prefects, and a form teacher co-ordinator from each curricular area, student representatives (one for each year), a representative of the advisory board and a representative of the Parents Association. The two students' representatives were only allowed to attend meetings of the board one year after the Parents' Association was set up, which leads one to believe that the latter had some say in the opening of "a space of power for parents and students". Initially there was some hostility between the School Board and the parents' representatives, a result of the resistance to elements outside the school being allowed in, but over time this has given way to mutual respect. An analysis of the observations carried out in six meetings of this board during the 1995/96 academic year shows that most of this body's time is taken up with information regarding the management of the school, from the central departments of the Ministry,

from entities wishing to disseminate or request the participation of students and teachers in cultural and educational activities. Planning, organisation and decision-making on pedagogical aspects and on school life are not given much attention by this board. In one school year the subjects that led to the most pedagogical discussion were the content and selection process for exhibitions at the school gallery and the revision of curricular programs. Issues related to student assessment, tests, exams and assessment meetings are brought up at half the meetings that take place.

The President of the School Board is in favour of the creation of regulations at the school, which make the rules of its operation explicit and, principally, provide transparency in terms of the management of money. He is interested in accounting for his actions to its members and seeks support from the Pedagogical Board for his decisions. The thirty-one members of the board are grouped in sections, which meet and work separately on issues such as teacher training, extracurricular activities, the school's educational plan and pedagogical organisation.

Active participation only comes from six or seven teachers; the others ask for explanations, provide information on the section's activities and little more. Worthy of note is the fact that the President takes up most of the speaking time, seconded by a teacher – Director of the Art and Audio-Visual Department, until he resigned. As his opinions differed, the latter would speak for lengthy periods and annoy many of those present, who "adopted the silent approach so as not to wear themselves out". The parents' representatives raise issues, ask for additional information and often put forward strategies aimed at improving living and working conditions at the school. The students speak out on pedagogical and organisational questions, but occasionally prove reluctant to speak when there is a clash of positions.

Initiative and dynamism at the school

> The internal situation of the school neither stimulates nor motivates the launch of experiments and the people are afraid of failure. The teachers do what they can, but that is little. I can go and talk to someone at a company, get something started, but the school never follows it up... (PTj)

Besides the organisational structure of the school, the dynamics that these structures involve also needs to be understood, as does the extent to which participation and initiative are taken up by the various members of the school community, the ties that are established between groups, departments, associations and the outside community, the groups themselves and their leadership.

The pace of life at the school is dictated by the School Board - as this is the instituted power - as a result of the close ties it establishes, but also because it is often in possession of information which is not circulated throughout the school as the established circuits do not operate properly. Although there is little participation on the part of teachers and a fair amount of criticism of many of the actions undertaken by the school's administration, there is no outright opposition as an organised group. The teachers share a feeling that there is little point in taking the initiative or getting too involved as this would only lead to disappointment, and would be seen as the individual will of a person seeking confrontation.

The School Board has expressed the desire that the school's intermediate structures function in such a way as to encourage decentralisation, although the co-ordinators, form representatives and form teachers have difficulty in motivating groups and solving problems. There is always a heavy reliance on the acceptance or otherwise of the President of the School Board. Students, parents and teachers often approach the School Board to try and obtain information, explain situations, ask for material or equipment, request permission to use the school's areas and equipment for educational activities, resolve conflicts between teachers, between students or between both, make complaints about the most varied matters, forcing the School Board to take on the day-to-day management as the different members of the school community do not recognise the intermediate structures and no project exists to organise action around the pedagogical goals to be achieved. Nevertheless, the "agenda" works to some extent despite the efforts undertaken. Despite the fact that the School Board has strengthened the intermediate structures, this has not led to decentralisation. Given the quantity and quality of the tasks and solutions expected of it, the School Board undergoes its fair share of difficult moments.

The school's educational plan was implemented as a result of the need to create guidelines for the school and to justify applications for funding. It was drawn up by a small group of teachers after consultation with teachers and students, and then taken to the Pedagogical Board and Parents' Association, and from there to the subject groups and arts departments by the respective representatives. This ensured that teachers at the school were allowed to have their say, but all the remaining members of the school were left out of the process. A few small alterations were introduced and the document covers guidelines in terms of student and teacher training and the organisation of the school, but now it does not operationalise or plans any future action.

The School Board is not a single body in charge of an educational plan but five separate members who divide responsibilities amongst themselves: one deals with student issues, another with teacher issues, one takes care of financial management, another deals with financial resources and the fifth deals with issues related to the evening classes. The President is represented in all structures and working groups, and is heavily depended on by the more insecure teachers or those whose ideas are unclear, underlining the high degree of centralisation that exists in the school's management model and the dynamics it generates.

Priorities are established by the President of the School Board. From the interview conducted with him, from informal conversations and from the priorities he sets, it is clear that his aim is to improve working conditions by renovating areas of the school and purchasing equipment and materials. Another of his ambitions is to restructure the syllabuses of the day and evening courses so as to create a school that is identified with specialised arts teaching, to make the school and its work known. He is also highly concerned with revealing the sources of funding received by the school and the way it is spent; in other words, "the transparency of the management of the school". Some of the School Board's projects get off the ground but end unsuccessfully. The school magazine was one such example, since teachers were unable to agree on its form and content. For some, it was felt that the magazine should provide information on the teaching at the school, putting across an image of quality. They felt it should be of high graphic, visual and editorial quality, its articles selected carefully. For others, it was felt that the magazine should be open to students and all members of the school community that wished to collaborate, motivating the students and disseminating information about

the school. Some were more worried about the product itself, others about student and teacher participation. This was an example of pedagogical controversy among different groups of interest in school.

In the teachers' opinion there is room for initiative, but getting projects off the ground is a hard task given the many difficulties and obstacles that have to be overcome, including the passivity of school structures and a certain resistance on the part of some of their colleagues. The School Board does not encourage initiative in the members of the school community but it is not, generally speaking, opposed to it, either. It does not deliberately create obstacles in the way of the development of cultural and pedagogical initiatives, provided that these do not prejudice the normal day-to-day academic running of the school. They are allowed to take place if the Pedagogical Board gives its blessing. The teachers come up with the largest number of individual or small group initiatives; the students rarely do and the non-teaching staff even more rarely as they have difficulty getting organised and feel that their roles are not acknowledged.

In recent years there have been more initiatives on the part of teachers since these are concerned with the problems of the school, with the needs and interests of the students above and beyond mere academic aspects, and because they feel that something can be done. These teachers get together informally as they share the desire to carry out pedagogical experiments in the classroom, to present an alternative syllabus, to compete for a contest, promoted by state - which is an opportunity to obtain funding for the school – to introduce an extracurricular activity such as the recycling of paper, to promote cultural activities and visits to centres of historical, natural or environmental interest, to play sports or take part in outdoor activities such as nature hikes, and to create spaces for healthy recreation and fraternising. The development of an alternative mathematics syllabus for arts students enrolled in technological courses and the supervision of its implementation caught the imagination of a group of teachers and received recognition from the Ministry of Education, later being adopted by another arts school.

The introduction of an outside project - "Viva a Escola" - geared towards the mental and psychological welfare of students (prevention of deviant behaviour) by encouraging student participation at the school, has led to an increase in the number of teacher

initiatives, to a shifting of the focus from the syllabus and organisation to learning how to live, to be and to participate. The school's psychologist has played an important role in the preparation of activities that provide situations focusing on social integration, communication between people of various ages and wholesome experiences and practices. "Viva a Escola" has, on the one hand, become a way of encouraging recognition of individual initiatives and those of small groups of teachers, and has given confidence to other members of the school community. Theatre, the recycling of paper and open-air walks in protected areas are some of the activities carried out by students and teachers throughout the academic year. The "Revolta das Trinchas" was an idea that a small group of teachers came up with which has proved extremely popular with students, thanks to its originality and its free character, as students had arts material and space to freely express themselves through painting.

Student dynamism. Those elected to the students association set themselves the aim of gaining space for student activities - open-air theatre and club - and showed concern for renovating run-down areas of the school and social aspects, such as the financial difficulties that many students are faced with when buying books and materials, which are very expensive. For the first time, books were collected from old students and distributed to newcomers with economic difficulties.

Students took advantage of some areas of the school that were not used for academic purposes and redecorated them, adapting them to activities they are developing and thus participating in improving their learning conditions.

Images of the school

Sharing the idea that the school is an organisation constructed socially with its own identity, an increasingly large number of educational administration researchers have adopted the term "culture" to define the social and phenomenological singularity of a specific school community. The concept of culture was imported from the field of anthropology for the study of organisations and has recently begun to be understood as an interpretative and analytical metaphor of schools from an organisational viewpoint (Sanches, 1991; Nóvoa, 1992; Gomes, 1993). The image that the school community has of the school itself has to do with the symbolic construction that is carried out and

which influences the construction of identity. From what teachers said in interviews, at meetings and in informal conversations, four metaphors could be identified: company, diversity, family and free zone.

Company - The image of the school associated with the corporate world, to the external challenges of a developing society with a connection to the expectations of the market, is held by teachers who have professional company experience, parents concerned about the professional future of their children, and students who want to finish secondary school and start their professional careers.

> The school has to widen its horizons, to work with companies on training courses during the summer, like Delfim Santos does. Ties with the community are few and far between at this school, as it has no roots. (teacher of technology -PId)

> As far as textile students are concerned, I feel it is important that they should be taught skills which will be of use to them for any technology. Students should have contact throughout the course with the professional world, with things that are done outside in the real world, but with what is geared towards textile design and not traditional factories where all they do is weave. They need contact with the world of fashion. That means being aware of what people wear, what their tastes are and what they buy.
> (...) the climate of crisis in this sector in terms of business, the competition of countries such as the Philippines, Korea, etc., the lack of competitiveness of companies in the sector and the close ties between consumption and production. All this justifies investment in the training of designers who are able to constantly create new designs, because no one wants to wear the same thing as their neighbour. (teacher-PTj)

Educational proposals aimed at modernising the school and introducing changes that bring it into line with the demands of today's world are expressed in the Educational Plan.

> A school with a long tradition in the field of arts teaching, it has undergone successive curricular changes yet retained the specific nature of its teaching. The school recognises that there is still much that needs to be defined, organised and planned before an educational proposal can be implemented that provides artistic training open to change and the demands of today's

> world, that can meet the interests, needs and expectations of the students and the challenges that lie ahead. (Educational Plan)

Texts drawn up by a group of teachers at the school point to student training linked to design and production.

> The professional trained by schools specialising in the arts should be able, through specific project methodology, to define simple, logical, harmonious and original structures that represent exact and just solutions to the problems derived from expressed needs. (...) The aim of specialised schools is to train people to carry out in full projects of prototypes from the design stage through to the production and critical analysis stage (Curriculum presentation)

It is recognised that the curricular organisation of the school does not meet the needs of production.

> The student should design, present a project and develop it using the workshops as and when necessary, all the way through to the printout stage. There should be workshops operating the whole time to provide support for students, and not one teacher for each class. (Curriculum presentation)

Some teachers even believe there should be an industry-school relationship in order to prepare students for professional life rather than higher education.

> The teachers should all be professionals, which is difficult as they are paid much less than outside. (...) If there were an industry-school relationship, companies could donate equipment to the school. The school should also have links with professional and business associations. (Teacher of technology -PGm)

Those teachers that would like to see the school open up to the outside world, to the business world, to the challenges of modern society, criticise the fact that there are no links between the school and professional life, that syllabuses are disconnected from application, that knowledge is compartmentalised and there is a gap between theory and practice.

Diversity - is something that students and teachers aspire to in relation to the school. This idea of difference was acquired in the past and any attempt to make syllabuses or educational practices similar or to bring the organisational model into line with other secondary schools is seen as an affront. The school reached its peak when it claimed to be a "free zone", during which time uniquely original arts practices found nowhere else were adopted. The project was led by the charismatic Lino António, now known only to those that lived through this period.

Students are attracted to the school by this difference they have heard mentioned, reflected in the acceptance of a different way of being, one in which each person's dress sense is respected, as are their works, their rhythms, their working and creative experiences. They also seek a "doorway" to the arts, a chance to do things that were hitherto out of their reach and have contact with arts professionals. The expectations of students and even some teachers are occasionally too high, and disappointment follows their first contact with the day-to-day reality at the school. The way of life and atmosphere are recognised by teachers and students as being different. The public's image of the school is that it is a different school, a tolerant one that allows behaviour that would not be permitted at other schools.

> Students act differently from those at other schools. In the past this was even more so, more noticeable perhaps. The students are at ease when dealing with teachers (which is a very positive factor). This really is the right school for anyone wanting to get into the Arts. It is a school where there are no serious discipline problems. (teacher of Portuguese - PPt)

> When I was at the "Belas Artes" I had colleagues that had come from Herculano School; they were well prepared and did excellent things. I was also surprised: the first time I attended the school there were kids that did things (graphic design) in the 10th Grade that I had never done. (Teacher of Drawing - PDz)

The school is still viewed as different as it brings together in one place studio equipment, technology and arts professionals, an attraction not only for students but also for teachers with artistic and cultural knowledge and interests. There is a search for identity on the part of those wishing to attend the school.

> The school is attractive to teachers who want to work with fellow artists who speak the same language, use the same dialogue, the same vocabulary and share the same interests. (Teacher of Geometry -PTz)

> These are the people that make the school different from other schools. One of the great advantages is that is provides a good deal of motivation for the students. A student that goes to a school and knows he was important, or important in that area, feels highly motivated. (Teacher of technology - PId)

Nevertheless, it is at the management level that many teachers feel that Herculano School is less different than other secondary schools as the management and organisation model is practically the same as that used at most others.
Some believe that there are organisational and management methods that are more suitable for this school given that it is a special case and given the need to build a network with others artistic schools in european space, which promotes the training of teachers and students.

> The management strategy is that of a secondary school, not a totally different school. It is as closed around it as many others.
> The school should focus on a new management strategy, which opens it up to the outside - nationally and internationally - to companies and practical experience. There is a need for an educational plan that brings together what already exists and the different efforts that are being undertaken. (teacher of technology - PTj)

Family - To an extent, importance is still placed on the close relationships between members of the school and not on the regulations. Friendship and mutual help between teachers and students are favoured. There are even teachers who were students at the school who would like to see the school become one "big happy family" as it was in the past.

I would like the school to be like the old Herculano School again. We were one big family: everyone knew everyone else, we shared the same concerns and got on well together. I wish the school were warm and welcoming, and that the aims for which it was created were lived more intensely, to prepare students not only for arts school but also for the various technologies. (Head of Former teachers - PGa)

There is a certain conflict between teachers that has to do with the division created by the professional status of teachers of theoretical classes and teachers of practical classes.

Free Zone - the school functions on a day-to-day basis with implicit rules that were instituted in the past when the school was a prestigious arts school, one that followed the ideological contestation of the former dictatorial regime, a "free zone" since it was not subject to national curricular standards; each craftsman could choose to do what he wanted with his pupils. Whenever possible, individual approaches are allowed, reflected in the absence of common criteria in relation to the presence or absence of students - including the exams themselves - and to the resistance to the application of regulations, both internal and external. A phrase by a member of the Pedagogical Board in respect of the creation of school regulations sums up the feelings of many others: "The school has always got along without regulations so I hope that it takes several years to draw them up."

The public image of an arts school - the social prestige that was attained in the past is a result of the position it occupied in the field of training recognised artists, of professionals employed by companies and the quality of the masters (professional of arts) on the school's teaching staff, who also ran it.

> The school has the image of an arts school, the prestige it acquired around 30 years ago. The majority of artists were trained here and made their mark on Portuguese society. I don't know what it's like today, but that idea still persists to a certain extent. The influence of the past has more advantages than disadvantages. One of the obvious advantages is that they're convinced that this is just for artists. There's a large group of people who pass through here and could pass through any secondary school, yet there is a minority who lap up the spirit of the school, if the school does indeed have a spirit. These are the people that make the school different from other schools. One of the great advantages is that is provides a good deal of motivation for the students. A student that goes to a school and knows he was important, or important in that area, feels highly motivated. (Teacher of technology - PId)

The school's identity is built around the "school it was", the prestige it enjoyed in the past, the atmosphere of the existing school, the prestigious teachers in the various departments who make up the teaching staff, the different way of being and the individualism.

In summary

> The vicious circle of bureaucracy is well known (Crozier, 1964). When individuals are confronted with an absence of autonomy, they end up conforming, preferring to use bureaucratic dysfunction to defend their interests and strengthen their position (in Gomes, 1993)

As set out in official legislation, power at this school is concentrated in a single person, the President of the School Board, who has various responsibilities. The management model in force at the school is the result of the interpretation of guidelines governing the basis on which actions and decisions are taken.

The main characteristic of the administrative model set out by legislation and adopted by the school is characterised by the division and separation of different administrative functions across various management bodies with overlapping responsibilities and competencies. Thus, the concentration of powers in a single figure has led to total dependence, which contributes towards the marginalisation of individual initiative, to a climate of generalised paralysis, in terms of decisions regarding anything not connected with the day-to-day running of the school, and a lack of participation on the part of the school community.

Although in legislative terms the school's management structure is dependent on multiple, detailed norms and regulations established by the Ministry of Education at the national level, and despite the fact that daily activities are subject to rules or regulations pre-established in the different documents produced by bureaucracy at the highest level of the educational system, the school remains on the edge of the law. It uses the policies to organise its requests and demands submitted to government departments, to block certain wishes expressed by members of the school community, to set the practical limits of what is allowed, but leaves room for freedom for the individual and collective

initiative of teachers to develop projects. Initiative is seen from an individualistic viewpoint as a personal need for fulfilment - protagonism - and not as a social contribution to the school community and, for this very reason, might arouse criticism but never recognition. Pedagogical initiatives, artistic initiatives, are often overlooked in the context of the school, although in recent years there is a feeling that there is more information and also more acknowledgement particularly when the people involved receive outside recognition.

There is, however, an attitude of critical analysis regarding what is produced in the arts area and much less attention is given to pedagogical procedures. An example of this can be seen when an exhibition area is opened - an art gallery - where works of art and projects of a recognised artistic quality are exhibited but which is only open to works by teachers/artists, artists or former students. The final exhibition of the year focuses on ceramics, jewellery, textiles, furniture and graphic and audio-visual media, displaying the final products of students. There are always comments: "The teachers take too great a part, there's no pedagogical perspective of what has been learnt."

The articles that are written, the conversations in the teachers' room, the interviews given, all denote systems of values and attitudes that constitute the implicit, that influence the decisions of the teachers and, in part, of the students, day-to-day behaviour and practices. There is an "openness to difference" - ideas, customs, dress, etc. - individual statement is encouraged, the acceptance of one's fellow man, equality of rights, respect for (artistic) figures from the school's past, and friendship.

The lack of recognition of pedagogical leadership given the basic centralism of the school leads to lack of motivation on the part of teachers for posts and functions at the school. Leadership is therefore often handed to those that conform to the established rules and at the same time offer guarantees of being able to respond to the details of daily management basing the running of this school, like many others, on a philosophy of subsistence or daily survival, the participation of the school community reduced to the formal aspects that have to be complied with and which are stipulated by higher powers.

There is no desire to take on management positions, due in part to the fact that the teachers feel great insecurity in the face of the rules that must be obeyed and that often are not adapted to the concrete problems that arise. For several years only one person has stood for election, a way of solving the problem of not placing the decision in the hands of the Ministry of Education. It would appear to be yet another case that supports the observation made by a group of experts from the OCDE:

> There seems to be considerable reluctance among the teachers (essentially those with the best academic qualifications) to stand for election for these positions of added responsibility, particularly for headmaster. A nomination system was thus introduced to elect headmasters. Designed as something to fall back on when no candidates were expected, it ended up becoming the norm (Review.1984, in Afonso, 1993, p.22)

Another aspect worth highlighting is the lack of participation on the part of non-teaching staff in the school's activities. Their functions are not clearly defined, their educational level is low and their professional status is neither prestigious nor recognised. They are not seen at the school as members of the School Board, nor are they considered in the actions developed by the school's Educational Plan. This lack of participation extends to parents, students, and even teachers.

The school remains "tied" to tradition in both senses, to the bureaucratic centralisation which brings rigidity to the organisation of the school, to its inability to adapt to local circumstances, to needs and strategies of resolution, and to its past as a decorative arts school. This is an obstacle to innovation, a waste of resources, an inadequate way of training young adults in relation to the needs of their development and social challenges and results in a lack of accountability to the community.

Chapter Six - The project

This chapter presents the story of the project, the motivations, beliefs and expectations that guided teachers` initiative and the uniqueness of the project. It also points out the conditions that inhibited and stimulated project development and the explicit intentions of change in three dimensions: curricular, teaching and learning and professional development.

In 1993/94, a project aimed at changing the mathematics curriculum, taking into account the needs and interests of the arts students at Herculano High school, was designed and implemented by six teachers of the eleven that constitute the mathematics department at the school. These teachers wanted to design a new curriculum that could be applied to art work, creating the possibility of interdisciplinary approaches, emphasising the experience of mathematics through interactive methodologies and promoting research and problem-solving activities. This was seen to be an alternative to the national curriculum that focused on Logic and Calculation.

The reason for this initiative may be partly located in 1993, when the Portuguese State Department for Education introduced a curricular reform. The Mathematics (Quantitative Methods) curriculum introduced for 10th Grade students of arts and humanities had frustrated the expectations of mathematics teachers, as it was not adapted to the needs and the interest of students. In the mathematics Department of Herculano School, teachers looked closely at this new curriculum and reached the conclusion that it was not adapted for 10th grade art students. They therefore decided to create a curricular alternative adapted to more specifically meet the educational needs of art students.

> The prospect for change that this reform created, coupled with the fact that students can opt between Mathematics and Quantitative Methods, brought some hope that the situation would change. But, on checking the syllabus of the latter, it was found to be totally unadapted to the interests, skills and needs of the students in this area.
> In the light of this situation, and taking advantage of the autonomy of this school and the experimental nature of the academic year in which new

> courses were launched, this group of teachers proposed altering and adapting the syllabus to the reality of this school. This was how a project with different levels of intervention came into being, among which was a pedagogical experiment that resulted in this syllabus proposal. (Document produced by the leader of the project -doc 6)

The intentions of this group of teachers for developing a project geared towards the aims expressed above were identified from interviews and also from documents they produced. The teachers believed students' attitudes towards mathematics could change if teachers created educational situations that provided opportunities for diverse experiences with materials and the solving of problems applied to reality. They also believed that a good classroom atmosphere in which it is possible to experiment, and allow for mistakes to occur and where knowledge is shared, will stimulate change in students' attitudes. In a broad sense, five global ideas underpin this new philosophy. These are:

- develop positive attitudes and work competencies in students, towards the Mathematics activity;
- provide opportunities for students to discover the aesthetics and the usefulness of Mathematics through Mathematical experiences,
- promote the success of students in Mathematics;
- introduce co-operative learning in Mathematics classes;
- introduce calculators and computers in teaching and learning processes.

This group of teachers was also concerned about professional development in their school Mathematics Department, and promoting innovation in teaching. They organised meetings within the school department to debate ideas, and exchange experiences and knowledge in the area of Mathematics education, particularly in the area of computers. They also intended to:

-promote the interchange, in school meetings, of experiences and materials with other teacher's teams involved in similar projects;
- develop interdisciplinary approaches with art teachers;
-disseminate the project experience in seminars and conferences.

One of the intentions that guided the project and which was given special relevance was the development of students:

> Individual competencies in order to explore, to make conjectures and to use logical mental processes, as the ability to use a variety of Mathematics methods to solve a variety of problems. (NCTM, Curricular standards and evaluation in school Mathematics, 1989). (This quotation was taken from one of the reports written by the group of teachers.)

