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Teaching with new technologies: a search for solutions for the University of Madeira

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Teaching with new technologies: a search for solutions for the University of Madeira

Ensinar com as novas tecnologias: uma procura de soluções para a Universidade da Madeira

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ABSTRACT

Name: Doroteia Ferreira Pita
Title of dissertation: *Teaching with new technologies: a search for solutions for the University of Madeira.*

This study examines the context of the integration of information and communication technologies (ICT), by teachers, at the University of Madeira (UMa) in Portugal. Debates on technology and education have been taking place and different perspectives have ensued with regard to the benefits to teaching in higher education. Despite the significant amount of investments and action undertaken, the integration of new ICT is still a critical issue for teachers in higher education. (GREEN, 1999). The main aspects considered in this study are (1) teaching staff's use of and attitudes to ICT and towards associated professional changes and (2) the contribution towards integration of ICT in teaching by the teaching services, resources and facilities of the university. Our research questions were approached following the case study methodology. Analysis of the data, in the light of the theoretical background previously presented, enabled definition of the context and problems of ICT integration at UMa, and recommendations for its implementation to be drawn up. The results of the study suggest that important measures regarding the integration of ICT at UMa include (1) fostering the involvement of the whole academic community, in particular the teachers, (2) encouraging greater flexibility in the organisation of pedagogical activities, and (3) introducing adjustments in the campus layout, consistent with current approaches to learning. Although it is our opinion that it would not be feasible for this young and small-scale publicly funded university, on the Portuguese Island of Madeira, to be transformed immediately into a digital university, our conclusion is that UMa has still to achieve a major stage in its development in order to successfully fulfil its mission as set out in the statutes. At