The aspirations behind this group's ideas reinforce the international trend in educational mathematics as the above quotation indicates. The use of a quotation of the curricular standards and evaluation produced in the community of mathematics educators in the United States (National Council of Teachers of Mathematics) shows the links that this project has to the ideas disseminated through the international community of mathematics educators.

Project Action

This project initiated by these teachers was intended to act in three dimensions. The first was centred on students' learning and instructional processes, providing an alternative to the traditional Mathematics curriculum. The second was to introduce an interdisciplinary approach for each art course (ceramics, cine-video, graphic design, interior design, textile, jewellery), to integrate knowledge of the different subjects and to introduce Mathematics in art projects. The third was to organise the interchange of educational materials, experiences, ideas, mathematics' knowledge and experience of computers among mathematics teachers in a network perspective.

Initially, the plan of action that was delineated by the group of teachers was detailed and organised for one year. It started at the beginning of 1993/94 and finished in December 1994. By that time, the group of teachers had developed:
-an alternative to the Quantitative Methods syllabus;
-some mathematics materials for classroom use to support the program;
-sessions for the teachers of the Mathematics department that were related to their identified needs: (i) curriculum development; (ii) assessment of students; (iii) applied subjects to classroom Geometry; (iv) the use of computers and graphing calculators in the mathematics classroom.

By the end of 1994, the team presented to the Central Educational Department of the Ministry in Portugal the formalised curriculum that they had tested, and the educational mathematics materials, as well as a document in which they had evaluated the project and provided some ideas for advanced project action. The curricular alternative produced by this group of teachers was approved by the Ministry of Education.

In addition, the invitation to present their experience, work and results at the University of Lisbon gave a new impulse to the teachers' project. The action of this group did not stop here. In 1995, 1996 and 1997 the project continued, guided by the idea of:
-creating a lab for Mathematics;
-acquiring some equipment that would facilitate students' mathematical activity under the new philosophy;
-selecting resources to enhance Mathematics activity;
-evaluating the curricular alternative;
-videotaping students' interaction for reflection on learning processes;
-reflection on the use of Mathematics materials and reformulating or creating others;
-peer interaction and students learning.

-

The uniqueness of the project

Initially the documents presented by this group of teachers in formalising the project and group interviews were analysed by the researcher. In the process of analysing the different projects that came from teacher's initiative some differences were identified. These were grouped in three levels: aims, activities and project organisation.

Aims and objectives. Considering the aims of the project, it intended to bring change, which covers three dimensions - students' learning, an interdisciplinary curricular approach and teachers' professional development. The project is not restricted to students and the didactic of mathematics. Teachers' professional development was considered and largely planned. The plan emphasised a large number of aims and actions towards teachers included in the project, the school's Mathematics teachers and teachers at other schools.

The aims of the project with regard to students built on those addressed by the national curriculum, but also paid special attention to attitudes toward mathematics as a factor in success and the values of autonomy and co-operation in the learning process. Another aspect that was addressed - *"To thoroughly examine elements of a scientific, technical, humanistic and artistic culture, which constitute the cognitive and methodological support..."* (From a document written by teachers) - is very broad but reveals the intention to integrate the different dimensions of the curricula in the education of these art school students. The aim was to show how mathematics could apply to artistic work, how it could be related with the history of art and technology.

The way teachers wrote and spoke about the aims of this project emphasises the place given to the relation of mathematics with to the real and practical aspects of life; mathematics was looked on as a tool that could be creatively used to support the intervention in the real world. This makes sense if we know that the major issue raised by students and by art teachers was that they regarded Mathematics as useless because *it is abstract and formal.*

The promotion of communication among peers and debate among teachers about educational practices and materials, was emphasised in this project. Other aspects, such as reflection among teachers and dissemination of the project's ideas and practices, are demonstrative of the desire for change addressed by this group of teachers.

Activities

Activities developed by the group of teachers that initiated this project revealed the importance given to the context and to the involvement of the other members of the school. They placed importance on various systematic procedures, such as the survey conducted with several art teachers that co-ordinate each art department and several students with different grades in Mathematics. Implicit was the need to define the characteristics of the problem and to have the right idea about how teachers and students think and feel about mathematics education in the context of this school, in order to give some consistency to the plan aimed at tackling the identified problem.

Another aspect that made this project different from other teacher initiatives was the relevance given to research, inquiry and reflection in regard to their practices, integrating theoretical and practical knowledge. They reflected in the group about their teaching practices, carried out research into educational mathematics curricula - they read books and articles - and discussed the ideas during the process of elaborating all the documents and materials that they produced. They also planned and assessed the project during the different phases of its development.

Project organisation

Teachers organised themselves as a group that generated an educational project. They also asked for space and time to have their weekly meetings, introducing the practice of working in a team. The group project has a defined leader accepted by all the members and a strong relationship among them.

They were one of the first project groups in Portugal to submit a project to the state educational committee for approval for professional accreditation. The project was drawn up not only to solve a problem but also to create a pedagogical model and a network that could provide a different dynamic in the mathematics department and school.

Support for intended changes

Initially, confronted with the documents of the project produced by the teachers and through the first interview and the informal talks with the team, the researcher could identify the changes that the group intended to implement and some assumptions that were present in the process of its development. Addressing the intentions of change of this project can provide an opportunity to understand and establish connections about what is desired, what is planned, the corpus of implicit theories that are behind the project and how they were developed. Changes were identified and grouped in three areas: curriculum, teaching and learning and teachers network.

Cross-curricular approach

Opening some doors to the different departments was one leitmotiv for introducing change in the curriculum. The idea of relating Mathematics to other subjects, such as Art and Design and Art Project, through students' project work was the beginning of promoting the articulation of knowledge and practices. These teachers expressed the willingness to identify what kind of mathematics students from each course (ceramics, cine-video, textile, so on) need to learn relating to the different artistic practices and implementation of co-operative teaching. Therefore, we can identify the articulation of subjects.

> Next year, 1994/95, we plan to promote project work with students that will also emphasise the application of mathematics in the arts. We will try to involve teachers from the art departments in those projects. We will also try to open some doors that traditionally work closely in relation to the subjects of the general and specific education to promote new ideas and new ways of acting. (Teachers report - doc4, p. 8)

The project work unit should last the whole academic year, in tandem with the others. The three other units should be dealt with in accordance with the specific characteristics of each academic year and each course. For example, teachers of Quantitative Methods should articulate with other subjects, particularly those that use mathematical models - Physics/Chemical Sciences, Applied Physics and Chemistry, Technology and Behaviour of Materials, Descriptive Geometry, and so on. (Teachers report - doc3, p.10)

The curricular alternative developed by these teachers stresses the applicability and usefulness of contents - Geometry, Functions and Statistics - to artwork and solving real life problems. Traditionally, the mathematics syllabus is considered very abstract, formal and neither useful nor applicable to art or real life. The meaning of this intention is to move towards a different curricular approach and also to a co-operative way of working among teachers. This is expressed in the written document by the project aim "to promote co-operative work among teachers of different subjects, especially with art teachers;" (doc1, p.8). The challenge is to build an alternative to the dual perspective

between theory and application that is present in the actual curriculum and to the individualistic way of working among teachers.

Learning and teaching

> The construction of mathematical concepts, the development of reasoning, the establishment of connections between mathematical content, mathematical techniques, should be worked on by solving problems.
> (Teachers written report, doc 3, p.7)

The intention of change in classroom practices was the main focus of this project. The introduction of interactive methods of work in class that stresses interaction between teacher and students and among students, the use of new technology as a tool that creates new situations and the manipulation of concrete material, were addressed as providers of a different dynamic in class. The pedagogical model implies a change in teacher and student role and class organisation. Teaching is centred on monitoring students' mathematical thinking processes, in creating mathematics situations that could provide students involvement in mathematics tasks. Learning is seen as a developmental process based on social interaction where student assume an active role. Given this, the classroom is organised for students' group work where concrete materials and resources are accessible and used by students and teachers.

Part of the project's purpose was to work systematically with students using co-operative learning. At the same time, the teachers intended to develop and implement assessment strategies adjusted to the students' learning process e.g. the project introduces descriptions for students, where students individually describe their mental processes when facing mathematics problems. With these descriptions, the teacher could analyse the students' mental processes and motivate or guide in ways to correct the reasoning or application process.

A consistency was found in all these purposes as they were supported by a theoretical framework and a corpus of believes and values that will be addressed in the next chapter. The idea that mathematical knowledge is constructed and is "built in the act of discovery" when students are involved in mathematical situations was the core belief

that supported the following ideas and which made this pedagogical model different from others.

Problem solving and reality. The importance of applying Mathematics to real situations was emphasised. The strategy of the alternative curriculum was the problem-solving approach centred on problems that established relationships between Mathematics and real world situations and with art.

> It has been a concern of ours to provide students with activities focusing on the discovery and construction of concepts by means of problem solving and investigative activities. These problems ideally focus on questions of reality or geometry so that they have some meaning and interest for these students. (doc 1,p.11)

> Ideally, the problems should have some connection with reality, preferably problems linked to aspects of the art and technology courses attended by the students. (doc 3; p. 14)

> Activities - example
> Find out the height, weight and shoe size of your colleagues. What is the mode, median and average of each of the distributions you found? (Worksheet used in class)

The curricular alternative for mathematics that these teachers created differed from the traditional one. They introduced a mathematical approach based on problem solving and not on demonstrations, repetition of exercises, reproduction and memorisation. Teachers intended to provide research situations that enabled students to discover, or set up activities for the students to build concepts in geometry, for example, through problem solving. The curriculum was centred on the implementation of activities and not on mathematical contents as it used to be, as the aims in the documents outlining the curriculum emphasised.

> Problem solving is at once the main objective and the main methodology used. As Polya would say, you only learn to solve problems by solving problems (...) You should avoid the insistence on repetitive exercises, the reproduction of algorithms, the memorisation of formulae. (Teachers written report - doc 3; p. 7)

-to use the problem-solving approach to research and understand the mathematics contents;
-to integrate strategies to solve problems in mathematics and other areas as artistic work.

-to apply mathematical knowledge and processes to solve problems in areas outside mathematics, namely art and design and associated technologies;
-to recognise, understand and formulate problems involving situations outside mathematics, namely art and design and associated technologies.
(Worksheets - doc 3 - appendix)

Learning through experience. This became the paradigm of mathematics activities in classroom. Students should be encouraged to explore, to learn by mistakes, to communicate, to solve problems, to discuss, to conjecture, to establish connections between concepts, to test, to organise arguments, to apply knowledge and processes to solve problems in different areas such as art and design. Individual and team reflection on the experience was considered a basis for *"building knowledge"*.

In as much as it facilities the multiplication and diversification of mathematical experiences and encourages individual and group reflection on these experiences, the school will contribute towards developing the mathematical ability of the students. They will gradually become more capable of analysing situations, making conjectures, proving or rejecting assertions, formulating and solving problems and thinking mathematically.
(Teachers written report, doc 3, p.7)

Intuition and manipulation of materials. This curricular approach differed from others by the value given to intuition in teaching and learning procedures. This was present when teachers emphasised the experience of students providing situations that promoted discovery, inquiry and manipulation of materials. The imagery was promoted as a way to reconstruct mathematical experience and guide students toward reasoning.

We want to combat secondary school failure. If we want our students to reach the stage where they can carry out formal mathematical operations, we should place greater importance on the tasks we give them and never neglect their previous experience, their intuition, by providing them with

> experiences that allow them to construct basic concepts and develop their capacity for abstract reasoning. (Teachers written doc6; p. 23)
>
> All geometry activities should be based, whenever possible, on the use of materials that can be manipulated: from folding in order to create flat figures and establish relationships and properties, to the construction of solids out of various types of material... (Teachers written doc. 3, p.14)

This can be illustrated by the activities and strategies stated below:

> Activity - Connections between Geometry and Art and Design
> Materials and new technologies. should be used for manipulation by students;
> Light sources to visualise cones;
> Materials to use in the simulation of curves and construction of mechanisms;
> Drawing material and measuring instruments;
> Scientific and/or graphic calculator;
> Computer with Geometer's Sketchpad program and others (graphic design, drawing)
> Strategy
> The construction of graphics, firstly using pencil and paper and later using graphic calculators or a computer, will be introduced using problems, preferably geometric ones or ones connected with the students' area of study.

Oral and written communication abilities. The new curriculum emphasised the development of communication, problem solving and reasoning competencies in students, instead of calculus, definitions and demonstrations as in the traditional model. Methods of work and thinking in mathematics were reinforced as a way for students to attain autonomy related to mathematics reasoning.

> We tried to encourage various habits and work methods, develop the capacity for reasoning and problem solving, and work on certain concepts we feel are important. (Teachers written doc 4; p.5)
> On one hand, the fact that we have placed a fair amount of emphasis on developing oral and written communication abilities, through new assessment instruments we have experimented with. (Teachers written doc 4; p.8)

> Communication and/or exposition of the product and processes. (Teachers written doc 3; in all appendices that provide suggestions for classroom project activities)

In the student assessment process, we could also see the value that was given to communication. Students were encouraged to explain all the procedures that they used and their reasoning processes in solving the problems.

> Descriptions
> The teacher should select some of the suggested activities and ask the students to write a report explaining the processes they employed to complete them. These will then be graded and each student will be given written indications by the teacher to enable him or her to overcome any difficulties, improve reasoning processes or increase their knowledge. These reports will complete the observation carried out in class and allow the teacher to modify or implement strategies, depending on the case. (Teacher written report)

Student's assessment. The teachers intended to change student assessment procedures based on the idea that assessment should be integrated into the process of student learning that gave emphasis to it and not to the tests and final products as was common in the traditional model. Continual assessment was also valued in changing student's attitudes and behaviours.

> In respect to student assessment, this should be integrated into the teaching and learning process and different assessment tools should be used, so as to ensure that assessment is focused on mathematical goals and learning processes in classroom and not on the product.
> It is very important that assessment provides information about the learning process to the teacher and to the student, so that both of them can improve their attitudes and behaviour. (Teachers written document 1, p.8)

Teacher's roles. Teachers regarded their roles to be very different compared to the way they had been in a traditional Mathematics class. Their educational activity was focused on the students' pace and processes in class, promoting interaction among students

organising them in small groups, monitoring their work and processes of reasoning. *"the teacher becomes an element that stimulates and guides the work"*. (Doc1; p.11)

> An explanation about the material by the teacher is sometimes necessary but should be kept to a minimum, replaced by discussions in small groups or as a class so as to summarise and clarify. (doc3;p.8)

Meanwhile, was expected that the student played an active role in the classroom, promoting his or her own learning.

> We intend students to play an active role in the classroom, promoting his or her own learning. The concepts are discovered and worked by him or herself, individually or in small discussion groups or in classroom debates. This allows us to take account of the learning pace and reasoning processes of each of the students, minimising the submission of each student to the medium pace of the class and to the reasoning of the teacher. (Teachers written doc 1, p.11)

Teachers' network

This project's emphasis on team work did not only refer to teachers themselves. An important part of their agendas was the interchange of educational materials, experiences, ideas, mathematical knowledge and experience with educational software. The participation of teachers in developing educational materials to introduce new Mathematics situations in the classroom is organised on a weekly basis. This was noted at different times to be a project *"to promote discussion and the interchange of experiences in a perspective of pedagogical innovation"*. (Teachers written report - doc 4;p.11)

Teacher development was considered an important part of the project. Teachers drew up a teaching plan based on the needs identified by the group in order to introduce new technologies into the teaching and learning of mathematics, as well as the project's work methodology and forms of assessment consistent with a constructive approach. It is expressed in the project aims *"to increase knowledge and examine techniques in the*

field of mathematics education, namely in regard to the use of new teaching technologies." (Teacher written report, doc 4; p.12)

The project intended to establish a network that would involve teachers interested in introducing new practices into the classroom and who considered the dissemination of educational experiences to be of importance. It was not limited to the teachers at this school.

In summary, this project would not have been possible without a group of Mathematics teachers, in Herculano School. These teachers showed an awareness of students' needs and felt that it was time to take risks and move from the identification of problems in teaching and learning mathematics in art schools to a new pedagogical model based in a theoretical framework that was built integrating their practical knowledge, that came from their experience, and the international trends in mathematics education. The desire to change their classroom practices and improve the academic success of students led the group of teachers to create an alternative to the traditional curriculum and educational materials. The values promoted and the integration of three levels- curricular, teaching and learning and professional development - made this project different from others also initiated by teachers.

The following conditions were relevant to the implementation of the project:

- the context of the curricular reform;
- the difficulties encountered by the national education department in creating alternatives to enable arts schools to reform their curriculum;
- the special status of Herculano School that in the past was recognised by the artistic education given to the students;
- the recognition of this project by the Mathematics Teachers Association.

Chapter Seven - The culture of the group

In this chapter, a brief presentation of the team is followed by a cultural analysis of the group in the sense as it is defined by Goodenough (1968). The research framework for this analysis is based on Schein's (1992) three levels of culture already presented in the selected review of literature, the culture of the project group is described in order to understand the social practices and cultural content present in the group that intended to innovate in the school. In the process of analysing the data the researcher worked interactively moving between the three levels in identifying the central. In reporting the analysis here, the researcher starts with beliefs, then move the values and finally rules and behaviours patterns.

The group is characterised by the interaction that they established with others in the school, by the theories, beliefs and values shared in their interaction with each other and others in the school context and their educational rules, norms and patterns of behaviour.

Project team

> Before we had this project, all of us felt the need to look for alternatives to the traditional model of teaching Mathematics. We felt unhappy with the results of students. We were conscious that something should be done to change the situation. Some of us more than others had identified what was not good and what we wanted to change in our classroom practice. We were sure that the content and what was traditionally emphasised, such as calculation, for example, was not adjusted to the needs of work life, and the students here. We recognised that individually we did not have enough courage to promote an alternative model and we did not find a consistent model that already exists which could answer different questions such as: What is Math? What is Math activity? What does it mean to learn Math? (Teachers written doc 5, p.11)

At the beginning of 1993, recently arrived at Herculano School, three of the six Mathematics teachers who comprised the project team began to feel the lack of relevance that Mathematics had for almost all the students and teachers of fine arts.

They identified that most art students who enter school had great difficulties in Mathematics and a negative attitude towards it. From the results of a questionnaire applied to five student classes, only 18% had no failures in Mathematics during nine years of school, while 58% had failed in the ninth grade and 24% had failed in the years before. Mathematics had always been seen as an obstacle for students hoping to finish the art course. This problematic situation made almost all Mathematics teachers feel unhappy and guilty. Many art teachers, based on their own experience, see Mathematics as something abstract that it is not useful for art students.

> The unhappiness of teachers toward Mathematics in this school was behind the project, which created this curriculum that we are presenting. The first reason is that traditionally this was not regarded as a prestigious subject by the artists - teachers and students. Secondly, there were a high percentage of students underachieving, as many students never finish their courses because they failed in Mathematics, Physics or Descriptive Geometry. In some cases students who failed for many years only finished the courses because the teachers helped them and not by their own merit. (Teachers written doc. 3, p.3)

One day, in September 1993, Maria, one of the three teachers recently arrived at Herculano School, presented to the Mathematics department a plan of action to create an alternative for the Mathematics curriculum and educational materials to support it. This proposal was debated and approved by the Mathematics Department. Six Mathematics teachers offered to contribute to it and to be involved in classroom experimentation. After that, they became a group that met at different times to formalise the project for presentation to the School Board for its approval and implementation during a school year.

The project team was initially composed of six teachers, their ages ranging from 25 to 40. All of them were tenured, some with as much as 17 years' teaching experience, one of them with only 2 years. One of the teachers worked on the project for only one month and had difficulty fitting in because her conceptions about Mathematics differed from the others. She later decided to withdraw from the project team. All the five remaining teachers of the group "loved Mathematics", and felt that teaching Mathematics was a pleasure. Ana, Paula and Carla had shown a great predisposition to teach since they were young. The mothers of both Carla and Paula were teachers. Carla

and Paula, in primary and high school, as students used to explain Mathematics theorems and problems to their fellow students. Only Claudia had doubts about studying the University Mathematics course. Initially, she wanted to be a lawyer but she has a dyslexia problem, which did not allow her to follow this profession. Maria, the recognised leader of the project, entered university with the idea of being a mathematics researcher. Only after three years of being in school, as a high school teacher, did she choose "teaching as a profession", and not only as a job, as she had perceived it at the beginning.

Of all the teachers in the group Maria has the widest experience in education. She did not finish her university course before she began to teach, as the other colleagues who attended university did. Fourteen years ago, she became a teacher because she needed a job to support herself and her baby. At that time, there were few teachers of Mathematics and schools needed teachers, even if they had not finished their courses. After some years of teaching, she finished her Mathematics course and gained teaching approval. One of her experiences in education was as a member of a High School Board. In addition she wrote Mathematics educational books for high school students, she belonged to a project team that organised courses and in-service sessions in Mathematics and, in the last four years, she has begun to present papers at conferences and seminars.

It was Maria's idea to set up the project and to try to tackle the identified problem by changing the methods of teaching, promoting student interaction, using problem-solving strategies, and reflecting on the processes and mistakes that students make. At the same time, she developed contacts with teachers of other subjects in order to promote interdisciplinary activities integrating Art and Mathematics.

From an analysis of teachers' narratives and documents, the main reasons that motivated the Mathematics teachers to develop this group project were:

- the willingness to change the situation relating to students' underachieving in Mathematics;
- the belief that only in a team could they find the solutions and alternatives to prepare students for the future;
- the need for Mathematics to be integrated in this school,

- the great pleasure of being a teacher and working with this subject matter and
- the desire for designing an educational alternative to curriculum and teaching mathematics adjusted to the needs of art students.

> This year was not the first time I had thought of adapting the teaching and learning of mathematics to the sensibility and needs of the art students. Many times [at other schools] I had art students, and I always tried to approach Math by making connections [with art] that met students' interests. It does not make sense to me that an artist has to learn the same Mathematics [subject matter] as a student of engineering or a mathematician. [Interview - Ma]

These teachers did not know each other in professional terms. Some were teaching at this school for the first time, and others worked individually. As already noted, Maria - a reflective teacher - assumed the leadership of the group by presenting alternatives supported by a theoretical framework about teaching and learning mathematics, and her leadership was recognised and valued by the other teachers. There was much participation in group sessions, discussing and making educational materials to promote learning activities that helped students to organise their thinking, discovering ways of thinking in Mathematics and creating methods for working together. Gradually over the course of a school year, teachers formed into a co-operative group with five teachers having an opportunity to share their perspectives about teaching and learning processes, educational materials and the philosophy to implement a new curriculum.

Group in a cultural sense

> A work group consists of three or more persons who interact regularly to perform a joint task, who share a common frame of reference, who have affective ties with one another, and whose behaviours and outcomes are interdependent. (Levine & Moreland, in Resnick, Levine and Teasley 1991: p.257)

We can consider Maria, Ana, Carla, Paula and Claudia, the five teachers that work together in the curricular project, a group. The fact that they have common goals, a conceptual referential frame, are organised to interact constantly in an interdependent way, develop affective ties and realise educational products, makes it a group with a

culture and not simply a work team organised to carry out a task. These teachers worked together around three main goals. These were:

- to create curricular alternatives that could have an impact on teaching Mathematics to art students by providing educational materials and real -life situations, facilitating students' thinking and promoting the acquisition of interactive methods of study in Mathematics;
- to create alternative methods of teaching and learning mathematics;
- to promote teachers' professional development.

The group came together to the project as they shared common motivations and expectations.

> 11. All of us, in fact, shared common concerns: dissatisfaction with the state of mathematics at our school, the desire for change, the flexibility and humility necessary to discuss and modify our teaching methods and the desire to learn. (Narrative Ma, 2)

For the purposes of the project, they were organised in a way that allowed different moments of interaction. Every day they talked informally in the staff room and exchanged opinions on class activities and information related to the project and to classroom experiences. They also shared their feelings of frustration or happiness when their students had difficulties in learning or failed to solve problems and also when they performed correctly in Mathematics showing independence in researching. Every week they had meetings to share materials and information, to prepare classroom tasks and tests, to discuss experiences and strategies, to make or to analyse educational materials, to plan and organise classroom activities, to discuss the criteria for student assessment, and so on.

> 2. The discussion of ideas and the exchange of experiences - which were a constant throughout this project (we held a two-hour meeting every week and spoke of the work we were developing every time we met in the Teacher's Room) - proved extremely enlightening. (Maria Narrative - 3)

Every month they also interacted with colleagues from the mathematics department to present and discuss what they were doing, and to plan for the next semester. On special occasions they interacted within the group to prepare and present documents, papers or

workshops outside the school. Sometimes they presented to the school - other teachers and students - a film related to mathematics to stimulate discussion and change attitudes toward mathematics. The most important decisions were taken within the group democratically. This meant that all arguments were put forward, discussed, and the decision came naturally when Maria summarised the aspects that were focused on the most during the meeting. Although, they had different strategies and opinions, I did not observe any conflicts between the members of the project group, as the leadership was clear.

Although the members of the group recognised that they were different, their behaviour and results were interdependent. Initially, these teachers did not know each other very well, but they came to form a closely-knit, friendly group. During the project these five teachers established strong affective ties; they socialised, had lunch together, cared about each other and brought presents on birthdays.

This was a group in a cultural sense because this set of people had been together long enough to have shared significant problems, solved them, observed the effects of their attempted solution and passed on these solutions to new members (Bohannam, 1963; Goodenough, 1968). They had also explicitly or implicitly demonstrated shared values, beliefs, expectations, attitudes, images, rules and behaviours. In school, other mathematics teachers referred to them as a Quantitative Methods group, and they were seen as something apart: "they are creating a new curricular alternative but we do not really know what they are doing in practice" (comments of math teachers of the department). When the education department asked for comments about the new programme, they would say: "It's up to you [the group]". You produced the curricular alternative so you should know what should be mentioned".

In the mathematics department all the teachers saw the project group as adopting a different practice using calculators and different mathematics' materials. Sometimes there was a conflict between Maria and other department teachers because of different beliefs and her approach.

> In the first year, Carlota and me taught the same curriculum differently from the project group, despite the fact that we were teaching the same subject matter, Quantitative Methods. It was a difficult year; they did not

> accept the fact that we did not work on the project and this was very complicated. There was not a very good atmosphere between teachers in the Mathematics department (...) The following year I did not teach the same subject and I only took it again this year. At the first meeting of this year, I told them that I needed help understanding the materials [which were different] from what we did before. If they do not work with me, it would be better to close the door as in the first year. Now, we get on much better and work together. (Interview1, math teacher , p.5)

The group expressed values and beliefs that set them apart from other mathematics teachers at the school. Shared values were the mathematical critical thinking processes, the attitudes of autonomy, co-operation in students' education, experience and social interaction in the learning process.

> 4. It was very important to attain this goal - "to develop attitudes of autonomy and solidarity" - the fact that in our classes the students are the first actors, having a sense of responsibility in their learning process, and usually work in groups. The discussions they had on Mathematics activities, the involvement I the work, the initiative that they showed ...(Interview 2, Maria p. 10).

The group conceived of Mathematics as a way of thinking about reality, of developing mental processes working as a symbolic language. They strongly believed that the mathematics experience is a challenging process and should provide pleasure that work for students should be like a "game with rules" that should stimulate "risk-taking and the imagination". At the same time, they believed that Mathematics activities should involve students in analysing, organising and experimenting.

The group also believed that Mathematics is a subject that is rigorous, creative, exploratory and implies the development of thinking skills, as opposed to the presentation of stable and definitive knowledge.

> 29. Mathematics is a pure invention by Mankind, there is no mathematics in nature, nothing physical, nothing at all. Mathematics is the pure imagination of Man, isn't it? Obviously it often reflects some of the senses...(silence) But the need for precision, its imaginary nature, means it transforms many of the things it observes, that it feels in the physical world, into objects...(silence) many things that come from the observable world.

It is Man that carries out this transformation of nature into ideal objects. It is Man's thoroughness that leads him to construct mathematics, through reason of course. (Interview Maria, p.33, p.34)

30. She (the student) cannot establish the connection between things, she doesn't have a wide, creative view of mathematics ... Mathematics can be very creative. A problem can be a good basis from which to move on to another, and can be a basis, a good basis, to formulate other problems, for example. (Maria's written comments about a student, Ent II, p.33)

Mathematics activity is a way of thinking about reality, of developing thinking skills and symbolic language:

31. Mathematics is more than a language. Mathematics has a language, but I wouldn't say that it was a language in itself. It's only a language in that it represents a way of thinking. Mathematics is stimulating. It's logical because it has rules. It's challenging (pause) And I'll tell you something else, it's a portrait of the human imagination. (Interview 2 Maria, 34)

The members of the group recognised that they were different from the other school Mathematics teachers, mentioning that they had a different theoretical framework about mathematics and about teaching and learning, which influenced the way they acted in class.

5. Now, at the end of a year's work, I realise that we were a close group, the best possible. It's just as well that certain teachers dropped out because they demonstrated during the year that their ideas on Mathematics and Mathematical Education differed greatly from ours. Although the group that remained was made up of very different people with quite distinct careers and personalities, it proved extremely tight-knit and with positive qualities for the work we set out to do (Narrative Maria - 1, 2)

Maria on other Mathematics teachers:

6. What I mean is: Although they focused on the same topics, taught the same material, explained the lessons to the students, it was no use. After a while a certain friction sprang up between us...There was no open hostility, but we realised that things weren't quite right. Their students hated Metodos Quantitativos, whereas our students would get to the end of the course and say how much they enjoyed it. (Interview 1, M-15)

Such a collegiate atmosphere is very different from the individualistic way most teachers worked in Herculano School. These teachers trusted each other and they felt free to expose themselves relating to the other members of the group the classroom episodes, and *sharing* their experiences and doubts.

> Now, as before, we are involved in discussing classroom episodes and are preparing mathematics materials to use in the classroom. Those meetings may seem as if we are not doing anything, we discuss things that happened in classroom - how students reacted to this, why they did not understand [what is in the worksheet]. This is important as it enriches our classes. (Interview Maria, M p.14)

Leadership was clearly assumed as crucial to the creation of cordial working relationships in this group:

> 7 The enthusiasm shown by the four teachers that worked with me during the year and the spirited way in which they tackled the tasks we set ourselves - even those that didn't enjoy (the reports) - played a decisive part in my persistence in going ahead with the project. I am convinced that if I had found a less enthusiastic group, I would have given up. At the very least, we wouldn't have eventually submitted a syllabus proposal or made plans to carry on working together, planning lessons, experimenting with new methods (project work), preparing materials and setting up the mathematics laboratory. (Narrative Maria -2)

In class, I observed that the group used common educational materials, the same strategies and resources, and involved students in teamwork. They stimulated the interaction between students based on questions of research or Mathematics problems. Meanwhile, each teacher had a different way of relating to students in class. Maria posed questions to encourage discussion in students' groups and the construction of argumentation; Ana emphasised the organisation of thinking and materials, and methods of study; Carla stimulated involvement in mathematics' tasks and a warm and friendly relationship among students and teacher; Claudia insisted on processes and calculation; while Paula insisted on processes and explanation. Their personal characteristics, professional experience, personal system of beliefs and implicit theories, influenced decision-making and the way these teachers acted in class.

The team project was formed because individually teachers saw an opportunity to put into practice their motivations, beliefs, values and ideas. The assumed leadership, with clear aims, which were theoretically supported, guided the action and gave the group a feeling of taking risks with safety. The personality of the leader, Maria, who is a very strong and energetic woman, noted in research diary, facilitated group union.

> I had just arrived at the school when I heard, in one of the first department meetings, Maria speaking about the high rate of students underachieving in Mathematics and the need to make an alternative curricular for these students, to adjust mathematics to the needs of students. I came to the project because Maria spoke with me. She began to organise it. Initially, the idea came from her. (Interview, Ana p.7)

Other teachers recognised the group's educational practice as different from their own and some of them felt attracted by their ideas; newcomers asking for some teaching materials to use in class.

> 8. I think, for example, that this happens with our mathematics group here at the school. Although some people support our projects and my way of approaching things, others tend to pull away. That's what I felt here at the school. (Teacher Interview II, p.22)

In spite of the fact that one of the teachers had to move to a different school nearer her home because of her newborn baby, these teachers felt the need to work as a team. They went on working as a team over four years, although they changed the initial approach. All the members of the group recognised after a time of working together that they could no longer work individually as they once did, as they felt the need to plan and share teaching materials and experiences. All the teachers in the team emphasised the benefits that they experienced from working in a group, such as discussing, sharing materials and ideas, evaluating the materials that they used in class, the support that they felt and in relation to what they were doing.

> 9. The work of the group brought with it many benefits, including:
> - discussion of the need to alter the syllabus, which points should be introduced and why;

- preparation and discussion of the ideas and materials to be used in the classroom as a group;
- assessment of the material prepared, the exchange of experiences and day-to-day concerns at the weekly meetings but also whenever it was necessary;
- the feeling that they were being supported by teachers in whom they had confidence, teachers who could help them inside and outside the classroom and who had something in common with our approach to the school.

Moreover, working as a group allows us to fill in any gaps and overcome any difficulties, and, in my own case, my "poor spirit of adventure". I have always believed that as a group one should discuss and clear up scientific, pedagogical and other doubts that confront us in our day-to-day lives. (Narrative Claudia,3)

Group culture

(...) we could take an oceanic metaphor in which the waves represent the turbulence of the surface observations, the shallow waters beneath, the signs and symbols and the depths of the ocean, the bedrock in which tacit beliefs are buried. (Paper presented by Hyatt & Simons, 1998)

This metaphor translates the relationship between the three levels of culture that Schein (1992) applies in his model to understand the symbolic and non-symbolic modes that are shared by a group and which are present in the social interaction with others and school. In this model of culture the different levels are integrated and a movement from the unconscious level of the implicit theories and beliefs to the conscious level of the patterns of behaviour is assumed. The culture of the group that is addressed here is described in order to understand the social practices and cultural content that is present in a culture of innovation. Culture in a more deep sense is also adopted here as the manifestation of implicit theories or beliefs that are present in group behaviours and acts.

Following Schein (1992) I will present first, the highly invisible, profound elements which are expressed by means of symbolic and non-symbolic language, which include the principles of personal philosophy, beliefs regarding the act of teaching, the role of

the teacher and knowledge. The second element considers the values, which can be inferred from the discourse, rituals and signs of the group. On a third level, the more observable one, the educational rules, norms patterns of behaviour and artefacts produced. We can summarize these three levels: the level of pre-suppositions that involve implicit theories, the level of shared values and the level of artefacts, rules and behaviours.

Beliefs and Assumptions

Based on Schein`s levels of culture, evidence was explored about the presence of a different subculture in the school. There are some main strong beliefs and values that are explicit in their discourse and are the basis of the group's action.

An important finding was that the group believed in their own contributions to changing the quality of education in the school and in the educational system by presenting curricular alternatives, developing alternative teaching and learning methods and materials and establishing a network that supported teachers' pedagogical action and professional needs. This group recognised their power and influence in changing mathematics education, and this gave them the persistence to deal with the obstacles that are imposed by a bureaucratic educational system and to confront the passivity that often characterises school culture.

> Our intention of becoming "good teachers", acting and intervening in the system as best as we can, will become increasingly more accentuated as we come to realise that we can, in fact, change the current state of affairs. (Teachers written doc 1, p.14)
>
> We sincerely believe we are contributing and will continue to contribute towards improving the quality of teaching in our schools. Because of everything said earlier, because of everything we intend to do from now on. (Teachers written doc 4, p.19)

In relation to this, they believed in the power of their action in changing students` and art teachers` beliefs about mathematics.

> Hence the need arose to look into this situation, to investigate it by interviewing each other, so that we could make people recognise the importance of mathematics, even for artists. (Teachers written doc 1, p.5)

In addition to this group's basic beliefs, there were consistent and shared beliefs, values and rules that centred on three main areas: curriculum, teaching and learning and the teachers' role. As curriculum and teaching and learning are interrelated, these will be considered together in the following section.

Teaching and learning One of the main beliefs about learning held by this group was that knowledge is socially constructed occurring through personal interpretation and development of social interactions in class when students are confronted with Mathematics problems. This social interaction was reinforced by co-operative learning in class and teacher and student' interaction. At the same time, this group also believed in the role of the diversification of mathematics experiences in developing student's mathematical thinking.

> In as much as it facilitates the multiplication and diversification of mathematical experiences and encourages individual and group reflection on these experiences, the school will contribute towards developing the mathematical ability of the students. They will gradually become more capable of analysing situations, making conjectures, proving or rejecting assertions, formulating and solving problems and thinking mathematically. (Teachers written doc 3, p.7)

In relation to this point above the group formulated an educational rule that established the relationship between students' construction of mathematical concepts and the emphasis that should be given to problem solving activity in class.

> ... the development of reasoning, the establishment of connections between mathematical content, mathematical techniques, should be worked on by solving problems. (Teachers written doc 3; p. 7).

A second belief concerned mathematical experience and its relevance in the process of learning and cognitive development. Their view here was that mathematical thinking implies deductive and inductive thinking processes that include observation,

construction and manipulation of materials and that the provision of a multiplicity of mathematics experiences, including these processes, has an important role to play in involving students in building mathematical concepts.

> 15. We were able to ascertain once again that by using materials that can be manipulated, students become actively involved in the construction and discovery of mathematical concepts, and can go much further in the study of Geometry in Space. (Teachers written doc 1, p.12)
> The idea is that it is the students themselves that build their models, because this requires them to clarify and work various mathematical concepts and ideas.
> By exploring, investigating and discovering, students develop their capacity for inductive and deductive reasoning and are able to formulate and validate hypotheses, argumentation and the building of concepts. (Teachers written doc 3, p.7)

Thirdly, the group believed that knowledge is constructed in the interaction between past experiences and the acquired knowledge that students bring to the class (practical knowledge) and the new situation that students experience when they are involved in Mathematics activities. Skills such as abstract reasoning are developed when students have an opportunity to experiment and intuition processes are promoted.

> 17. It seems to us that if you want to combat academic failure in secondary schools, if we want our students to reach the stage in mathematics where they can carry out formal operations, we should place greatest importance on the tasks we give them but never neglect their prior experience, their intuition, giving them experiences that enable them to build basic concepts and develop their capacity for abstract reasoning. (Teachers written doc 6, p.23)

A fourth shared belief of the group was that learning in Mathematics is a process of developing reasoning and thinking skills which implies that students explore and establish relationships between mathematical concepts, to organize and communicate mathematical thinking.

> 20. It takes them a while to realise that what is important are the processes used and not just the final result but they are already showing signs that they feel the need to organise and interpret data, to experiment and make

> hypotheses about situations, to find explanations for their discoveries. (Teachers written doc 1, p.11)
>
> 21. This is the first time our students are doing work of this type - oral or written construction and explanation of their reasoning, the discovery of concepts, experimentation and formulation of hypotheses, validation, and so on. (Teachers' written doc 2, p.6)

In relation to the role of computers in the Mathematics' classroom, the group's beliefs were reinforced by their classroom experiences.

> 28. Although we have not yet fully explored these programs, we are sure that the computer will prove a highly important instrument in terms of new methodologies, the creation of learning situations, the exploration of problem-solving strategies and development of the ability to get mathematics across. (Teachers written doc 2, p.11)

A fifth fundamental belief of the group was that students learn by making mistakes and recognizing them when they analyse the process of solving problems. In this way student assessment is integrated into the learning process. This group had a theory of assessment that located it in the teaching and learning process by focusing on reflection about mistakes and stressing the processes of problem solving, and thinking instead of a focus on the attainment of behavioural objectives and results.

> 33 Considering that mathematics should not be seen as simply the attainment of behavioural objectives, the focus of assessment should not just be on the result, but the processes too. Processes are more important than results and, as such, besides verifying behaviour, assessment should interpret them too. (Teachers written doc 3, p.17)

Students' assessment includes tests that took place in two phases, and also by observations and descriptions. Students ' reports provided to the teacher how students developed their reasoning in mathematics.

> 19. Given that students work in groups a lot of the time and that making systematic observations is sometimes difficult, the students were asked to draw up short reports explaining the processes by which they carried out their given tasks. (Doc 2, p.8)

A sixth belief concerned the group's various theories about learning. Learning, for them, is based on an open and attentive relationship between teacher, student and Mathematics. They placed a great deal of importance, for instance, on the classroom atmosphere and the teacher's attitude toward Mathematics and the students.

> 23. Trying to adapt mathematics, the language used and the approach, to their needs and what they feel, and not just teaching mathematics. I found the importance of the teacher/student relationship in the classroom climate and in the process of learning. (Interview, p.12 and p.13)

> 24. I normally assign tasks or discuss tasks with them so that they are forced to think things through and arrive at the answer. I'm not saying that all learning is done this way, far from it, but that's the way these moments are, moments in which I think the learning process is a richer one. Because they are carrying out a particular task or involved in a particular task, they begin to discover relationships between things they are learning and things they have learned so far. (Interview Maria p.14)

Teacher's role. When it came to the teacher's role, the group expressed beliefs about the importance, in teaching and learning, of the teacher's attitudes toward the subject of mathematics, the profession of teaching itself and students. Enjoyment in teaching as a profession, they believed, is something that is crucial to being a good teacher and important in developing positive attitudes in students.

> We believe that in order to be a good teacher, you need to like what you do. You need to like Mathematics if you wish to pass this enjoyment on to the students, you need to enjoy teaching Mathematics and, above all, you need to like people, youngsters and teenagers in particular. (Teachers written doc1, p.14)

Love and care were important characteristics in their image of a good teacher as someone who searches for solutions to improve teaching and learning.

> 14. People who enjoy teaching care, and this concern clearly leads to the formulation of questions regarding method, to the search for solutions to improve this method. A teacher that likes students is interested in them and

respects them, and consequently tries to find out what their interests are and how they learn (Teachers written 1, p.14)

Group Values

Values in students' education. Democratic values are illustrated in this group by the way they stress the importance of equal opportunities for all the students, in their attitudes towards their peers and students, the role they attribute to the teacher, and the student in class, and in the curricular aims and goals they expressed toward mathematics education. Students' participation in class was also highly valued.

These teachers held a strong belief in the capacity of all students to learn mathematics provided the curriculum and mathematics per se are not seen as abstract but valued for their social interest. In the Portuguese system, mathematics has long been a subject that has experienced a high rate of underachievement. The reasons for this situation include the characteristics that have been emphasised during the teaching process, by the methods used and by the social image that has been given about mathematics that "only very intelligent people can make it". This group of teachers argued that the mathematical body of concepts and mathematical skills can be understood by everybody in class; it depends on the opportunities given to students to acquire them.

With this in mind, they valued more interactive methods of teaching and learning that involved an active student role in building meaning through their learning process. This appealed to the teachers as they could adapt the curriculum towards the specific group of students in class. It was a group aim to get all students involved in problem solving activities that worked with basic concepts in mathematics. The strategy used was intended to give self-confidence to students and at the same time identify the problems that students had in their performance in mathematics, instead of beginning with advanced mathematics that would exclude the majority of art students. This strategy was adopted in class to provide equal opportunities for each student to learn and have success. The teaching was focused on students' learning and pace and not on contents per se. In a second stage, teachers worked with students at different levels of performance in mathematics and helped them to work toward their own progress in mathematical thinking.

> An analysis of this situation reveals an option that we believe is vital for developing and assessing our work: either we set apart from the outset those students that couldn't keep up with the workload, which was probably the overwhelming majority, or we started from the beginning, working on basic concepts and reasoning without any presuppositions, but sacrificing certain topics and not really going into some of them with the depth we wanted. (Teachers written doc 4, p. 5)

The process of assessment already mentioned facilitated and underpinned this belief as it provided feedback for students and teachers and showed how learning together can promote a change of attitude in teachers and students.

> 801. It's very important that assessment provides feedback on the learning process for both the student and the teacher so that both can reformulate their attitudes and behaviour and optimise this process. (Teachers written doc 1, p. 8,9)

The group also clearly expressed the importance of developing students' values and attitudes of self-confidence, autonomy and co-operation and of respecting the differences between students.

> 35 The third aim has to do with the development of values and attitudes that are not directly connected with Mathematics but which can be encouraged in Quantitative Methods classes if self-confidence and group work are promoted. (Teachers written doc 3, p. 4)
>
> How do you encourage personal achievement in a student who has had difficulties in Mathematics throughout his or her education, has failed several times and, quite probably, stopped trying because he or she feels they aren't capable?
>
> Firstly, you need to get their self-confidence back, show them that they are capable. We think we've been quite successful in this respect and the reduced dropout rate is a sign of this success. The key was to not approach concepts as if they were new to them, but make an effort to use less formal language, language that the students could understand easier. (Teachers written doc 4, p.9)

They also pointed this out in their curriculum goals:

> - to develop self-confidence in reasoning;
> - to co-operate in team work and to respect difference (heterogeneity among students);

Participation of students in the classroom learning process was of vital importance in the pedagogical model implemented by this group, which was strongly valued as an alternative to the traditional model of teaching, though they were aware that they still had some way to go.

> Of course, we haven't yet reached the stage where all the students participate one hundred per cent in all the classes, as we'd like. We'd need much more time! (Teachers written doc 2, p. 6)

Values about mathematics education. The major values that teachers intended to expand in their educational practices were related to mathematical experience, the thinking and reasoning process in learning mathematics, the use of technology such as computers and graphic calculators, and also, the applicability and usefulness of mathematics to art students taking into account the present projects and their future work. They also expressed the value of a holistic approach that promoted relationships with other areas of knowledge by emphasising *"the connections between mathematics topics, mathematics and other subjects"*. (Teachers written doc 3, p.6)

The group expressed four main values in relation to mathematics as a subject.
Firstly, the experience as well as the pleasure of being involved with mathematics:

> 34. The mathematics experience should constitute the paradigm of school activities in this subject (...) In accordance with the level of development and maturity of the students, they should be immersed in an intellectually stimulating environment in which experimenting and doing Mathematics are natural and desired activities. (Teachers written doc 3, p.7)

Secondly, the development of Mathematics skills and research methods:

> To develop ability to solve numerical problems by using geometric representations. (Teachers written doc 1, p. 8)

> To develop problem-solving skills applying to algebraic calculation (Teachers written doc 1, p. 8)
> To organize data, to observe and find patterns, to formulate hypotheses, to generalize, to experiment, to decide, ...(Teachers written doc 1, p. 8)

> 301. We tried to encourage habits and working methods, develop reasoning powers, problem solving, and work on the concepts we felt were important. (Teachers written doc 4, p. 5)

Thirdly, the use of technology such as computers and graphic calculators in students' learning skills for the needs of this society;

> 401. Our aim as far as the work we're doing with our classes and the chapter on functions are concerned is to use graphic calculators.
> The activities we carried out led us to the conclusion that students were able to experiment with various situations that would otherwise have been beyond their grasp due to the complexity of the calculations they involved. They can analyse all kinds of functions more thoroughly, solve problems, test and validate hypotheses. And they can do all this without wasting time, because the boring task of drawing graphs point by point, calculating zeros, solving equations to study the sign of a function, and so on, is eliminated. (Teachers written doc 2, p. 12)

Finally, the usefulness of Mathematics for students' present and future artwork:

> 501. This unit underscores the connections between geometry and calculus. Calculation is frequently useful for these students in solving geometric situations (measuring, for example), and is more understandable if accompanied by geometric interpretations. (Teachers written doc3,p.13)

> The study of functions, because of their numerous concrete applications, is today indispensable in any curriculum. In fact, the analysis of graphs and the concept of function are essential for the interpretation and comprehension of many phenomena that the students will deal with in their professional careers, and not just in school. (Teachers written doc 3, p. 15)

Values in teachers' professional development. In relation to their own professional development, this group of teachers valued research and inquiry procedures, the

discussion of ideas, co-operation and reflection on and about methods of teaching and learning mathematics.

> We felt (the selected bibliography) was fundamental to the work we wanted to set ... The ideas contained in these documents have been discussed at the weekly team meetings and are present in our short, medium and long term plans. (Teachers written doc1, p.4)
> ...Because it means something to us: it continually forces us to rethink our work, our pedagogical practices, our day-to-day methods; because it makes us look for alternatives to things we feel are not right with books, the opinions of other colleagues, or even the students themselves; because it also forces us to confront ideas and methods, it makes us feel that the work of the teacher only makes sense when it is part of a group, part of a more ambitious process than simply "teaching classes" every day. (Teachers written doc 1, p. 15)

> The idea is that teachers improve their methods and get used to questioning what they do so that they can keep improving. (Teachers written doc 1, p. 15)

Democratic values were identified in the way that teachers co-operated in building the curriculum, in the relationship with students in the learning process and in the recognition of teachers' action/intervention in changing beliefs, and educational practices was Each person's role in the process of learning, teaching and school politics was valued.

In the teacher's discourse and action it was possible to infer that they valued individual mental competencies, research processes, and the ability to intervene in social and economic reality. Mathematics knowledge was seen in the personal and social context of the meanings that each student and teacher bring to the class. The desire to learn and the involvement in rich activities, in solving problems and research in mathematics enabled teachers to develop their own construction of knowledge.

Educational rules

The meaning given by these teachers to their actions in the project, to the artefacts developed, to their behaviour, to the events that occurred in class and to the meetings of the Mathematics department allow us to identify a number of rules, which follow that guide their practices and patterns of behaviour. Each of these rules is stated followed by a quotation to illustrate its origins in their discussion or written documents.

Discovery in Mathematics. Students have to discover their understanding in mathematics through problem-solving situations that involve students in experimenting, manipulating materials and resources

> The construction of graphs, first with pen and paper and later by using graphic calculators or computers, will be introduced based on geometric problems or those related with the students' area of study. The discovery of the analytical expression of a function is also an objective that is sought through problem solving. It is essential that they be allowed to use graphic calculators. (Teachers written doc 2, p. 4)
>
> To study Geometry, it is recommended whenever possible that materials which can be manipulated are used to support discovery and investigation. Teachers written doc 3, p.8)
>
> All geometry activities should be based, whenever possible, on the use of materials that can be manipulated: from folding to produce plane figures and establish relationships and properties, to the construction of solids with various types of material - cardboard, acrylic sheet, straws, polyhedron, etc. (Teachers written doc 3, p. 14)

The same rule is applied to assessment, which is included in the learning and teaching process

> By using this type of assessment we can use materials other than pen and paper in tests, the type of task students are set can be varied: from building objects using cardboard, scissors and glue, to the use of appropriate

software and saving activities into floppy disk. (Teachers written Doc 2, p.9)

Activities in this program means that students have to improve their reasoning.

The activities focused on in this programme may mean that students have to improve their reasoning. They must predict a construction sequence, they must understand the relationships between geometric objects in order to succeed in their activities. Deductive reasoning is thus developed in a way that is more motivating than the usual two column demonstrations. Observation and experimentation with the constructed figures leads to new hypotheses, which need to be demonstrated. This type of activity is undoubtedly more interesting, more complete in terms of reasoning processes... (Teachers written Doc 2, p. 10)

Mathematics problems should relate to students' knowledge of reality

A discussion of the aim and usefulness of Statistics and the introduction to its specific language will be based on the reading and analysis of newspaper and magazine articles or other real-life publications.
Students should carry out a task as a group involving statistical analysis, from data collection to communication of the analysis and interpretation of the data. This task should be based on a concrete problem related with the day-to-day lives of students. (Doc 3, p. 12)
The concept of similarity should be developed with scale representations, with which most students are familiar. Problems should be presented that help students grasp this concept and that allow the application of relationships between similar figures to make the problem easier to solve.
It would be ideal if the problems posed were linked with aspects of the arts and technology courses taken by the students. (Teachers written doc 3, p. 14)

Teaching is monitoring students' Mathematics work

As classroom time is largely taken up with student activities and as the role of the teacher is to monitor this work, with dialogue, questions and suggestions, the teacher has the chance to find out to a reasonable extent how the students think, how much they know, what their abilities are, their attitudes to the different situations and teachers involved in the learning process. (Teachers written doc 2, p. 5)

The teacher should monitor the activities carried out by each student, stimulate oral explanation of the processes used, discuss questions he considers relevant and, if necessary, provide useful indications so that the student can develop his or her own processes. (Teachers written doc 3, p.17)

Teaching should promote the development of oral and written skills;

Teachers should select several activities and ask students to write a report explaining the processes they used to complete the activities. (Teachers written Doc 1,p.10)

36 (Students) have great difficulty in explaining, organising their reasoning and interpreting the results obtained in group work; "forcing" them to draw up reports or descriptions enables them to gradually overcome these difficulties and simultaneously gives them greater confidence for future tasks. One of my students told me that "tests and group work allow us to overcome difficulties and we learn much more because we discuss things more". (Teachers narrative Claudia -4)

Teaching should respect students' learning pace:

The aim of these tests is to respect the learning pace of the students, give them the time necessary to think and to write without feeling restricted, relieve the tension they are normally subject to by the fact that they only have one opportunity "to show what they're worth"; to place less emphasis on assessment, in other words, eliminating the "negative charge" it usually carries. Furthermore, the second stage serves to confirm - or otherwise - the information gathered by the teacher during the first stage. (Doc 3, p. 18)

601. Students need time to adapt to new abilities and attitudes. (Doc 1,p.15)

Students should experiment, solve problems and recognize the mistakes that they make.

With these reports (written by students during class), the teacher can analyse the processes used by the students and suggest ideas so that, in the second stage, the students can correct badly constructed concepts or inadequate processes. (Teachers written Doc 1, p. 8)

Students should learn how to use graphic calculators and computer programs

> Students should also learn how to use graphic calculators and computer programs, such as spreadsheets and geometry software - "Geometer's Sketchpad" or "Cabri Géometre", for example, to solve problems. (Doc 3, p.8)

Students should develop a project relating Geometry and Art and Design;

> During the academic year, students should develop a project relating Geometry and Art and Design. This project will ideally be of an interdisciplinary nature, without allowing Quantitative Methods to assume a secondary role, however.
> As there are such a great variety of arts and/or technology courses, the subject chosen for the project should be suggested by the teacher at the start of the year in accordance with the specific nature of each course. The work should be carried out by groups of students throughout the school year and take up 15 classes. Each group of students should develop original work as part of the theme chosen for the class. (Teachers written Doc 3, p. 11)

Assessment should integrate the learning and be focused on processes

> As far as student assessment is concerned, it should form an integral part of the teaching/learning process. Different means of assessment should be used to make sure that evaluation focuses on the aims set in the classroom, concentrating on the processes used rather than the results obtained. (Teachers written Doc 1, p. 8)

Assessment should promote new learning

> Following the first stage, which will take place during lessons, the teacher will give the tests back to the students without grades, but with suggestions as to how each student can improve his or her performance. (Doc 1, p.10)
> To develop assessment as an integral part of teaching and not doing assessment by simply counting how many correct answers students got on the tests, focusing only on classification. (Doc 3, p. 17)
> Assessment should accurately reflect what students have learnt and correct it, promoting new learning. (Teachers written Doc 3, p. 17)

Finally, teachers should assess what students know and not what they don't know;

> To assess what students know and how they think about Mathematics and not what they do not know. (Teachers written Doc 3, p. 17)

In informal talks teachers often referred to the importance of creating a stimulating classroom environment where students felt free to question. For them, when students had questions this was because they were involved in trying to solve the problem and the teacher could "identify where students are stuck".

Behaviour patterns

> 16. I normally assign tasks or discuss tasks with them so that they are forced to think things through and arrive at the answer. I'm not saying that all learning is done this way, far from it, but that's the way these moments are, moments in which I think the learning process is a richer one. Because they are carrying out a particular task or involved in a particular task, they begin to discover relationships between things they are learning and things they have learned so far. (Teacher interview, 14)

By observing classroom activity and meetings and listening to teachers' comments I could identify certain patterns of behaviour in this group. Observations included students interacting in work groups of: two, three or four and the teacher working with a group.

Whilst observing classroom activities we can easily be involved in an informal work climate, where students interact trying to solve problems, exploring and discovering the way to the solution, organising evidence and communicating to others the thinking processes.

One of the most notable behaviour patterns was that teachers interacting with other students in the group, did not give the group opportunity for only one or two students to work whilst the other(s) took a rest. Initially, the teacher presented the mathematics activity, gave a worksheet with some problems to solve that applied to the use of graphic calculators, the computer, to manipulative materials or to concrete situations that they had to realize.

A second was that they promoted different learning strategies related to a problem-solving approach and always encouraged group interaction and interaction in class.

> I entered class just in time to see students moving toward the tables to sit in groups of three or four colleagues with whom they usually work in the Mathematics class. The teacher explained what the Mathematics task for the day was and gave each student a worksheet. She introduced the main aspects about what they had to do. Students read the first question individually and then prepared some comments for their colleagues. In one of the groups, two students took their calculators out of their bag and began to work on the problem; the other student had forgotten her calculator and asked the teacher if she could lend her one. The teacher got one from the shelf and lent it to her but insisted that everybody should bring their own calculator. Within a few minutes, students were discussing the problem in groups. A student from another group asked the teacher for explanations about the statistics problem and she invited him to discuss it with his peers before asking her. She emphasised the importance of discussion with their peers in trying to reason and solve together. The teacher walked among the groups questioning, explaining and supporting group interaction. (Ob 1, Ma Register from observation)

> 18. In this way, concepts are discovered and worked by them, either individually or in small groups, or even discussed as a class. (Teachers written doc 1, p.11)
> 99. Besides the activities carried out by the students, some in-group, others individually, there is also an extended discussion period involving the whole class aimed at organising technical and strategic knowledge acquired through the activities. (Teachers written doc 1, p. 9)
> The study of functions will be introduced using graphic examples, which will be interpreted by the students in small groups. (Teachers written doc 2, p.4)

A third behaviour pattern was the encouragement of co-operation, a word that is used at different times and not only for work -related tasks but also applied to attitudes. Teachers attended each group asking questions, monitoring students in their thinking processes, preventing them from getting stuck when students asked for help, creating a very open relationship and stimulating student argumentation and presentation of alternatives and the communication of Mathematics thinking. It was common for

teachers to present problems to solve or research tasks that applied to real world observation, inquiry or manipulation of materials. Teachers presented tasks to students that they defined as "riches" because they involved students in making Mathematics connections and developing strategies. When a student wanted to proceed quickly to a solution, usually the teacher asked him or her for the different steps that he/she had taken.

From the observations it is also possible to say that teachers' attitude towards student assessment was very different from other teachers not only because they used different procedures to assess students such as descriptive memos and tests in two phases but also because they encouraged students to expose their reasoning processes. They did not punish students' mistakes; on the contrary, they give them the opportunity to correct their mistakes by giving feedback that stimulated them to go forward. When teachers identified a lack of knowledge they prepared strategies and materials that could help students to understand concepts and develop skills.

Finally it was clear that teachers adopted an open and experimental approach to teaching mathematical problems where they could experiment with different situations that were completely unknown for them with the intention to discover the process for effective learning by promoting thinking skills and different alternative solutions that could be discussed in class. It was evident that they stimulated students to use technology such as computers and graphic calculators by teaching them how to use it, by introducing Mathematics tasks that needed to be done using the modern technology and showing how the mechanical procedures in Mathematics could be simplified.

> Beginning of May 96, it is a class that lasted 100 minutes, students are divided in groups of three and had moved to the computer workstation where they had to apply to Golden Number to project a design. Students take turns to use the computer but they interact in the each group. In one group students have trouble to fit in the task and different times ask the teacher for some help. Meanwhile in another group they are exploring computer facilities to make the design that was asked. The bell is ringing for a break but only six of fifteen students are leaving classroom. The other ones decided to stay and go on in their work. (Classroom observation)

Teachers' meeting. In most of the meetings organised weekly by the project group, teacher's dealt with pedagogical class strategies, but one third of them were related to teachers' educational activities, the elaboration of the mathematics syllabus and the curriculum that they were testing. These meetings were a group` responsibility and the time spent by these teachers was taken from their free time and lunch hours.
The following meeting, for example, focused on class strategies:

> April 96 the teachers involved in the project are sat around a table in the staff room in one of their week meetings and they are debating the best strategy to make students understand volumes. Maria defends the idea that students should manipulate materials to get into the concept. Carla says: students at this stage - 10th Grade - should have acquired this concept but they show that they have not. The way that can be more adjusted to them is to do the planification of the geometric solids, to glue them and leave one face open. After that we ask them to fill different solids with rice and observe the difference of volume among them. They will relate the geometric solids with objects and furniture relating the volume. The next step will be to write in Mathematics language what they recognise and get the formula to use when they need it. Ana and Claudia make some comments trying to figure out how it can work for students and how to organise the materials. They will ask students to bring cardboard to class, a pair of scissors and glue and they (teachers) will bring the rice. One of the teachers put the question if they will lose so much time. She is worried about the extension of the program and the contents they to go through. Maria argues that there can be a way to get over the problem and introduce connections with other concepts that are very important to artwork.
> The meeting finished after the members of the group had addressed their ideas about the next mathematics test that is booked and the school final tests that should be done. Maria concluded: next week each of us should bring some problems to the tests then we can organise the tests and send them to be printed.
> The meeting took place in school lunch hour and lasted around 75 minutes. (Observation)

From observation of these meetings it is possible to say that the group had an informal and positive relationship that stimulated the debate of ideas, experiences, queries and promoted production and reflection at the same time. There was an atmosphere of trust and productive climate in the group meetings.

In contrast to other teachers in the school, the group showed a distinctive behaviour. On the one hand they tried to involve other school' teachers in workshops based on identified needs, inviting sometimes experts in some areas of mathematics. On the other, they also attempted to integrate mathematics in artistic projects by interacting directly with art teachers. The group organised meetings, discussions to share ideas, experiences, and educational materials through which they attempted to disseminate their pedagogical experiences and materials within and beyond the school.

Section III – Culture of innovation and change

This section has addressed the meaning of change in three different ways. First of all, chapter eight looks for the significance of leadership in establishing the culture of a group. This was examined primarily through the detailed profile of Maria. Secondly, chapter nine focuses was upon the given meanings to change, related to educational practices, given by teachers, students, the researcher, the school and the educational mathematics community. Finally, in the chapter ten, the interrelationship of the culture of the group and the culture of the school is analysed.

Chapter Eight – Building Meaning from Personal and Professional experience

This chapter presents how Maria, the leader of the group, built her professional identity as an innovator in education through a narrative of her personal and professional experience. Narratives were developed of all the teachers. The choice to present only one story, and that of Maria's, was taken due to space limitations in this thesis and the importance of Maria as the leader of the group in terms of the process of change.

Maria' s Life Story

> "The teacher is a person and an important part of a person is the teacher" - (Nias, 1991)

As the quotation from Nias above implies, the self is present in teaching and professional acts, and, while it may be possible to conceptually distinguish between the personal and professional self, in teaching they are intimately linked. The self is also present in the way teachers' act, the way they make choices and the beliefs and values that underpin their projects. To understand how a culture of innovation was built, we also need to understand the process these teachers as a group adopted to build their identity. Each teacher brought his/her culture to the group, which was characterised by

his/her images, beliefs, values, rules and patterns of behaviour. Images here mean the experience registered and crystallised in memory as experiential knowledge that guide individuals' action Elbaz (1983) and Clandinin (1986). These images come up on the speech as short and descriptive. These images are built around the feedback that individuals receive from others in a given context. The relevance attributed by the teacher to her experience and the idealistic images that guide his/her personal and professional career will also be presented. One needs to take into account that these images may be constantly rethought by the individual in as much as the meanings constructed are contextual; drawn up, in other words, at a time and space where a complex set of factors is present.

The following questions were used to access teachers' stories and also to reconstruct, in writing, the way in which the teachers involved in the project built their identity.
How did they come to be teachers? How do they see themselves as people, teachers and professionals?
Who are these teachers that are always involved in school initiatives introducing new methods in class, in building curricula, using new technology, etc.?
What reasons and motives led these teachers to become involved in action projects?

Maria and her self-image

A sad, shy and insecure teenager. Maria's image of herself as a youngster was of a girl who rebelled against the ideas and values imposed on her by her strict Catholic upbringing. She did not subscribe to the ideals and values of her family as they were not based on logical, rational arguments and had nothing to do with her day-to-day life. She felt different from other young people of her age and social class and had difficulty becoming part of a group and meeting people like herself. Isolated at home and at school, she was sad, unfulfilled and surrounded by contradictions brought about by her ideals and those of her family.

> During my adolescence I... I was very sad, rebellious. Rebellious... against the church, because my family were staunch Catholics, and then there were all those contradictions. When I first discovered these contradictions and

> began to rationalise things, the whole thing sickened me. I felt I'd been lied to as a child. It disgusted me too as they were repressive but unable to argue in favour of the very repression they exerted. So, for me, they had to argue rationally or they wouldn't make sense. So I was a fairly sad teenager. (Interview II, p.2)

Maths was a refuge, as it required rational, logical thought, skills that Maria realised she possessed. It was something she enjoyed, that she could do on her own and at which she easily got good marks at school. This was not the case with other subjects. Maths created a world for her far away from the reality she had rejected, at the same time boosting her self-esteem and self-confidence.

> I felt a bit lost. I don't know to what extent maths served as a refuge for me, because it was abstract, rational, there were no contradictions. I was good at it, although a bit lost at other things because I couldn't master them, couldn't identify with the values that were defended. (Interview II, p.3)

There is not a single theory, nor a single truth. As a university student in her first year, Maria discovered that in maths you could construct a mathematical theory that is different but just as true as existing theories provided the principles are consistent with and independent of one another. By altering a presupposition, an equally valid theory could be obtained. This fact, resulting from reflection on her experience in terms of mathematics, had a great impact on her personal life and on the image she had of herself and her personality. In Maria's case, reason and logic were co-ordinates that oriented the construction of values, beliefs, and that made her feel safe in the decisions she made. This feeling of safety helped her to develop her self-esteem and self-confidence, which would have repercussions on her private and professional life.

> I began to realise that it wasn't just valid in terms of mathematics but that the family believed in principles, values that were my axioms and that I didn't have to believe in the same presuppositions and values that my family or society said were correct. When I started to rationalise about it, I realised that they had their values and I could have my own, and that didn't mean that one of us was wrong. So I felt good about myself. That gave me a rational confidence that had been lacking. (Interview II, p. 3)

I'm not very outgoing, I have difficulty getting along in a group. Since her childhood, Maria had had trouble getting along socially. She put this down to being fairly unforgiving, a logical, rational person, someone who does not open up and talk about herself and her problems. She has always felt different from others, played a passive role in a group and felt isolated. This was partly to do with her interests, which had little to do with aspects of day-to-day life and more in common with ideological, cultural and social aspects, and - naturally enough - mathematics, in which the majority of people around her were not interested and had difficulty discussing. The social and emotional context in which she lived until she entered university did not allow Maria to grow as a person, to gain self-confidence and develop her abilities.

> I started to gain a bit more self-esteem at university but, for example, my relations with the group were very complicated. I've always had trouble getting along socially in groups, particularly when I was younger. I always took on a fairly passive role. (Interview II, p. 5)
> I'm a little ... (pause), I speak my mind and people don't like that. (Interview II, p.22)

Authoritarian, hard working, ambitious, persistent and enterprising is how others **saw** Maria in her personal and professional relationships. She put this down to the fact that she is active, pushes people into doing things for which they feel they might not be prepared, and doesn't sit around waiting for things to happen.

> I think that some of them (the others) feel I'm very authoritarian because I came here and tried to change things. They think I'm trying to impose certain things... and in a way I am because I take the initiative in changing things.
> My daughter's father told me that I was very authoritarian, because at home I was the one who took the initiative and he didn't like it. (Interview II, p.24)

Choice of profession. Maria recognised that she had a natural tendency for maths and when she left secondary school she had no doubts as to what university course to take. As for a profession, research and Pure Mathematics interested her. Her life was not compatible with her plans, however, and many things happened before she became a secondary school mathematics teacher.

Mathematics had nothing to do with the revolution. The 25th April 1974 revolution created the social context for the participation of all those who had wanted to help lead Portugal on the path to democracy for many years, transforming it into a democratic, pluralist and developed country. This was the case with Maria, who wanted to play a social and political role. At the time, Maria questioned the social function of mathematics and the isolated world in which she had lived. She even considered changing course and taking a degree in architecture as she felt that it would better serve to help improve the quality of life.

> When the 25th April revolution took place, I was in my first year at university. I began to feel that maths had nothing to do with the revolution nor with the things that I considered were important at the time, so I quit my course. I stopped studying for three years and thought about taking a degree in architecture as I felt it had more to do with work, it was socially more important, and had more in common with my ideals. (Interview I, p. 2)

In the social context of the revolution, Maria began to view her own colleagues differently. She even began to question the meaning of their lives. The world of mathematics no longer fulfilled her needs.

> I was hugely disappointed with my colleagues. They were all so unhappy even though they were the "bigwigs" of the maths department. We were all experiencing what was going on and they could do nothing but talk about theorem X, theorem Z, and demonstrations. For me, there were more important things. (Interview II, p.10)

For three years she abandoned her degree, mathematics and the closed world in which she lived, and dedicated all her time and effort to the revolution, searching for jobs just to make ends meet. At the end of this time, aware that she needed a professional career suited to her abilities, she returned to university to finish her degree in mathematics.

Professional Career.

Being a teacher to make ends meet. Maria began her teaching career at a private college, aware that this was not the career she really wanted but the only one that was

possible in view of her qualifications. The need to survive and deal with the life options she had chosen led her to teaching when her real desire was to do research in the area of Pure Mathematics. Her words illustrate her frustration.

> During the first year I didn't like it at all. I taught at a priests' college. There were no professionals there, it was all very amateurish. Those teaching maths had degrees in chemistry and economics so scientifically they knew less than I did. The only difference was that they had more teaching experience. I had discipline problems and they didn't have any sort of pedagogical project or plan. The whole thing was reminiscent of an old-fashioned priests' seminar. The Fathers would look through the door to see if I was getting on all right with the pupils and if they were behaving properly. There was a lot of repression and, as a result, I didn't get on very well there at all.
>
> Then, after a while, I decided to try to get into State teaching, which seemed far better, and moved to Lisbon because I wanted to teach evening classes. That year went all right, but I still felt that what I really wanted to do was pure mathematics. (Interview I, p.3)

Discovering a teaching career. It was later, while she was teaching at a State school, that Maria decided that the career she really wanted was in teaching. This turn around came about when she came into contact with non-demonstrative teaching models through the pedagogical activity of a group of teachers at the school, discovering that being a Mathematics teacher didn't have to be a routine, mundane activity and that closer relations could be formed with the students.

> I only decided to become a teacher when I realised that being a teacher was not the same as I had imagined when I was a student. Doing the same thing year in, year out, the same way. You didn't have to always give demonstration classes. I realised there were other ways of being a teacher. (Interview I, p.4)

The full-time professional teacher delegate was a role model representing involvement in the construction of teaching alternatives that covered student-teacher relations, the creation of different situations and materials for teaching maths. Initially she had become a member of the teaching staff at the school solely in order to make ends meet. Choosing teaching as a profession after three years had a lot to do with her involvement

with a group of teachers seeking pedagogical alternatives for maths teaching. These experiences, coupled with her professional experience, remain very much alive in her memory, and she attributes her discovery of teaching as a career to them.

> There was a really interesting full-time professional teachers' group and I started to get involved with them. From then on, I decided I'd try and become a full-time teacher [at the school]... Vitor was one of those that aroused in me the interest that the profession can have. He was a sort of role model of what a good teacher should be because up until then... (Interview I, p.4)

Becoming a full-time professional teacher put Maria in contact with different approaches and perspectives in terms of teaching and learning, the activity and nature of mathematics. Her experience allowed her to feel and recognise the personal and cultural dimension established through maths, as well as the value of social group interaction.

I've never forgotten. There were two critical incidents that had a special impact on her professional life and on the relationship she had established with maths and on her own self-image.

> A very interesting workshop in which I took part was with an Italian who had published an article on maths and reality, the dynamic teaching of maths, quite some time previously. It was the first time I had come into contact with this sort of thing. The workshop was something I have never forgotten. She (the seminar leader) demonstrated other ways in which mathematics can be put across and enjoyed, not just abstract maths. (Interview I, p.6)

Different view of myself. Maria described another experience that she claimed help change her self-image and had an impact on her professional choices:

> As part of a group activity, I was chosen to play the part of a leader of a group of teachers. I felt that the role I had been given had nothing to do with the type of person I was, as I felt incapable, naturally, of being the leader of anything. It was interesting because I was astonished at the fact that I could

> take control, something I felt I could never do. I left the session with a different view of myself. (Interview I, p.5)

I dedicated and threw myself into teaching. Maria's life experiences, her personal characteristics and motives, together with certain dissatisfaction, the constant need to learn, convinced her to take an active role as a teacher. Her personal characteristics of initiative and creativity in the search for situations, proposals and solutions led her to be a teacher involved with new approaches.

Her enjoyment working in a group and her sense of social participation with ways of thinking and approaching the profession were recognised as different from those she had had contact with as a student. All of this gave way to an interest in discussing, preparing and applying mathematics materials in the classroom. This interest was gradually transformed into enthusiasm at being a teacher and a passionate involvement in projects and courses for maths teachers.

> I started out as a teacher because at the time it was the easiest way to make money. Today, I love what I do. I have fallen in love with the profession. I increasingly get the feeling that I won't be leaving teaching. (Interview I, p.9)

I like people. One of the aspects that also influenced her choice of career was the fact that she enjoys interacting with people, teenagers in particular, and trying to understand their learning processes.

> I like people, and I enjoy finding out how my work influences the way in which they learn. I have come to the conclusion that for me one of the most important things in teaching is the student-teacher social relationship. I like relating with teenagers, I think it's important for me. (Interview II, p.12)

A bad professional experience. Maria refers to her participation in the management of a secondary school as the worst experience during her fourteen-year career as a teacher. Although the teachers on the School Board, of which she was a part, got on well together internally, this did not prevent conflicts arising caused by other groups of teachers with different interests and approaches. It was a tiring, frustrating time that reinforced in her the idea that the pedagogical aspects of maths teaching were the most

important. She felt and believed that she had difficulty in handling conflicts at institutions.

> I was on the School Board at the Dom Pedro V School. It was a bad experience because there was a lot of internal squabbling of which I only became aware later. There was a group of teachers who did everything to try to ruin our work at the school. It was a bad experience in those terms because as a School Board we got on very well and things always ran smoothly. (Interview I, p.6)

I had to do different things. At one point, at the end of the eighties, when Maria was feeling dissatisfied with teaching methods, a colleague from another school, who was doing her Masters Degree, asked her to collaborate on a project aimed at introducing calculators into the maths classroom. The project had two sides to it: training teachers to use calculators for teaching purposes, and their practical application in the classroom, the aim being to find out their impact on learning mathematics. The joint work went very well, in terms of both students and teachers, with invitations to teacher training courses and presentations at other schools.

> I needed to do something different. I ran the teaching programme based on the calculator and used the teaching methodologies. It was an innovative experience at the time given the theme and the use of the calculator.
> The project included training teachers in the use of calculators. We met every two months to discuss things we had tried out. She gave us other tasks, we discussed and carried them out, and then experimented in the classroom with our students. I began to experiment and, or so it would appear, I experimented the most as I planned all my work for that year around this experiment. (Interview I, p.12)

This, the first project in which Maria took part with 7th grade students on the use of calculators for the construction of concepts, was an important group work experience, as it made her believe that it was possible to put her ideas into practice and change the way students approach mathematics in the classroom. The work developed with Silvia, the author of the project, gave her greater confidence and belief in her own abilities and also strengthened the professional relationship with her partner, leading her to accept her invitations to disseminate the work carried out both orally and in written form.

> I'd prepared a work to be presented at Profmat (an annual seminar for the maths community) and as I had to go to Brazil, Silvia presented it for me. That was very important in terms of my self-esteem. (Interview I, p.13)

Snowball. Maria recognised that since she worked on the project with Silvia, her professional involvement "had jumped *(spread beyond?)* the school walls". It has been like a "snowball" as she has received requests to run courses at Profmat (an annual seminar for the maths teaching community), to talk and collaborate with different people, particularly those connected with the teaching of Geometry. The relationships that were established as a result of the work and pedagogical proposals conducted created in Maria the need to continue to contribute towards turning failure in Mathematics into success, adapting the subject to the reality of the students, allowing them to think for themselves once more and encouraging positive attitudes.

It was Silvia who persuaded me to formalise this project. Maria, having recently become a member of staff at a school dedicated to the arts, decided to present an idea she had had in mind for some time to her disciplinary group at the school, the aim of it being to adapt Mathematics to the real lives of the students taking arts courses. Her proposal was well received by several teachers who shared identical concerns and wished to find curricular alternatives to a Mathematics syllabus that had little in common with most of the arts students, who therefore had great difficulty with the subject. They set about their task for a year and, two years later, the group is still continuing its work. Maria recognised that Silvia, who taught maths at the College of Education, greatly influenced the development of the project in the beginning and that without her she would not have had the courage to formalise the project.

> It was Silvia who suggested that we did this project, because I'd had this idea for a long time but it wasn't that developed (...) She knows far more about the way things work at institutional level. (Interview I, p. 9)

I co-ordinated the project. The fact that Maria had set up a project group that was recognised outside the school by other institutions, such as the Association of Mathematics Teachers and the Secondary Education Department, gave Maria a certain self-confidence in terms of leading projects. She recognised, however, that if it had not been for the group, she would never have attempted a project so wide in scope.

> I co-ordinated the project. You've probably noticed that at meetings I'm the one in charge. That's not to say that the others don't participate actively, but I do tend to take charge. (Interview I, p. 10)

She could never have managed it on her own. Maria recognised that when working as part of a group, she could achieve much more. She considers the project a good example of this.

> In professional terms I did what I had wanted to do, deep down, for a long time but which I could never have done on my own; at least, I would never have had the courage to do it so radically. Creating a new syllabus for my students (arts). (Interview I, p. 20)

The situations described here regarding Maria's passage from student to teacher had a special significance, not only in professional but also in personal terms. Reflection on what had happened and what could happen meant that she rethought the way she viewed her career, the way she viewed herself and her day-to-day affairs.

Maria's views on teaching, learning and being a teacher

Teaching the same way every year. As a student and during her first few years as a teacher, Maria formed an idea of what it was to teach and be a teacher, one which was undoubtedly related to her experiences as a student at school, and the models she found when she initially began to teach. The idea of teaching that Maria had was a negative one that made her reject a teaching career. Her personality required a career that was far more creative, hence her interest in becoming a mathematics researcher.

> My idea of being a teacher was someone who did the same thing every year. That was not what I wanted to do. I wanted to move forward... investigate. (Interview II, p.11)
>
> I had this idea that teachers always did the same thing, were aloof from their students and did nothing but explain. (Interview I, p. 2)

I progressed slowly. During her first years as a teacher, the problems she came up against whilst teaching led to her question the traditional mathematics teaching and learning model, which she considered formal and abstract. Reflection on the way she

taught, interaction with maths colleagues who had put into practice another model and several experiences provided by mathematics workshops all meant that gradually her image of what a teacher was began to change.

> When I started giving exposition lessons, they were the only ones I knew how to give, the only ones I had ever had. I'd get there, and I felt that I was teaching them to think because I'd tell them how I thought. I also began to realise that (the students) think differently from the way I think and there are other reasoning processes that are different from my own. (I felt) that I was too formal.
> I gradually altered my approach in the classroom. I progressed slowly. I remember going to a seminar where they care a great deal about these issues... (pause) Teaching based on tasks for students but also connected with real life. I learnt things there that I'd never thought of before. (interview II, p.18)

The decision to take up a teaching career was closely linked with this changed image.

> I decided to teach because at the time it was the easiest way to make money and (laughing) I ended up falling in love with it. I came to the conclusion that teaching was something I really enjoyed. (Interview II, p.11)

The classroom as a workshop. Her image of a teacher and teaching was changed when she came into contact with people and a situation that showed her that teaching could be a *creative activity*. Today, her daily approach to teaching is guided by an ideal image of teaching and being a teacher. "Ideal" as she recognises that she still hasn't managed to put it into practice, although it is her aim.

Maria would like to implement the dynamism of a *workshop* in the classroom, in which the teacher's role is to facilitate learning, stimulate teamwork and encourage dialogue with students.

> I'd like my classes to be a workshop, with manual and intellectual work... students involved in a given task at the workplace. A lesson should include manual and intellectual (aspects). (Interview II,p.15)

Students learn when they experiment, discuss and discover. Her experience as a teacher - she has worked with youngsters for around fifteen years now - and reflection on the way in which students learn mathematics led her to believe that interaction and experimentation are of the utmost importance in learning. A relaxed atmosphere in the classroom that provides dialogue between student and teacher means that students have a positive attitude and consequently are more willing to learn.

> Students learn when they discover. I discuss maths problems with them so they can get there. Those moments are the richest in terms of learning. (The students) are involved in a particular task, they begin to discover relationships with other things they've studied earlier. (Interview II, p.14)

She has put this idea into practice in the classroom, presenting the task or problem to the students, who are organised in groups. She creates an atmosphere that allows students to raise any doubts they might have and ask questions. She manages the activity in such a way that the students can find the answers for themselves. This is frequently done by asking questions, exploring materials and mathematical situations connected with real life. In conjunction with other Mathematics colleagues, it is Maria's wish to create materials and situations that integrate knowledge and practice in the area of arts, allowing students to use maths in their arts projects.

> If you went into one of my classes or one of Carla's classes today, you wouldn't see exposition classes, the lessons are not traditional. It's a lesson where students are seated around the desk working, doing something. The atmosphere is becoming more one of work, which is our aim. (Interview I. p. 17)

I play an increasingly smaller role in the classroom. Maria's image of herself as a teacher has changed: she now plays much less of a leading role, instead creating situations that offer resources and facilitate students' learning.

> I'm increasingly a "helper", the students take up more and more space. (Interview I, p.8)
> I play an increasingly smaller role, they (the students) play an increasingly larger one. I'm there to encourage them. (Interview II. p.21)

I try to be an innovative, investigative teacher Maria idealises her role as a professional constantly carrying out research and searching for new teaching methods. Dissatisfaction, intellectual curiosity and the desire to widen her knowledge make her search for pedagogical alternatives, to carry out research and exchange ideas with others in informal spaces or at pedagogical meetings.

> The approach I wanted to adopt in day-to-day teaching was of creating and researching. (Interview II, p.)

Learning mathematics. Reflecting on her experience as a student, Maria mentioned that she always found maths an easy subject. Although the teachers she had were very traditional and used approaches that she now rejects - a very formal method of teaching of mathematics with classroom activity only involving calculating and demonstrating - she really enjoyed learning maths. *"I fell in love with mathematics"*. The subject *"was a refuge because it was abstract, rational, there were no contradictions"*.

I have learned far more maths as a teacher than as a student. In her role as a teacher, she recognised that her desire to learn **was** not just for scientific reasons but mainly to transform the way she taught. She felt that she had learnt a lot more about mathematics as a teacher than she did as a student, especially in situations that encouraged maths research for purposes such as: the teaching of the subject, the preparation of teaching books, courses and teacher training sessions. She recalled episodes that were learning experiences for her, such as interaction, discussion and sharing knowledge with colleagues, and observation and reflection on the educational activities developed with students and teachers.

Summary

Maria's life story, a forty-year-old full-time member of the mathematics department at a secondary school in Lisbon with around fifteen years' teaching experience, shows us how the image she had of herself changed and in turn changed the context to match her personal characteristics and needs. It was this context, that was behind the change and the significance attributed by her to these situations, experiences and social events.

During her life, various events took place that affected her professionally. The birth of her daughter and divorce from her husband, brought about financial difficulties that restricted her in professional terms. Once this had been overcome, as Maria gained self-confidence, her self-esteem increased and she began to achieve professional fulfilment. The social, family and academic context played an important role in the change in the way she viewed herself as a person, teacher and professional, due to the importance of situations and experiences in which she was involved. The negative feeling of dissatisfaction stimulated reflection and encouraged her to seek solutions. It was in this context that she developed as a person and a teacher. Her dissatisfaction with her own knowledge and her desire to continue to tread new paths has led, over the last few years, to her returning to university to complete her degree in teaching mathematics and moving on to her Masters.

There is no doubt that Maria's personal and professional career would not be the same if she were not the person she is: reflective, rational, unsatisfied and demanding, a person who enjoys ideological confrontation with her peers. A person who enjoys discovering pedagogical solutions, someone who likes to take risks, is thirsty for knowledge, creative, averse to routine and passiveness, a person who enjoys team work, sharing and building.

She took on the career of teaching with the same passion that she currently dedicates to teacher training, the pedagogical project she runs at the school, writing teaching books, writing articles for a mathematics magazine and carrying out research into how students learn mathematics. All her professional work is carried out as part of a team, in groups that are formed informally at the school, in the Association of Mathematics Teachers, and at the university where she is doing her Masters thesis. Maria recognised that in certain contexts she was a group leader, as is the case with the pedagogical project she developed at the school; in other cases that she belonged to groups where others were in charge. Maria also recognised that she was a good professional who did a lot of work outside the classroom, who took part in preparing alternative curricula, changing educational practices and designing teaching materials.

From the outset, the choice of mathematics was based on the image that Maria had of herself, as a logical, rational and creative person, and the characteristics she attributed to

mathematics. She said that she loved doing what she does, mathematics in particular, and tried to pass on this enjoyment to her students.

Her strict family and scholarly upbringing led to rebellion, not passive acceptance. In this case, her ideals and culture were not passed on to her, but sprang from interaction with others and her capacity for analysis and reflection.

The importance she placed on her experience as a teenager, her rebellion and conflicts, characterised the relationships she established with her students. She engaged in dialogue, logical argumentation, questioning, social responsibility and understanding of the enthusiasm, disagreement and inner conflicts of the teenagers.

Her desire to participate in innovative educational practices and investigate learning processes meant that she was recognised as a pedagogical leader within the professional community to which she belonged.

Chapter Nine - Meanings of Change – The Impact of the Project

This chapter presents a discussion about the following issues: what was the impact of the project in creating a different culture in the school taking into account; (i) the curricular approach (ii) teaching and learning methods; (iii) teachers' professional development network; (iv) the school staff; (v) the mathematics community.

The impact of curricular approach

Two years later, the project had begun in Herculano School, the state department promoted a meeting where the leader of the project presented the curricular alternative for high school art students. The curricular alternative was a motive for discussion of pedagogical ideas in the mathematics department in the two schools specialising in arts and crafts. The experience mainly provoked a confrontation between two different cultures, one based on the traditional model of curriculum centred on the content of the program emphasising teachers` transmission, and the alternative one, already described in chapter six, which stressed the experience and research methods in the development of mathematics abilities with special relevance to mathematics thinking and communication. The introduction of interactive methods for teaching, project work in Geometry and students' assessment were the most controversial points for some teachers, but the most innovative for others by promoting flexibility and creativity, in relation to teachers and students agendas toward artistic education.

During the meeting of the mathematics teachers of the two schools, it was became clear that some teachers had trouble in accepting project work. A conflict was apparent between the two different pedagogic models that incorporate different classroom culture and beliefs about mathematics. In one of these models, teaching and learning is based in knowledge transmission using the blackboard to do demonstrations with the corresponding insecurity teachers felt using interactive methods. In the second model construction of knowledge was generated through group interaction, and generated manipulation of materials. The representatives of state department promoted negotiation

and curricular organisation was changed, as well as the program of Metodos Quantitativos. In Herculano School the relationship among mathematics teachers was affected in the process of the project development and clearly defined by the team group and other teachers, *"we and they"*. This attitude increased the resistance of department teachers to the generalization of the curricular mathematic approach - designed by the group - to all mathematics classes in school.

The intention to develop an interdisciplinary approach was the most critical aspect of the project created by the group of teachers. This intended change was ruined, in part by the group difficulty in relating to art teachers and establishing a dialogue that could provide the opportunity to find the links between arts and mathematics. The context and school organisation did not facilitate, this development, but the primary problem was that the group of teachers involved in the project did not plan implementation of the project across the school. It could be said that they were rather enjoying their own experience and the gaining of new knowledge about curriculum development without a thought for future generalisation. An image of what could be in future was not present, so the group could not assume control of the approach and change through school, therefore did not happen. Despite this fact, this curriculum and the materials that supported the project has been recognised by the community of mathematics educators as a pedagogical model that could stimulate change in classroom mathematics practices. It was presented as an example of curricular development that empowers teachers in the specific context of the school, in seminars, conferences, schools and university meetings. Written comments (Doc 7, p. 8- doc. mathematics educator) made by one of the leaders of the mathematics community in Portugal, shows how international trends are present in this curriculum and in the criterion which guide how change is analysed. Consistency was found in the global mathematics curriculum between and within the different components - aims/goals, contents, methods and assessment - the expressed theory that supported it and the educational mathematics materials developed. The acceptance of the project by the mathematics educators' community is justified by the theoretical support: (i) the social constructivist theory – the relevance of social interaction in building knowledge; (ii) the value given to experiential knowledge to reach abstract reasoning in Mathematics; (iii) the application of gestalt theory to classroom activities; (iv) the problem solving approach; (v) the introduction of new technology to support teaching and learning processes.

Community mathematics educators questioned if the community of professionals in Herculano School were becoming more interactive creating links in thinking and working to produce knowledge, or whether this was a simply acceptance of outside ideas?

The impact on teaching and learning

> These pedagogical experiences [educational practices] for introducing innovation do not make sense if they only last one year. The aim of them is that teachers can improve their practices and get used to questioning themselves about what they are doing in an on going process of improvement. (Doc 1, p.15)

The group of teachers relates change in educational practices with on going process of teachers' self and group reflection. The impact of teaching and learning methods were analysed, by this project teachers group, in respect to students taking in account their feedback along two years of classes. From the point of view of the teachers in the group, the curricular approach that they adopted in the classroom has developed in students a different attitude toward mathematics and has increased substantially their success in the discipline of Metodos Quantitativos. The inquiry that teachers undertook at the end of the year, revealed through the results of a questionnaire, that the dropout rate decreased for 4% and the underachieving for 17%. In these underachievers are included the students who failed in other disciplines (75%). Generally speaking the inquiry inducted that, students showed a modification of their attitudes towards mathematics activity. Instead of waiting for teachers` explanations, definitions and demonstrations, as they used to, they began to be involved in the process with a state of mind for working in problem solving and researching. They also gained a different attitude toward the subject matter, making a distinction between the Mathematics they learnt before in middle school and Metodos Quantitativos, a different kind of Mathematics, for students from the humanities and arts.

> In fact, the early classes of the year, students came in taking a passive attitude expecting "to receive information", and they did not know what to do with worksheets that we gave them, almost all the students thought that we wanted a "key answer" and as it was not exactly taught, they did not do

> anything waiting for teachers to give directions to solve the problems. Slowly, they began to understand that what was important were the processes that they were discovering to solve the problems and the debate of these processes was promoting the learning. In the middle of the year, their attitude to mathematics tasks was completely different: they became active and tried to be original and critical in their work. (Teachers' report doc 4, p.8)

Teachers are also convinced that they promoted in students the development of self-confidence, autonomy and cooperation by giving them an active role, providing mathematics situations where they could interact (work groups) and the use of a less formal mathematical language.

> It was very important to attain this goal, the fact that, in our classes, students were the first actors feeling the responsibility for their own learning, and work mainly in groups. The debates that they had with each other about the activities, the involvement that they showed in their work, the initiative they revealed, the way they spontaneously formed the groups, were manifest signals that occurred as the year went by. (Doc 4, p.9)

The majority of students, (76) in total, also made comments revealing that the most important element in the alternative curriculum was the interaction that it promoted in class, developing thinking and reasoning in mathematics. It was recognised by them, that the classroom environment created by the teacher promoted the interaction between her and students and between students. The changes in classroom environment also provided students with the opportunity to construct evidence based on their process of thinking and action related to testing and manipulation of concrete materials. Generally speaking, students recognised that their role in class had changed as they were active, manipulating materials, doing experiences, establishing connections and describing their thinking process to communicate to the teacher and to the whole class. Students also revealed an attitude of curiosity and a special interest in the applicability of mathematics to art projects.

> This year, we learnt Mathematics researching by ourselves. Daily, we had to solve the problems that were present in a paper sheet or with material that was around. In a team of three or four, we debate the problem and we solved it together. We had to learn how to work in a team and also how to explain our reasoning in a paper sheet. Sometimes the teacher presented us

> some theory that was needed but is clear that the goal of her teaching was that we learnt by ourselves. During this year I had the opportunity to develop my mathematics thinking by debating with my fellows. (Student interview Teresa-p. 39)

For some students, the mathematics learnt during this school year was very useful to apply in their future work. There were a few negative comments related to; (i) the attitudes of one teacher in class, more related with her personality; (ii) the frustration felt by a few students was related to the lack of advanced mathematics content.
In fact, it was confirmed that the teacher's personality and background influenced the class climate and the quality of interaction.

The development of the interactive teaching introduced changes enlarging the use of concrete materials for mathematics learning and the use of new technology as a mathematical resource. Teachers' ideas about the role of computers in Mathematics education was confirmed and reinforced by their classroom experiences.

> Although we have not yet fully explored these programs, we are sure that the computer will prove a highly important instrument in terms of new methodologies, the creation of learning situations, the exploration of problem-solving strategies and development of the ability to get mathematics across. (Doc 2, p.11)

Teachers inducted students into a project work as a learning process. Given the routines developed in class through, at least, nine years of passivity, students took some time before they fully took part, as they were so accustomed to waiting for teachers to control the time.

In the context of this school, it is possible to affirm that a new culture of teaching and learning was introduced by this group of project teachers considering the theoretical base and the pedagogical model implemented. The model and educational materials can be disseminated per se but if it was not integrated in the corpus of beliefs and values embedded into the project, it is difficult to say what kind of impact it will have. In this case, change in teaching was integrated into the way these teachers were open to creating different relationship within the teachers' group based on co-operation, opening themselves to criticism, reflecting about class episodes and their own professional role.

What was also important was the perspective on knowledge that teachers held on developing inquiry and research procedures. It is not possible to say that the change in teaching occurred in other classes outside this group of teachers neither it is possible to say a great deal about students learning in terms of the level of thinking about mathematics. Sometimes teachers were frustrated by the level of knowledge attained by students, recognizing the importance of many other factors in the curriculum.
Some other mathematics teachers at this school tried to introduce some materials, worksheets and resources such as calculators, but had not assumed the corpus of beliefs and values. Their rules and patterns of behaviour followed the ones that traditionally are assumed in a tranmissive model where interaction and communication is not present in teaching and learning and where students are not seen as the focus of the learning process. Rather, whose emphasis is given to content and to performance in tests.

As time went by, students began to participate fully in the learning process. This group of teachers expressed the idea that they became confident in managing all the dimensions of the project in the classroom including: time, space organisation and resources, group work, and materials. With experience and over time through shared reflection the group's ideas maturate and changes were introduced in teachers' routines. The challenge of this pedagogical model was the focus on learning processes instead of teaching ones. Daily and weekly the group of teachers analysed students` mistakes in mathematics and the discussion was used to identify the reasons behind the students´ incorrect reasoning and processes of resolution. In this process, teachers became aware of how students learn and what was behind the mistakes. In this way, student assessment also became related to the process of students' learning.

Two years after, the project started changes in classroom organisation and management of resources were introduced by this group and have been adopted by all teachers in the mathematics department in the school. The application of computers in mathematics activities in the classroom also became dominant..

Although teachers in the group had in mind to use other spaces (such as the arts studio), where art projects were developed, it was not possible to implement collaboration between mathematics teachers of this group and art teachers, due the lack of dialogue and negotiation. But what is relevant in the project group is the idea that mathematics is

related to the real world, that it is social and is practiced in different contexts. In spite of the limitations in introducing mathematics in art projects, the project group used artistic production from the past and the present to introduce mathematics activities and concepts.

For this group of teachers, this project introduced changes in the classroom and students` learning and this became the focus of all the processes developed, rather than the instruction of the mathematics content. Teachers and students involved in this project recognized this changing process, in their attitudes toward knowledge and learning, as they came to understood that they could be participants in the process and ideas were not imposed from outside.

Teachers' professional development network

In this project, the group had stressed the intentions of changing educational practices for mathematics teachers` professional development. These teachers were open-minded to changing their attitudes and practices in class. They believed in the value of change by identifying the point where things were wrong. They actively engaged in developing inquiries, researching in books, interacting over findings, elaborating plans and looking for support in the professional community. Their attitude may be described as one of intervention to change the status quo related to students` education and their own professional development. This is a different position from that held by the majority of teachers.

> It is common, when someone asks questions about the deficiencies of the educational system, to listen to teachers blame the system, the programs, the physical conditions of the schools and the lack of preparation of students. But it is less common to listen to teachers questioning their own educational practice, trying to look for solutions, perceiving their own limitations. Be sure they have some reason. It is true that the educational system does not work well. The reform was imposed by policy, there is no political willingness to change the system, to invest in teacher's educational training, to improve the physical conditions of the schools, and to promote a serious enlarged debate about the implementation of new curricula, and its evaluation and reformulation. But there is the responsibility of teacher. There always have been good and bad teachers and these [good teachers]

> have always been determinate to support the academic success of students. It is important that teachers have the willingness to improve their practices and do their best. (Teachers report Doc 4, p.14)

Two points of view arose from the discourse of teachers when confronted with their practice. One was related to scientific knowledge as a basis for improving performance. Teacher's needs, in terms of mathematical knowledge, were identified related to the content of the program in high school. Sessions were held by experts invited by the group to all teachers in the mathematics department in areas such as: (i) Geometry, (ii) Statistics; (iii) the use of technology and (iv) students` assessment. The other point of view was, guided by teacher's desire to improve their abilities in teaching, gain self-confidence in introducing innovations and the conviction that they could change other teachers' attitudes, beliefs about mathematics, teaching and learning. A network was established based on the educational materials they developed and on teachers` classroom experiences. An assumption that sharing, interacting, debating and reflecting moves teachers forward to a different one, a more collaborative culture of teaching, a collaborative one, was the basis for the organisation of a network. However in fact, there is no evidence of change in other mathematics teachers' practices and beliefs, outside of the group. Each member recognised that changes were introduced in their practices in the classroom and as professionals. The interaction within the group and between them and community members of mathematics teachers provided more than experience, and introduced them to a different way to be a professional. As time went by, the group came to believe that *"the work of the teacher only makes sense if part of a team"* (Teachers report Doc1, p.15) as this is a way of exchanging ideas and experiences, creating meanings and rethinking the pedagogical relationship and day-to-day methods. They also gained self-confidence about their teaching and their role as professionals..

Self-reflection and individual engagement were also developed through this process giving the teachers the feeling of empowerment. Professional development was centred on teachers` needs and desires focused on improving their educational practices and involving themselves in the process. This was an experience recognised as challenging for them, creating an awareness of power that they had in the process of change.

> This project, among other things, helped us to improve our educational practices (...) Our intention of being "good teachers", and active actors intervening in the educational system, (...) has been reinforced by perceiving the power that we have for changing things. (Teacher report Doc 4, p. 14)

Impact of the project on the school

Explicitly, there is little that the school community has recognised as change or improvement brought about the development of this project, but it does not mean that changes did not occur. From the beginning, the school community in general was not involved with the actions adopted by this group of teachers. The School Board, the Pedagogical Committee and the Mathematics Department maintained an attitude of neutrality when confronted with project activities and the alternative curriculum. This is despite the fact that they had been informed about the proposal, and the ideas on which it was based had been disseminated in public sessions of the Pedagogical Committee, the Mathematics department and in informal conversations with art teachers. Generally speaking, this attitude was a passive translation of the individualist culture that characterises the school. The group of teachers who implemented the project did not have limitations imposed by the bureaucracy or the formal leadership of the school or state department but sometimes they felt frustrated by the school's lack of participation. The obstacles that this group of teachers had to "jump" were related to the school and the teachers` passivity that was manifest into no co-operation, no participation and lack of reflexivity towards the educational practices developed. An appeal to other teachers` for their collaboration in developing an interdisciplinary approach had no impact and the initial goal of the teachers' project was not developed through the school. There were various reasons for this, including: a lack of time to meet for planning, the difficulty teachers has in creating a dialogue, teachers were overworked, the professional lack of enthusiasm in investing in an interdisciplinary approach, the limitations of teachers' educational background in curriculum development and the fact that the project' goals were not incorporated by the school into its agenda.

Seen from another point of view, the evidence indicates that the posture of the group was characterised by the self-confidence they displayed in their educational ideas,

which was interpreted by other teachers as an arrogant attitude in their action toward them. Also, the group assumed a different culture of teaching from the one that already existed in the school, promoting the attitude "we and the others", creating resistance, but not an evident conflict. The collaboration demonstrated that the others should make an effort to change their own beliefs, attitudes and practices. Added to this, was a lack of conviction about school change, in spite of the reform process and the policies stressing school autonomy. The other teachers' images of school, related to their experience of a centralised institution, affected their beliefs and their action, in changing the school.

It is difficult to speak about the impact of the culture of collaboration and autonomy that was introduced in the school by this group of teachers, as two years is a short time to gain a perception about whether attitudes, values and beliefs in a school have changed. However, it is possible to say that, in the last two years, teachers` initiative had increased in this school as more projects focused on teaching and learning had been developed, in addition to a more confidant attitude towards external institutions, and the development of an attitude of autonomy, regarding the routines of bureaucracy and centralisation.

Mathematics community

To the surprise of many, the repercussions of this project were revealed in this school and others, when the state educational department officially recognised the model of the curriculum for high school art students. The project group of teachers gained visibility throughout the state department, the community of mathematics educators and the school. The Mathematics teachers association promoted the dissemination of the project, the alternative curriculum and the educational materials. The curricular approach developed was classified as an innovation because of the consistency between the theoretical perspective adopted, the materials developed and the teaching, learning and assessment procedures implemented. The political context facilitated the promotion of this curriculum and its recognition as an innovation. The new government team for education that came in as a result of the elections of 1995 had the intention of

supporting teachers´ initiatives in changing schools. The mathematics education theories of this project gained "echoes" in the state department. Confronted by the written reports and the success of a public presentation of this group project, the Teachers Mathematics Association adopted the project as a model, noting the fact its consistency has been demonstrated.

The group was invited at different times to communicate their project and experiences to different audiences in seminars, conferences and workshops. For further development, the state department invited Maria, the leader of the group, to write educational brochures and to orient advance teachers´ training for mathematics high school teachers in curriculum development. So far, the community of mathematics' educators and political forces have stressed the change, empowerment and visibility of this group of teachers. Meanwhile, the culture of the school has promoted passivity and individualism.

Chapter Ten - Interaction between group culture and school culture

This chapter presents an interpretation of the descriptive data about the school and group culture and their interaction.

Through the cultural analysis described in Section 2 of this thesis, the presence of a group was identified (Levine & Moreland 1991). This comprised five female teachers with common goals and a common frame of reference who were developing a constant interaction in relation to mathematics' educational practices and materials, demonstrating interdependent behaviour and affective ties. The culture of the group stressed school and curricular change based on a model where the following was present:

- empowerment of teachers in the school which enabled them to create alternatives;
- democratic values emphasising participation, autonomy and co-operation;
- personal practical knowledge as a concept embodying a dialectal view of theory and practice, where practice was seen as theory in action and theory assumed to change and modify according to the shifting exigencies of the practical world;
- critical thinking processes;
- problem solving approaches;
- social constructivism approach valuing social interaction in the process of learning;
- applied research methodology.

The group behaviour reflected the difference in attitudes and practices in relation to other mathematics teachers in the department. The original problem addressed by the project was identified in the department and its design was open to all teachers who wanted to participate. The leadership of Maria was recognised by some teachers – six - who identified with the expressed ideas and methodology. The other five teachers firmly resisted the project as defenders of formal mathematics, and accustomed to

perform by the demand of a national curriculum and central state prescriptions. The project group lost one member in the first month. Personal problems and personal incompatibility with the leader were the reason for abandonment of the project.

Given this difference the mathematics teachers became divided between the project group and the others who assumed passive resistance towards the project. The leader's discourse assumed the difference "them and us", in organisational strategies proposed to the department. Through Maria, the group assumed the cognitive conflict with the other members of mathematics department, and this was easily transformed into an inter-relational one. The conflict was manifest between two different cultures centred on different mathematics beliefs and strategies, values and patterns of behaviour.

The project group took an individualist or defensive position in relation to other teachers. They did not adopt the goal of trying to change the beliefs and practices of teachers in the mathematics department, either to gain influence or to change educational practices in the school. To defend themselves, they decided that "who wants to be integrated in the project development has to adjust to our dynamics. It's not a question of just using the mathematics materials and calculators, they need to understand the philosophy that supports the project. They can not be afraid to make mistakes and be open to discuss, to ask, to experiment and to research". (Rg5 meeting)

The other mathematics teachers in the school were self-confident of their status centred in their scientific knowledge and traditional pedagogic model. They would teach the formal and abstract mathematics, developing rational explanations and theoretical demonstrations using the blackboard, and believed that students should be silent whilst taking notes and doing pre-defined exercises from a book. They also related achievement in mathematics with clever students and a developmental process of conceptualisation in the early ages of schooling. Teaching strategies in class were ruled by their experience as students, namely, explanations, exercising mathematics and individual work. The national curriculum was seen as a guide and it was not intended to promote innovation in educational strategies. Over many years, they used the same teaching routines, supported by the idea that students and curriculum were abstract entities. In formal meetings, they accepted the choice of the adopted mathematics manual, the curricular organisation by school year and the organisation of students'

assessment. They also accepted that the state was responsible for teachers' professional development, adjusted to the needs of different curricular subjects.

The leadership of the project reinforced the group's isolation in the school. This was partly due to Maria's personal characteristics and problems with social relations, and also to teachers' images about Maria as authoritarian, hard working, ambitious, persistent and difficult to get along with. These perceptions influenced the relationships she was able to establish between the project group and the school community. At the same time as leader she was responsible for the dissemination of the project in the Portuguese mathematics community, reporting the project and its educational practices to a mathematics teachers' association (APM) of which she had been an active member.. The support of this teachers' association played an important role in creating a discourse and an educational practice toward a new mathematics teacher's identity. In this case, it was relevant to support the group providing peers and partners with whom the group could interact to break the isolation and gain self-confidence.

The school community practically ignored the project development. The project was created by the initiative of teachers. The Mathematics department, the Pedagogical Board (PB) and School Board accepted passively without active resistance, while there were individual discordant voices. The teachers' initiative was not integrated in the Educational Plan Document that orients the school. Also, the meetings of the group were not included in the annual plan of school activities. The weekly meetings of the members of the group occurred at a time arranged by them, for example, during lunch hours, and not in the official planned time organisation, although the group asked for this. A contradiction was identified between the official agreement of School Boards to the project development and what was provided, corresponding to the conflict in school culture.

In the second year of the project the Pedagogical Board approved a curricular organisational plan that included the program of Métodos Quantitativos developed by the project group. The following school year the School Board allowed the acquisition of new educational material and resources to support the introduction of a mathematics laboratory. We can say, then that there was a process of assimilation, which promoted the curricular alternative, although, there was no evidence that the theoretical support

and educational approaches had been integrated by the other mathematics teachers and the school. Change in educational practices was confined to the classes of the project teachers.

The school culture reflected the contradiction of being traditional, the need to be modernised and the ethos "of being different" as a value. It was traditional in terms of the sense of state bureaucratic centralisation and the rigidity of the organisation of the school, reflecting an inability to adapt to local circumstances and to the needs and strategies of resolution. Also, it was "tied" to a past memory of being a pioneer school during 1940-70, taking a relevant role in artistic education in Portugal as a decorative school rooted in the Bahaus movement. Apart from the memory of staff about educational practices rooted in practical work and charismatic leadership, there was also the recognition of the relevance of this school in creating the Portuguese artistic movements neo-realism and surrealism. Many artists – painters, sculptors and designers – educated in Herculano School were recognised as relevant creators who had an impact on Portuguese society, originating new movements in visual arts.

The culture of the school was also dominated by the individualism that in one way was stimulated by the state-centralised model of administration in education and in another by the need to be different in relation to the other secondary schools. Decision-making and information were centralised to the President of the School Board and the Pedagogic Board. Neither was involved with the initiatives of this group of teachers or disseminating the results to the school at any stage. The curricular or extra curricular initiatives could exist but were considered irrelevant, they were not seen as relevant for social and educational benefit, in the sense of school community. In fact, the individualistic culture worked as an obstacle to building a culture of innovation supported by a new teachers' identity based on teachers' team work oriented towards the needs of students' education and social challenges. There was a lack of congruence between the school culture and the culture embedded in the change proposed.

Change and resistance

Resistance to project development and conflict was identified in the mathematics department and in the school, resulting in the confrontation of the mathematics group culture and the dominant culture of individualism and passivity.
The identified reasons for the conflict were: (i) different beliefs about mathematics, teaching and learning and the teacher's role; (ii) different values about educational practices (iii) the characteristics of the leader (iv) the confrontation of school culture with group culture.

The need for modernisation of the school and the values of "freedom and being different", gave the group of mathematics teachers the opportunity to implement the project and initiate a process of professional development. The professional community of mathematics educators supported the initiative of teachers, promoting the visibility of the group and the dissemination of the curricular approach and teachers' professional development model. The political context in Portugal worked as stimulus for this group of teachers, creating a discourse of change to promote a new identity for teachers looking for innovative practices in school, Recognition was later given to the school by the state department who were interested in introducing a new curricular model and reforming the traditional one. In the late nineties, the state department formally recognised the project and its results for supporting the new model of mathematics curriculum to be implemented in the curricular reform in 2001.

Section IV

Evidences and Discussion

This section is divided into two parts. The first one presents the evidences taken from the research developed and reported in the last chapters, to respond the main questions addressed on this research.. The main focus is: (i) the role of teachers' initiative in changing educational practices in a context of a Portuguese school during the educational reform; (ii) the impact of their action, organised through a educational project, intended to change curriculum and school practices; (iii) teachers' profile and change and (iv) the cultural relationship between a culture of innovation and the educational community.

The second part is a discussion between the evidence taken from this study and the relationship to the theory of change, and also, to the confrontation of change as a discourse of power in the context of globalisation and its role in creating a new identity of teachers.

A teacher's role towards change

In this case study, teachers involved in the project perceived change as a transformative process (Doll, 1989). They had taken the initiative of creating a rupture with the traditional mathematics model of curriculum and classroom educational practices. The initiative for change stemmed from the need to create solutions to the negative attitude of art students towards mathematics and their underachievement. Throughout, the leader's vision of a social constructed curriculum was integrated with a process of professional development as a continuous process of research.

In the context of the Herculano School, the five teachers had an active attitude and the wisdom and freedom to challenge not only the curriculum but also themselves in a process of sharing educational experiences and materials, feelings and concerns about

their classroom practices. The meaning of change for this group of teachers was built by interaction, promoting opportunities for sharing their experiences, dilemmas and feelings about classroom activity. Sharing was not seen only as a strategy, for them, also as a value promoted in the classroom with students. Change was recognised by the impact of the action and not by the intentions expressed. Teachers identified the project development as the context for challenging their educational practices and their own thinking and acting to the extended as one summarised *we are not able to be and act in the same way as before.*

In the preceding changes there, change occurred through a reflexive and discursive process within the group of project teachers, as they deliberated together about the problems of their curriculum and pedagogical practices. Both curriculum and educational practices changed through the empowerment of the group of mathematics teachers as they assumed the role of action researchers. Meaning was shared and built in an ongoing process where actions and discourses were negotiated.

The project developed was not merely something that was done to solve a problem. It affected the ideology of the people through an action that was planned, developed, evaluated through reflection and incorporation into further development. The culture of innovation developed in this case study integrated a corpus of beliefs, values, images about teaching and learning, rules towards education, the curriculum and the teacher's role which was manifestly different from that which was dominant in the school. This was also a new culture in mathematics education in the Portuguese educational context as it introduced a pedagogical model centred on students' learning processes, instead of teaching approaches or procedures. Students' mistakes and incorrect reasoning as well as the different processes of resolution were analysed by teachers through a constant process of researching mathematical reasoning for designing classroom approaches. The awareness of teachers and students' awareness was developed in a constant process of inquiry, analysis, reflection and research.

The impact of teachers' initiative on curriculum and educational practices

In this research, the change that occurred in teaching and learning was connected with professional development and ownership of the change, in the sense that has been

defended by Stenhouse (1975), Fullan, (1991) and Simons (1998). The curricular approach in itself was recognised as an innovation in a substantive sense as defined by Simons (1998) and Blenkin & al (1992) because it affects the deeper structures of the curriculum in reordering categorical meanings. Students were involved in the process of learning, accessing knowledge and provided with opportunities to deal with different situations. Also, changes were introduced in teachers' aims and values, developing a different way of thinking and classroom practice. The open structure of curriculum planning made the outcome less certain, but the students recognised that they gained the knowledge through their own mental processes and skills in a process of group interaction. In the project, the basis of art teaching lay more in the encouragement and facilitation of autonomous intellectual activity around well structured and well chosen subject matter, through a process of emphasising exercises of creativity and curiosity, than in putting too much emphasis on the ability of students to arrive at satisfactory problems, themes, and topics. Students recognised that the open environment, the problem solving approach, the manipulation of educational materials for creating mathematics situations, the team work, the process of constant inquiry and research procedures, changed their attitudes toward mathematics and made them more open to more complex reasoning on the subject matter. The flexibility of resources created by the teachers' group during the project development and the applied mathematics to art projects encouraged students to change their attitudes toward mathematics and knowledge in a general sense. Changes were introduced and a new culture of teaching and learning was built by the group of teachers, considering the theoretical basis and the pedagogical model implemented.

Teachers' profile and change

The motivations and the personal characteristics of teachers were revealed to be of great importance in the process of change. In this study, the teachers of the project believed that only in a team could they find the solution to the problem identified and design an educational alternative to curriculum and teaching, which should be more adjusted to students' needs and future challenges. These teachers also demonstrated a great pleasure in "being a teacher" and working with mathematics. They were open to change their practices in an going process of questioning themselves about what they were doing and were willing to take risks and lead with uncertainty. Also present was the sense of

building alternatives to what was the dominant practice in mathematics at this school, as well as the desire to break routines and have challenging experiences. There is evidence in the data that teachers were receptive to creating a different relationship within the group based on cooperation, opening themselves to criticism, reflecting about class episodes and their own professional role.

The research further suggested that there was a relationship between how Maria built meaning about her experience and her images about herself as a teacher and as a leader. Also, this study showed that the images, which Maria developed through reflection about her experiences, influenced the way she promoted change and innovation in this project. For her, change occurred in the context of: (i) mathematics experience where she discovered that there was not only one truth; (ii) the democratic social revolution were she had an participant role; (iii) a teachers' group searching for new approaches in mathematics teaching from which that she decided to integrate the career of a teacher; (iv) role playing during a mathematics workshop where she got a new image about herself as a leader; (v) educational experience and in interaction with the full-time professional teacher involved in curricular research from which she decided to be involved in an action research project; (vi) team work which gave her incentives to follow this, in professional terms. Maria' images about the learning process came from her experience and was strongly affected by interaction, discussion, sharing knowledge with colleagues, observation and reflection.

Maria recognised herself as a leader of the group, and that she was characterised as demanding in terms of a constant appeal to learn, experiment with new approaches combined with initiative for searching proposals and solutions. She also felt the need to play a social and political role.

Maria's leadership was centred on teachers, students' participation and the empowerment of the school actors in a community of school learners. Participation had special relevance in the new culture of innovation that was built on the context of this Portuguese school. The action and the values promoted by Maria's leadership can be considered democratic, in the sense that is defined by Sanches (1998).

The culture of innovation and educational community

The school gave the opportunity, the freedom to experiment and change practices and routines to develop the project, but did not wholeheartedly support the conditions needed in resources and time planning. The existing resources imposed some restrictions to the development of change. The school was not prepared to invest in technology and did not integrate into the annual plan, the time needed to promote the development of change.

The culture of innovation, promoted by the group, used cultural codes that were not incorporated by the school. At some time, during project time, the group of teachers did not developed an active strategy towards school change. Frustration was present, when the mathematics department and other teachers did not understand their purposes and practices or when the art department and art teachers were not available to develop the interdisciplinary approach they intended to introduce. Teamwork, and the democratic values of cooperation, participation and autonomy were not present in the dominant sense of the school culture. The school culture was rooted in an educational system where there existed a contradiction between traditional centralisation and the rhetoric of decentralisation. The educational system promoted the dominant attitudes of passivity and individualism, in spite of the recent state discourse and normative approach towards decentralisation and to the integration of schools in local communities.

The culture of innovation was also built on a dynamic of conflicts, which arose as a result of the interactive relationship in the mathematics department confirming the theory of Moscovici (1982) and Canario (1991). It was possible to conclude that there was a active resistance inside the mathematics department and a passive resistance in other school departments. The determination of the project group of teachers to pursue the alternative curricular approach based on the pedagogical co-operative model that they assumed endangered the cohesiveness of the mathematics department in the school. The department was an arena where pedagogical models and paradigms were confronted and boundaries were established, conferring a sense of identity on the project group. This project group was seen as a source of destabilisation, by other teachers in school, and lead to a rearrangement of the power relationships between

individuals. The maintenance of the status quo –conservatism – and the idea of deterioration of it was already certain, created resistance in the school.

While the project was not then supported at the school it was well received and disseminated by the community of mathematics educators as it corresponded to their agenda. The professional mathematics community had an active role in developing educational research and curricular approaches that were disseminated all around the world. They also generated theory related to educational practices in mathematics. The educational mathematics community reinforced this project as a challenging one and had an active role in its dissemination. The relationship of the leader of the project with Mathematics Association created the opportunity to build up a professional network and gain support for the project development. The Association also disseminated the pedagogical model, because the mathematics educators considered it innovative, as it was focused on student's processes of learning instead of teaching procedures. This project of began to build a community of theorizers within the school who collectively analyse and build theory, providing a basis for curriculum and professional development network.

The state department that is leaded by mathematics educators recognised the curricular teachers' approach as it corresponded to the needs of the educational system reform. A new professional identity was needed to really promote innovation in the educational system. As has been pointed out by Benavente (1995), educational practices including those in classrooms do not change by the adoption of good ideas neither by reform policies. There is a need to change teachers' images, beliefs and knowledge, which implies reflection about what they are doing and thinking.

Main Findings

This research revealed some dominant findings and created some questions for discussion. Teachers' initiative played a role in the school building up a culture of innovation generating an alternative to the national curriculum for Fine Arts students, which consequently had impact on their educational practices. This curriculum was centred on students' learning rather than teacher-directed instruction. It was also underpinned by democratic values and supported by teachers' strong beliefs about how knowledge is built (social constructivism) and the nature of Mathematics.

Secondly, this group of teachers formed a distinctive subculture in schools and took an active role in researching their own experience of changing classroom practice. This confirms the theory of change advocated by Stenhouse (1975), Elliot (1998), and Simons (1998). There is no change and innovation without teacher development and the sense of empowerment.

Thirdly, the research demonstrated that it was not possible for this subculture to have a major impact on the culture of the whole school. However, the educational community (mathematics' educators and state department) acknowledged the innovation with the state department subsequently including it in the national mathematics curriculum. The meaning of change was not shared by the school as collective renegotiations of anchored myths and metaphors did not happen. in the sense that Deal (1990) asserts. The support given to the teachers by the professional community created conditions for the innovation, but support from the school is needed if the influence is to spread throughout the school.

Fourthly, Maria's democratic leadership played an important role in the process of change as she stressed the values of participation, collaboration, interaction, and reflection within the group of teachers involved in the project, providing an opportunity for the group's development. This leadership provided network and relational links that

had repercussions in the cohesiveness of the group and social recognition by the professional community.

Fifthly, the identity of this group and the subculture of innovation was built on a dynamic of conflicts of pedagogical models and paradigms and lead to a rearrangement of power in the department.

Sixthly, the innovation was possible as the leader was integrated in a community of professionals – mathematics educators – and the group had the support of the Mathematics Teachers Association.

Seventhly, the group of teachers involved in the project proved that it is possible to theorise within the school about their practice, students' learning and processes of reasoning in Mathematics, providing a sound basis for curriculum and school development.

Eighthly, this research also shows that the implementation of change in school is related to the different dimensions of the individual person, the project group and school. From teachers personal building of meaning there are a number of factors that facilitated change:

- social and environmental changes;
- role playing;
- social interaction;
- team work;
- modelling a senior, a teacher, a researcher, etc.
- exposure to challenging situations;
- access to information written, oral experiences, virtual, etc

Finally, in this process of building innovation a new professional identity of teachers arose and is characterised by:

- willingness to play a social and political role;
- stressing participation in school and in educational community:
- promoting democratic values;

- using social interaction and collaboration in a process of creating meanings and images;
- promoting team work;
- promoting networks in school and classes;
- problem solving approach to educational practices;
- teachers' awareness and reflexivity about their practices;
- adopting action research methods to improve themselves as people and teachers;
- centred in students' learning instead of teachers instructional procedures.

Discussion

The analysis of the role of teachers' initiative in building a culture of innovation raised some questions for discussion based on the *assumption that regimes of truth are constructed by discourse and discursive practices* (Usher 1994:p84).

- Was teachers' initiative that built a new identity or the political discourse that created a new image of the teacher? What role has the political discourse played in promoting a new identity of teachers in Portugal?

The discourse of politicians and mathematical educators and their discursive practices helped to create a new identity of teachers as they appealed to the social community and the social construction of knowledge.

The discourse in the Portuguese Educational Act, discourse emphasised that *the change should be understood, taught and applied* taking into account the future challenges. During the nineties, the most common political discourse about education stressed change and expressed the need to adjust the curriculum and school organisation to social and economic development or to the needs of the social system. Developing values and attitudes of autonomy towards knowledge, management of space and resources are some of the intentions associated with it.

Reform documents also explicitly expressed democratic values through which *education is assured to all Portuguese in respect to the value of freedom of learning and*

teaching and by the emphases given to participation of the whole community through the educational structures that were created. Parents and the local community are encouraged to participate in the school. The responsibility of education is no longer attributed to the state but to the social community.

The text of the reform responded to a number of concerns previously identified by educators and researchers as the need: (i) to introduce innovation in the educational system as a process to create a dynamic of improvement; (ii) to educate individuals in relation to the professional world where a dynamic of evolution in technology is recognised; (iii) to educate for democracy, reforming attitudes and ideologies that have been against economic, social, scientific and technological progress.

The new teachers identity that was revealed in this study is centred on the classroom but is also evident in teachers' development. As Lawn (2000) asserts the new identity is built in a discourse centred on abilities and attitudes such as enthusiasm, team work, collegiality and showing a new sociability in the work place. The method for creating new identities is centred on the school as a social organisation instead of the professionalism of state workers. This can be very polemic if new competitive identities will come through in a context of globalisation.

- How did the discourse of globalisation affect the dissemination of this educational model?

The research also suggested that the socially constructed culture promoted by mathematics educators influenced the development of this culture of innovation. A network was born in the EUA by prestigious mathematics educators and has been disseminated all around the world. In Portugal, its influence came later through the first Portuguese graduated (PhDs) at American and English Universities. Thorough them research in mathematics education was promoted, the Departments of Education were developed at most of the universities and the most active Teachers Association was founded. These newly qualified PhD's were also responsible for the dissemination of theoretical and pedagogical models that promoted student-centred learning and empowering forms and practices supported by the discourse of socially constructed knowledge, and learning how to learn by using problem solving approaches. Usher

(1994) asserts, *learning how to learn,* becomes a major prerequisite of higher education and enhances the performance of the social system. Future teachers who are formed in the universities are dealing with the model of change that was here described in this thesis.

This study also suggests that today, there is a convergent standardised influence in educational system, in contrast with the apparent singularity of each country, as Inkeles & Sirowy (1983)[i] and Meyer & Ramirez, (1999) have pointed out. This educational globalisation is related to an educational model that is common through different countries as it is based on the value given to education as a factor that generates progress and equality in both an individual and collective sense. Meyer, (2000) asserts that there is a phenomenon of global dissemination in most of the countries related to the increase of the number of students in the system, as well as the increase in high education and the ingress and participation of female in universities. And also, there is a convergent change in the curricular models adopted by the different countries. This is an indirect influence of the fast expansion of the international industry of tests, which demand that the same subjects are taught in similar ways in all the world Schmidt et al., 1996. The same is happening with the new identity of teachers that is built on school.

In many respects, some of the findings in this study replicate those found in studies of innovation in the US and the UK, though from a very different starting point. The relevance of this study needs to be seen in the context of Portuguese educational research, which is a recent field that only began in the late eighties. Teachers' initiative and processes of change had not been researched before this time. This case study provides an understanding of the processes of change and how a culture of innovation can be built by a group of teachers and come to be validated by the educational community.

This is very significant given the previous state centralised education system in Portugal and compared with US and UK studies of innovation in the seventies in decentralised systems. Prior to the educational reform in Portugal, these teachers had not had a culture of autonomy and local curriculum and teacher development to facilitate changing their practice. This study is also significant given the comparative status of educational research in Portugal noted above, compared with other countries. Only in

the nineties did educational research come to have an important role in building a political and educational discourse in Portugal oriented to supporting and helping to create a new identity for teachers.

APPENDIX A

1.º ciclo do ensino básico: 4 anos de escolaridade* – ensino oficial e particular

[QUADRO N.º 3.6]

Anos lectivos	Alunos matriculados	Alunos que concluíram	Pessoal docente	Número de estabelecimentos	Número de salas (*d*)
1960-1961	888 235	132 920	26 087	18 086	23 924
1965-1966	892 603	140 139	20 966	17 915	–
1970-1971	992 446	166 320	29 554	17 018	23 532
1975-1976	922 204	188 259	38 706	13 111	25 368
1980-1981 (*b*) .	886 046	168 998	41 091	9 727	25 328
1985-1986	846 318	170 031	42 732	12 741	28 087
1990-1991	668 889	–	–	9 726	–
1991-1992	658 305	(*a*) 137 180	43 531	10 617	(*b*) 27 592
1992-1993	613 697	(*d*) 129 875	42 769	9 794	29 534
1993-1994 (*b*) .	585 190	(*c*) 137 000	41 038	10 151	29 179
1994-1995 (*b*) .	518192	–	–	10155	–

2.º ciclo do ensino básico: 5.º e 6.º anos de escolaridade* – ensino oficial e particular

[QUADRO N.º 3.7]

Anos lectivos	Alunos matriculados	Alunos que concluíram	Pessoal docente
1960-1961	82 053	29 464	–
1964-1965	104 221	37 137	–
1970-1971	153 710	55 472	9 582
1975-1976	277 111	94 316	20 789
1980-1981	322 382	107 632	26 411
1985-1986	388 994	152 668	30 611
1990-1991	356 420	151 776	34 724
1991-1992	354 631	(*a*) 136 323	(*c*)
1992-1993	339 244	(*d*) 145 254	(*c*)
1993-1994	328 671	(*e*) 159 500	(*c*)
1994-1995 (*b*)	283 294	–	–

Notas:

* 1.º e 2.º anos dos liceus até 1967-1968; ensino preparatório do ensino técnico até 1967-1968; ensino preparatório do ensino secundário de 1968-1969 até 1986-1987; 2.º ciclo a partir de 1987-1988; o ensino preparatório TV oficial iniciou o funcionamento em 1971-1972; em 1971-1972 inicia-se a experiência do 3.º ano da «reforma Veiga Simão»; em 1972-1973 inicia-se a experiência do 4.º ano da «reforma Veiga Simão».

(*a*) Não inclui as conclusões do ensino básico mediatizado.

(*b*) Só continente.

(*c*) V. quadro n.º 3.8.

(*d*) Dos quais 12 067 do ensino básico mediatizado.

(*e*) Valor estimado – continente.

Fontes: DEPGEF, Núcleo de Estatísticas da Educação, do Ministério da Educação; de 1960-1961 a 1990-1991, INE, *Estatísticas da Educação;* a partir de 1991-1992, DEPGEF do Ministério da Educação.

3.º ciclo do ensino básico: 7.º, 8.º e 9.º anos de escolaridade* – ensino oficial e particular

[QUADRO N.º 3.8]

Anos lectivos	Alunos matriculados	Alunos que concluíram	Pessoal docente (*a*)
1960-1961	106 988	12 749	15 832
1964-1965	153 176	18 565	21 349
1970-1971	217 976	27 070	23 122
1975-1976	233 421	50 546	28 621
1980-1981	259 289	47 809	38 338
1985-1986	335 980	65 422	50 196
1990-1991	408 120	94 151	83 801
1991-1992	438 939	101 150	99 383
1992-1993	431 552	107 494	100 639
1993-1994	439 695	(*c*) 101 755	103 736
1994-1995 (*b*)	410 579	–	–

Ensino secundário: 10.º a 12.º ano de escolaridade* e cursos técnico-profissionais – ensino oficial diurno

[QUADRO N.º 3.9]

Anos lectivos	Alunos matriculados	Alunos que concluíram
1960-1961	8 360	2 747
1965-1966	13 095	3 654
1970-1971	25 726	6 862
1975-1976	82 870	22 446
1980-1981	134 746	29 974
1985-1986	170 961	61 748
1990-1991	309 114	124 979
1991-1992	296 315	–
1992-1993	291 758	170 545
1993-1994	301 545	–
1994-1995	288 065	–

Notas: * 1.º e 2.º anos dos cursos complementar liceal e técnico profissional; 6.º e 7.º anos do 3.º ciclo do ensino liceal oficial; 1992-1993 a 1994-1995, dados pré-definitivos; 1960-1961 inclui alunos matriculados no 6.º e 7.º anos do 3.º ciclo do ensino liceal (oficial) + alunos matriculados nas secções preparatórias (oficial) + requerentes de execução (oficial); inclui conclusões no 7.º ano do 3.º ciclo do ensino liceal (oficial) + conclusões nas secções preparatórias; 1965-1966 inclui conclusões no 7.º ano do 3.º ciclo do ensino liceal (oficial) + conclusões nas secções preparatórias; inclui 6.º ano do 3.º ciclo do ensino liceal (oficial); inclui 7.º ano do 3.º ciclo do ensino liceal (oficial) + alunos matriculados nas secções preparatórias (oficial); 1970-1971 inclui conclusões no 7.º ano do 3.º ciclo do ensino liceal (oficial) + conclusões nas secções preparatórias; inclui 6.º ano do 3.º ciclo do ensino liceal (oficial); inclui 7.º ano do 3.º ciclo do ensino liceal (oficial) + alunos matriculados nas secções preparatórias (oficial); 1975-1976 inclui 1.º ano dos cursos complementares liceal e técnico profissional; inclui 2.º ano do curso complementar liceal + anos intermédios e último ano dos cursos complementares do ensino técnico profissional; inclui conclusões do 2.º ano do curso complementar liceal + conclusões no último ano dos cursos complementares do ensino profissional; 1980-1981, oficial e particular; 1992-1993, «alunos que concluíram», inclui apenas as conclusões no 10.º, 11.º e 12.º anos via de ensino; 1994-1995, «alunos matriculados», só continente.

APPENDIX B

Dissertation Research

Isabel Branco

I am Isabel Branco. Currently doing a PhD at the University of Southampton under Professor Helen Simons. The purpose of my research is to study the influence of educational projects, initiated by teachers, on school educational practices.

The focus of the research is the educational projects from teachers initiative and its development in the Portuguese high school.

The methodology of the study will be essentially qualitative. Data will be accessed by interviews, informal talks with participants of the projects and school staff members, analysis of documents and observations of activities and group interaction. The interviews will be recorded and transcribed and/or mapped. The participant teachers will review and comment transcripts before final analysis.

There will be no discomforts or stresses. Sessions will take place within the participants schedule. Interviews will take place in a relaxed and friendly environment. All individual data will be coded and securely maintained by the researcher for the study and won't be shown to unauthorized persons, unless required by law. All the data will be destroyed when the study is finished. The true names will be confidential, pseudonyms will be used in reporting. Any identifying characteristics will be altered so no individual can be recognized.

The researcher will share the findings of the study with participants and will answer any further questions about the research.

APPENDIX C

Research Goals

1. To characterize the culture of the project.

- To identify the culture that is shared by the teachers of one project that has the intention of changing: (i) the educational practices (ii) the beliefs of students about mathematics (iii) the mathematics curriculum.

2. To understand how project culture interferes with the culture of teaching of the Mathematics teachers in one high school.

3. To analyse the relationship between teachers personal and professional curriculum and their motivations to be in a project.

4. To understand the role of projects imitated by teachers in school clime and school culture.

5. To identify the aspects that can inhibit or stimulate project development.

6. To analyse the role of the projects in building a culture of teaching and teachers professional identity.

7. To analyse the relationship between the culture of the project and school culture (one Portuguese high school).

APPENDIX D

Appendix

Project characterization	
School	
Can you give me an idea about the projects that exist in school?	
When and who initiated these projects?	
What are the goals of these projects?	
What kind of needs or interests is in the base of these projects?	
How was formed the group of project?	
Who are the team members? How are they organized?	
How much time these teachers work together?	
What is the plan for the project?	
What kind of relationship exists among different projects?	
Resources and participants involved	

Observation
Guide
for classes

Date:

Hour:

Teacher name:

Number of students in class:

Number of group students:

Activities in class:

Who proposes the activity?

What kind of work is purposed to students?

What attitude do they show?

How many students are involved in the same activity?

How are they organized?

How do they relate with teacher?

What kind of questions do they pose to the teacher?

How do they relate in the group?

How do different students groups relate among them?

What kind of activities teacher ask students for?

What kind of attitudes students have in relation to the worksheet or teacher purpose?

How is the climate during the class (beginning and end)?

Observations:

Teacher appreciation:

Note: the goal of this observation is to identify how each teacher implement the ideas of the project.

Observation guide for the activities of the project

Type of activities

Leadership

Participants and their role

Relationship in-group

Relationship inter groups

Project recognition by the different staff

Space and organization for the activity

Resources involved

Individual interview guide - teachers

1. Tell me what experiences, happenings and reasons have influenced your professional choice and the discipline that you teach.

2. Can you tell me the most relevant aspects of your professional and personal biography that can be related with your options? Tell me the most important and painful episodes.

3 Can you tell me what expectations do you have about the profession of teaching? In the beginning of the career, and now.

4. Can you tell me anything about your experience in projects?

5. What are your main reasons to be involved in projects?

6. What adjectives do you use to describe:

   a. the discipline that you teach;

   b. yourself as a professional;

   c. the project that you are working;

   d. How do you think that people describe you?

SECOND INTERVIEW GUIDE

Teachers

1995/96

1. I am very interested in your experiences with mathematics. Please tell me what significant episodes or experiences as a student do you remember with math in and out of school.

2. Reflecting about your experience with math, what were the circumstances and reasons that makes you give importance to these experiences? And how they are relating with your professional choices?

3. In what situations do you remember and recognize that you were learning.

4. In the last interview you told me that the project was a way to learn. This aspect was one of your motivations to participate in its development. I would like that you comment this.

5. How do you think that the students learn mathematics? Can you give me an image that you identified as a students learning situation?

6. What would you like that your students had learned when they would finish schooling?

7. How do you see yourself in the role of a teacher in the classroom set?

8. Can you give me an idea about how you think that the other teachers see you as a teacher?

Interview guide for the group of project

Appendix

1. Can you tell me the story of this project?

- the origin of the project;
- motivations that move the group project;
- involvement of school participants in the different points of the project.

2. What kind of conditions stimulated the project? What kind of difficulties did you have?

3. What is your idea about the visibility of the project? What idea do you make about other teachers, students and staff perception of the project?

4. What kind of repercussion did the project have in relation to others teachers educational practices?

5. If you have to develop a project in the same area what will you do differently?

Interview Guide

Students

Last week of classes -1996

1. Describe a situation that you really understand what mathematics is about.

2. What do you think that was important for creating the conditions to learn Math?

3. During this year (10 - Grade), which was the positive and negative experience with Math that you have? Tell the reasons why these experiences were positive and negative.

4. What subject matter do you remember most to learn in class? What makes it to have more importance?

5. If you were a teacher, how do you motivate students to mathematics?

Students Interview

Guide

1995

1. How do you feel in mathematic class?

2. What makes you feel enthusiastic during a classroom session?

- The subject matter...
- How teacher presents the subject matter?
- The characteristics of the teacher...

3.How do you think that you learn better? When the teacher is exposing the subject matter? When you are studying and making exercises by yourself? When you research about the subject? When the teacher brings materials to illustrate the learning concepts? When teacher is questioning? When the teacher presents a problematic task to discover the process to solve it?
When the teacher provides a process of identifying and correcting the mistakes? When some students explain to others in class? Through exercising very much?

4. What subject matter do you remember to learn in class?
What subject matter did you like more? What subject matter was more difficult?

5. Which positive and negative experience do you remember? Why?

6. If you were a teacher what did you do to motivate students to mathematics?

7. In your opinion what is important to do or to have to be a good student in mathematics?

8. In your opinion what is need to be a good teacher?

APPENDIX E

LEVELS OF CULTURE STRUCTURE

(adjusted from Schein, 1985)

Beliefs and personal theories

Nature of math
Nature of teaching and learning process
Role of the teacher
Main essence of professional activity

Values

Stories, rituals, myths and icons

Artefacts

Rules
Patterns of Behaviour
Educational materials developed

APPENDIX F

GENERAL COURSES OF ARTS				
Component	**Discipline**	**10th**	**11th**	**12th**
General education	Portuguese	3 h	3h	3h
	Philosophy	3h	3H	-
	Foreign Language	3h	3h	-
	Physical Education	2/3h	2/3h	2/3h
Specific formation	Mathematics	4h	4h	4h
	Drawing	-	4h	4h
	Descriptive Geometry	3h	3h	-
	Register materials and Techniques of Expression	-	-	4
	Theory of Design	-	3	-
	Choose one of:	3	3	3
	Art History	4	4	4
	Physics and Chemistry	-	-	5
	Physics	-	-	5
	Chemistry			
Artistic and technique formation	Atelier of Arts	6h	6h	6h
Total curricular week hours		31	31	26/28

9. What are the conditions that are important to you to be a good teacher?

COURSES TECHNOLOGICAL OF ARTS				
Component	**Discipline**	**10th**	**11th**	**12th**
General education	Portuguese	3 h	3h	3h
	Philosophy	3h	3H	-
	Foreign Language	3h	3h	-
	Physical Education	2/3h	2/3h	2/3h
Specific formation	History of Art	3h	3h	3h
	Theory of Design	3h	3h	-
	Mathematics or Quantitative Methods	3h	3h	-
Artistic and technique formation	Includes five disciplines that are adjusted to each course and the artistic area chosen by students.	12h	12h	24h
Total curricular week hours		31	31	32

APPENDIX G

Appendix

Decree-Law n°43/89

2nd February

The autonomy of the school is reflected in the drawing up of its own educational plan, constituted and executed in a participated fashion, within the principles of accountancy of the various persons responsible for school life and suitability to the characteristics and resources of the school and the requirements and support of the local community.

Article 2

Definition

1 - The autonomy of a school is understood to mean the ability to draw up and implement an educational plan to the benefit of students and with the participation of all those involved in the educational process.

2 - The educational plan involves the preparation of pedagogical development priorities, annual plans of educational activities and the drawing up of internal regulations for the main school sectors and departments.

3 - The school enjoys autonomy at the cultural, pedagogical and administrative level, within the limits established by the law.

References

Afonso, N. (1995). *A reforma da administração escolar: Abordagem política em análise organizacional*. Lisboa: IIE.

Bacharach, S. (1993). Organizational Politics in Schools: micro, Macro, and Logics of Action. Educational Administration. *Quarterly Vol 29, number 4*, 423-452.

Baldrige, V.J. (1971*). Power and Conflict in the University.* New York:John Wiley.

Ball, S. J. (1987). *The Micro-Politics of the School: Towards a Theory of School Organization.* London: Methuen.

Ball, S.J. & Goodson, I.F. (eds) (1985*). Teachers' Lives and Careers*. London: Falmer Press.

Ball, S. J. (1981). *Beachside Comprehensive: A Case Study of Secondary Schooling*. Cambridge: University Press.

Barbier, J. M. (1993). *Elaboraçco de Projectos de aAçco e Planificação* . Porto: Porto Editora.

Barreto, A. (1996*). A Situação Social em Portugal, 1960-1995*. Lisboa: Instituto de
Baldridge, V. J. (1971). *Power and Conflict in the University.* New York: John Wiley.

Ciências Sociais, Universidade de Lisboa.

Becker, H. S. (1993). Theory: The Necessary Evil. In *Theory and Concepts in Qualitative Research. David J. Flinders and Geoffrey E. Mills, eds. Pp. 218-229.* New York: Teachers College Press

Benavente, A.e al. (1993). *Mudar a Escola, Mudar as Praticas.* Lisboa: Escolar Editora.

Benavente, A. e Lobo, C. (1992). Inovadores e Pioneiros: Viver em Projectos. *In II Congresso Português de Sociologia.*

Benavente, A. (1990). *Escola, Professores e Processos de Mudança.* Lisboa: Livros Horizonte.

Bernardi, B. (1988). *Introduç‹o aos Estudos Etno-Antropologicos.* Lisboa: Ediç›es 70.

Bennett, N. (1992). *Managing Change in Education.* London: The Open University.

Bernstein, B. (1971). On the Classification and Framing of Educational Knowledge.*In M.F.D. Young (ed.) op. cit.*

Blenkin, G., Edwards, G. & Kelly, AV. (1992). *Change and the Curriculum* London: Paul Chapman Publishing Ltd.

Blumer, H. (1969). *Symbolic Interactionism: Perspective and Method.* New Jersey: Prentice Hall, Inc.

Bolman, L. & Deal, T. (1984). *Modern Approaches for Understanding and Managing Organizations.* California: Jossey-Bass.

Bogdan, R. C. & Bicklen, (1982). *Qualitative Research for Education: an Introduction to Theory and Methods.* Boston: Allyn and Bacon.

Boutinet, J. P., 1990). *Antropologie du Project.* Paris: Presses Universitaires de France.

Branco, I. & Cibele, C., (1992). *Area Escola em Experiência: Um Estudo de Caso numa Escola C+S.* Lisboa: Instituto de Inovaç‹o Educacional.

Bullough, J. R., Robert, U. Knowles, J. Gary and Crow & Nedra, A. (1991). *Emerging as a Teacher*. London: Routledge.

Burgess, R. (1985). *Srategies of Educational Research: Qualitative Methods.* London: The Falmer Press.

Burgess, R. (1983). *In the field.* London: Allen & Unwein.

Burtonwood, Neil (1986). *The Culture Concept in Educational Studies.* Berkshire: NFER- NELSON.

Canario, R. (1992). *Inovaç‹o e Projecto Educativo de Escola.* Lisboa: Educa.

Canario, R. (1991). A Inovaç‹o como Processo Permanente. *Revista de Educaç‹o, Departamento de Educaç‹o da Faculdade de Ciências de Lisboa, n° 2, volume 1, 1978, pp. 17-22.*

Carvalho, A., (1995). Intervir em Educaçao: o Lado Sério do Aventureirismo. In *A Escola um Objecto de Estudo,* Association Francophone Internationale de Recherche en Sciences de L«Education.

Carvalho, C. M. (1991). da Discordância à minoria e da Minoria à Inovação. *Unpublished Master Dissertation.* Faculdade de Ciencias de Lisboa.

Castoriadis, C. (1975). *L« Instituition Imaginaire de la Societé.* Paris: Editions du Seuil.

Charmaz, K. (1990). Discovering Chronic Illness: Using Grounded Theory. *Social Science and Medicine. 30 (11): 1161-1172.*

Clandinin, D.J. (1986). *Classroom Practice: Teacher Images in Action.* Philadelphia: The Falmer Press.

Clark, C., & Peterson, P. (1986). Teachers' Thought processes. In M. Writtrock (ED). Handbook of Researcgh on Teaching, p. 250-296. New York: MacMillan.

Clemente, R. (1992). Teachers as meaning makers in an educational change initiative. *Unpublished Doctoral Dissertation.* Kent State University Graduate School of Education.

Coffey, A. (1996). *Making Sense of Qualitative Data.* Thousand Oaks: SAGE Publications.

Comissao Global de Reforma. (1988). *Relatorio Final.* Gabinete de Estudos e Planeamento, Ministério de Educaçao.

Corbett, H.D., Firestone, W.A. and Rossman, G.B. (1987). Resistance to Planned Change and the Sacred in School Cultures. *Educational Administration, Quartely, Vol.23, 4, p.36-59.*

Cuban, L. (1990). *A Fundamental Puzzle of School Reform.* In Lieberman (ed) op. cit.

Cuban, L. (1990). Reforming again, again, and again. *Educational researcher, 19 (1), 3-12.*

Cuban, L. (1989). The persistence of Reform in American Schools. In D. Warren (Ed), *American teachers: histories of a profession at work* (pp. 370-392). New York: Macmillan Publishing Company.

Dalton, T. (1988). *The Challenge of Curriculum Innovation.* London: The Flmer

Daná, N. F. (1993). Teachers for Change: An Elementary School Collaborative Program for Enhancing School Climate. *Paper presented on Annual Meeting of the American Educational Research Association,* Atlanta, EUA.

Daná, N. F. (1992). Creating a Culture of Change.

Day, C., Pope, M. & Denicolo, P. (1990). *Insight into Teachers' Thinking and Practice.* London: The Falmer Press.

Deal, T. E. (1990). Reframing Reform. *Educational Leadership, Vol. 47, n° 8, pp. 6-12.*

Deal, T. E. (1987). *The Culture of Schools.* In L.T. Sheive and M. B. Schoenheit.

Deal, T. E. and Kennedy, A. A. (1983). Culture and School Performance. *Educational Leadership, Vol. 40, n0.5*, pp. 44-15

Denzin, N. (1994). *Handbook of Qualitative Research.* Thousand Oaks: SAGE Publications.

Denzin, N.K. (1989). *Interpretative interactions.* Newbury Park: SAGE Publications.

Denzin, N. K. (1987). *Interpretative Biography.* Newbury Park: SAGE Publications.

Doll, W.E. (1989). Foundations for a Post-Modern Curriculum. *Journal of Curriculum Studies, Vol. 21, no. 3,* pp.243-53.

Eden, C. , Jones, S. & Sims, D. (1983). *Messing about in Problems.* Oxford: Pergamon, 1983.

Eisner, E. W. (1990). *Objectivity in educational Research.* Paper presented at the Annual Meeting of the American Educational Research Association, Boston, April.

Eisenhart, M., Cuthbert, A., Shrum, J., & Harding, J. (1988). Teacher beliefs: Definitions, findings, and directions. *Educational Policy, 2 (1), 51-70.*

Elbaz, F. (1983). *Teacher Thinking: A Study of Practical Knowledge.* London: Croom Helm.

Elliot,J. (1998). *Curriculum Experiment: Meeting the Challenge of Social Change.* Buckingham:Open University.

Elliot,J. (1993). *Reconstructing Teacher Education.* London: The Falmer Press.

Erickson, F. (1986). Qualitative Methods of Research on Teaching. In M. Wittrock (Ed). *Handbook of Research on Teaching (p.p. 119-161).* New York: Macmillan.

Feiman-Nemser, S. and Floden, R. (1986). *The Culture of Teaching. In Handbook of Teaching.*

Fennell, H. A. (1990). Policy, Coupling and Culture: Three Factor Related to Change in *Educational Organizations: an exploratory paper.*

Flinders, D.J. (1988). Teacher Isolation and the New Reforme.. *Journal of Curriculum and Supervision, Vol. 4,1, p.17-29.*

Freire, P. (1997). *Pedagogia da autonomia. Saberes Necessarios a Pratica Educativa.* Colleccao Leitura. Paz e Terra.

Fullan, M. (1992). *Successful School Improvement.* Buckingham: Open University Press.

Fullan, M. (1991). *The New Meaning of Educational Change.* London: CASSELL.

Fullan, M. (1982). *The Meaning of Educational Change.* OISE Press, Toronto.

Glaser, B. & Strauss (1967). *The Discovery of Grounded Theory.* Chicago: Aldin.

Goetz, J. & LeCompte, M. (1984). *Ethnography and qualitative design in Educational Research.* London: Academic Press.

Gomes, R. (1993). *Culturas de Escola e Identidades dos Professores.* Lisboa: Educa.

Goodenough, W. (1971). *Culture, Language and Society.* Reading: Addison-Wesley.

Goodson, I. F. (1983). Subjects for Study: Aspects of a Social History of Curriculum. *Journal of Curriculum Studies, Vol. 2, nº 2, pp.163-80.*

Goodson, I. F.(1981). Becoming an Academic Subject: Patterns of Explanation and Evolution. *British Journal of Sociology of Education, Vol.2,2, p.163-180.*

Gomes, R., (1993). *Culturas de Escola e Identidades dos Professores.* Lisboa:Educa.

Green, T. (1971). *The activities of Teaching.* New York: Mc Graw-Hill.

Guba, E. (1990). *The paradigm dialog.* Newbuty Park, CA: Sage Publications.

Guba, E. (1978). *Toward a Methodology of Naturalistic Inquiry in Educational Evaluation. (Monograph Nº. 8).* Los Angeles: University of California Center for the Study of Evaluation.

Hammersley, M. (1983). *Ethnography: Principles in Practice.* London: Tavistock Publications.

Hargreaves, D.H. (1994). *Changing Teaachers, Changing Times: Teachers Work and Culture in the Postmodernage.* London: Cassell

Hargreaves, D. H. (1990). *Individualism and individuality: reinterpreting the teacher culture.* Paper presented at AERA. Boston, April.

Hargreaves, D. H. (1989). *Curriculum and Assessment Reform.* Milton Keynes. Open University Press.

Hargreaves, A. (1986). *The Culture of Schooling: the Case of Middle Schools.* Lewes: Farmer.

Hargreaves, A. (1984). Experience Counts, theory doesn't: how teachers talk about their work. *Sociology of Education, Vol. 57,* pp.244-54.

Hargreaves, D. H. (1982). *The Challenge for the Comprehensive School - Culture, Curriculum and Community.* London: Routledge & Kegan Paul.

Holly, P. J. and Wideen, M. (1986). *The Culture Club.* In OECD/CERI Institutionalization. Paris: OECD/CERI.

HopKins, D. , Ainscow, M. & West, M. (1994). School Improvement in an Era of Change. London: Cassel.

House, E. (1980). *Evaluating with validity.* London: Sage Publications.

Huberman, M., (1989). *The Lives of Teachers* . New York: Teachers College Press.

Huberman, A. M. (1973). *Como se Realizam as Mudanças em Educação.* São Paulo. Editora Cultrix.

Inkeles, Alex & Sirowy, Larry (1983). Convergent and Divergent Trends in National Educational Systems. *Social Forces, 62 (2), p.303-333.*

Johnson, K. E. (1990). A Case Study of the Role of a School - Based Management Team in Changing a School Culture. *Unpublished Doctoral Dissertation.*

Jorgensen, L. (1989). *Participant Observation: a Methodology for Human Sudies.* Newbury Park: SAGE Publications.

Kaestle, C.F. (1990). The public schools and the public mood. *American Heritage, 41 (1),* 69-81.

Kelchtermans, G. (1993). Getting the Story Understanding the Lives: from Career Stories to Teachers `professional Development. *Teacher & Teacher Education, Vol. 9, nº 5-6, pg. 443-456.*

Krieger, S. (1985). Beyond "subjectivity: The Use of the Self in Social Science: *Qualitative Sociology, 8, 309-324.*

Lacey, C. (1977). *The Socialization of Teachers.* London; Methuen.

Lawn, M. (2000). Os Professores e a Fabricacao de Identidades. In *A Difusao da Escola, Eds [Antonio Novoa & Jurgen Schriewer eds.]* Lisboa: Educa

Le Compte, M. D., Millroy, W. L. & Preissle, J. (1992). *Qualitative research in Education.* San Diego; ACADEMIC PRESS, INC

Le Compte, M. D. (1987). Bias in the Biography: Bias and Subjectivity in *Ethnographic Research. Anthropology and Education Quartely, 18 (1),* 43-52.

Levine, J. M. & Moreland, R. L., (1991). Culture and Socialization. In *Work Groups.* In Resnick, L. B., Levine, J. M. & Teasley, S. D. *Perspectives on Socially Shared Cognition.* Washington DC: American Psychological Association.

Lieberman, A. , & Miller, L. (1990). *Restructuring Schools: What Matters and what Works.* Phi Delta Kappan, 71.

Lieberman, A. (Ed.). (1989). *Building a Professional Culture in Schools.* New York: Teachers College Press.

Lieberman, A. (1986). *Teaching as a Collaborative Culture.* Falmer Press. (Falmer - Imprint of Taylor, Francis 800-821-8312.

Lima. L. (1998*). A Escola como Organização e a Participação na Organização Escolar*. Braga: Universidade do Minho.

Lincoln, Y., & Guba, E. (1985). *Naturalistic Inquiry.* Beverly Hills, CA: Sage Publications.

Ludke, M. & André, E. (1986). *Pesquisa em Educaç‹ao Abordagens Qualitativas.* S‹o Paulo: EPU.

Marris, P. (1974). *Loss and Change.* London: Routledge & Kegan Paul.

McLaughlin, M. W. (1990). The Rand Change Agent Study. revisited: Macro Perspectives and Micro Realities. *Educational Researcher, 19 (9)*, 11-16.

McNiff, J. *Teaching as Learning – An Action Research Approach.* London: Routledge.

Meyer, J.W. (2000). Globalizacao e Curriculo: Problemas Para a Teoria em Sociologia da Educacao. In *A Difusao da Escola, Eds [Antonio Novoa & Jurgen Schriewer eds.]*Lisboa: Educa

Meyer, J. & Ramirez, F. (1999). The globalisation of Education. In *Discourse Formation in Comparative Education* [J.Schriewer,ed.] Berlin: Peter Lang.

Merriam, S., (1988). *Case Study Research in Education..* San Francisco, CA: Jossey-Bass Publishers.

Moscovici, S. (1982). Psycologie des minorities actives. Paris:PUF.

Moscovici, S. & Lage, E. (1976). Studies in Social Influence III: Majority versus Minority Influence in a Group. *European Journal of Social Psychology, 3, 2*, p. 81- 94.

Nias, J., Southworth, G. and Yeomans, R. (1989). Staff Relationship in the Primary School: A Study of Organizational Cultures. London: Cassell.

Norris, N. (1990). *Understanding Educational Evaluation.* London: Kogan Page.

Northcott, N. (1996). Cognitive Mapping: An approach to Qualitative Data Analysis. *NTresearch, Vol.I, NO 6, p. 456-462.*

Nóvoa, A. & Schriewer, J. (2000). *A Difusão Mundial da Escola.* Lisboa:Educa.

O'Hanlon, C. (1993). The Importance of an Articulated Personal Theory of Professional Development. In Elliot. *Reconstructing Teacher Education.* London: The Falmer Press.

Okely, J. (1994). Thinking Through Fieldwork. In: Bryman A and Burgess R G (editors) *Analysing Qualitative Data.* London: Routledge.

Parsons, T. (1970). On building Social Systems. *Daedalus, 99, p.826-75.*

Patton, M. (1990). *Qualitative Evaluation Methods.* Bevery Hills. CA: Sage Publications.

Peper, S. (1948). *World hypot hesis study of evidence.* Bercekley University of California.

Peshkin, A. (1988). In Search of Subjectivity - One`s Own. *Educational Research Journal n° 17, n° 7; October , p.17.*

Peshkin, A. (1986). Virtuous Subjectivity: In the Participant`s Observer`s I`s. In the D. Berg and K. Smith (Eds), *Exploring Critical Methods for Social Research (pp. 267-282).* Newsbury Park, CA: age Publications.

Peterson, A. (1979). Applied Comparative Education: The International Baccalaureate - a Case Study in *Comparative Education 13.*

Ponder, G. A. and Doyle, W. (1977). The practicality ethic in teacher decision-making. *Interchange, vol.8, n° 3, pp. 1-12.*

Popper, K. (1945). *The Open Society and its Enemies.* Vols. 1 and 2, Routledge & Kegan Paul.

Prosser, J. (1998). *Image-based Research- A Sourcebook for Qualitative Research.* London: Falmer Press.

Purkey, S. & Smith, M. (1985). School Reform: The district policy implications of the effective schools literature. *Elementary School Journal, 85 (3),* 353-389.

Roman, L. , and Apple, M. (1990). Is Naturalism a Move Away from Positivism? Materialist and Feminist approaches to Subjectivity in Ethnographic Research. In E. Eisner and A. Peshkin (Eds), *Qualitative Inquiry in Education; the Continuing Debate (pp.38-73).* New York: Teachers College Press.

Reinharz, S. (1983). Experiential Analysis: A contribution of feminist research. In G. Bowles and R. Duelli Klein (Eds), *Theories of women's studies* (pp. 162-191). London: Routledge and Kegan Paul.

Rosenholtz, S. J. (1989). *Teachers Workplace.* New York: Longman.

Roman, L. G., and Apple, M. W. (1990). Is naturalism a move away from positivism? Materialist and feminist approaches to subjectivity in ethnographic research. In E. W. Eisner and A. Peshkin (Eds), *Qualitative inquiry in Education, (pp. 38-73).* New York: Teachers College Press.

Roman, L. (1989). Double Exposure: Politics of Feminist Research. *Paper presented at the Qualitative Research in Education Conference, University of Georgia, Athens, GA, January.*

Rubin, H. (1995). *Qualitative Interviewing: The Art of Hearing Data.* Thousand Oaks: Sage publications.

Rubin, H. (1981). Sociological Research: The Subjective Dimension. *Symbolic Interaction, 4. 97-112.*

Sanches, M.F.C. (1998). Para uma Compreensao Democratica da Lideranca Escolar: da Concepcao Hierarquica e Racional a Concepcao Participatoria e Colegial. *Revista de Educacao, Vol. VII, 1.* Departamento de Educacao da F.C.da Universidade de Lisboa.

Sarason,S. B. (1990). *The predictable Failure of Educational Reform.* San Francisco, CA: Jossey- Bass.

Sarason, S. B. (1971). *The Culture of the School and the problem of Change.* Boston, MA: Allyn and Bacon.

Senge, P. (1990). *The fifth discipline. The art and practice of learning organization.* Century Business.

Schein, E., (1992). *Organizational Culture and Leadership.* Second Edition. San Francisco, CA: Jossey-Bass.

Schmidt, W. et al, eds. (1996). *Characterizing Pedagogical Flow.* Dordrecht: Kluwer Academic Publishers.

Schon, D. A. (1987). *Educating the Reflective Practitioner.* San Francisco: Jossey-Bass Publishers.

Schon, D. A. (1983). *The Reflective Practitioner: How Professionals Think in Action.* London: Temple Smith.

Silva, A., Pinto, J. (1990). *Metodologia das Ciências Sociais.* Porto: Afrontamento.

Simons, H. (1998). Developing Curriculum through School Self-Evaluation. In Beyer, Landon E. And Apple, Michael W. 2nd edn. *The Curriculum: Problems, Politics, and Possibilities.* P. 358. Albany: State University of New York

Simons, H. (1993). Evaluation and the Reform of Schools. In J. Wallace & W. Louden (eds) *Leaders among the Learners. p. 125. Proceedinds of an International Conference sponsered by Fremantle Eduction Centre Inc. 20-22 August 1992.*

Simons, H. (1992). *Avaliação da Reforma.* In António Novoa, Avaliação em Educação. Lisboa: EDUCA.

Simons, H. (1989). *Rethinking Appraisal and Assessment.* Milton Keynes: Open University Press.

Simons, H. (1989). *The ethics of Educational Research.* New York: The Falmer Press.

Simons, H. (1987). *Getting to Know Shools in Democracy: The Politics and Process of Evaluation.* Lewes: Falmer

Simons, H. (1981). *Conversations Pieces: the Practice of Interviewing in case Study Research.* in Adelman, C. (ed.) Uttering, Muttering. London: Grand Mclntyse.

Simons, H. (1980). *Towards a Science of the Singular. Essays About Case Study in Educational Research and Evaluation.* 93-142. Norwich: Centre for Applied Research in Education.: Univewrsity of East Anglia.

Simpson, M. & Tuson, J. (1995). *Using Observations in Small-Scale Research: A Beginner's Guide.* Glasgow: SCRE.

Smircich, L. (1983). Concepts of Culture and Organisational analysis. Administrative Science Quartely 28 (3) p. 339-358.

Smith, L. M. & al., (1986). *Educational Innovators: Then and Now.* New York: The Falmer Press.

Smith, M. L. (1980). Solving for some unknowns in the personal equation. *CIRCE occasional paper. Urbana: University of Illinois.*

Smoliez, J. (1981). Core Values and Cultural Identity. *Ethnic and Racial Studies 4: 75 -90.*

Spindler, G., & Spindler L. (1987). *Interpretative Ethnography of Education - At Home and Abroad.* London: Lawrence ERLBAUN Associates Publishers.

Spindler, G. (1987). (1987). *Education and Cultural Process: Anthropological Approaches* (2nd ed) Prospect Heights, IL: Waveland Press.

Spradley, J. (1980). *Participant Observation.* New York: Holt, Rinehart and Winston.

Stake, R. (1995). *The Art of Case Study Research.* New York: Sage Publications, Inc.

Stake, R. (1978). *The Case Study Method in Social Inquiry. Educational Researcher, 7, 5-8.*

Stenhouse, L. (1975). *An Introduction to Curriculum Research and Development.* London: Heinemann.

Strauss, A. L. (1987). *Qualitative Analysis For Social Scientists.* Cambridge: Cambridge University Press.

Strauss, A.& Corbin, J. (1990). *Basics of Qualitative Research- Grounded Theory Procedures and Techniques.* London: Sage Publications, Ltd.

Stroempl, R. H. (1993). Ethnoghaphic Interpretation of Faculty Perspectives on School Culture: site-based implications for school system. Unpublished dissertation. Cleveland State University.

Tyler, R. W. (1949). *Basic Principles of Curriculum and Instruction.* Chicago: University of Chicago Press.

Tromnsdorff, G. (1983). Value change in Japan. *International Journal of Intercultural Relations 7;* 337 -366.

Usher, R. & Edwards, R. (1994*). Postmodernism and Education.* London:Routledge.

Van Manen & Barley (1985). Cultural Organization: Fragments of a Theory. In F rost et al (Eds*) Organizational Culture.* Beverly Hills: Sage Publications, pp. 31-54.

Wallace, J. & Wildy, H. (1993). Pioneering School Change: Processes, Products and Problems in School-Site Restructuring. In J. Wallace & W. Louden (eds) *Leaders among the Learners. p. 125. Proceedinds of an International Conference sponsered by Fremantle Eduction Centre Inc. 20-22 August 1992.*

Wasley, P. (1993). Stirring the Chalkdust: Three Teachers in the Midst of Change. In *Leaders among the Learners*. Western Australia: John Wallace and Wiiliam Louden.

Webster`s New Collegiate Dictionate (1985). Springfield, MA: Merrian-Webster Publishers.

Wilkins, A. (1983). The Culture Audit: a tool for understanding organisation. *Dynam, 12 (2) 24-38.*

Wilkins, A. (1983)b. Organisational stories as symbols which control the organisation. *In Pondy et al, 1983, p. 81-92.*

Wilson, A. (1977). The use of Ethnographic Techniques in education research. Review Of Educational Research 47, 243-265.

Wolcott, H. (1995). *The Art of Fieldwork.* London: Altamira Press.

Wolcott, H. (1994). *Transforming Qualitative Data.* Thousand Oaks: Sage Publications.

Wolcott, H. F. (1973). *The Man in the Principal's Office.* Newyork:Holt Rinehardt and Winston.

Woods, P. (1986). *Inside Schools - Ethnography in Educational Research.* London: Routledge & Kegan Paul.

Wooten, C. (1993). The Team: An Ethnographic Account of Teachers in an Urban High School Program for At-Risk Students. *Unpublished Doctoral Dissertation. Pittsburgh.*

Yin, K. (1994). *Case Study Research: Design and Methods.* Thousand Oaks: SAGE Publications.

Young, M.F. D. (1971). *Knowledge and Control.* London: Collier Macmillan.

Young, M.F. D. (1971). *An Approach to the Study of Curricula as Socially Organised Knowledge* in M. F. D.

Zavalloni, M. (1980). *Values.* In Triands, H. and Brishis.

Zelditch, M. (1962). Some Methodological Problems of Field Sudies. *American Journal Sociology, vol. 67 n° 5.*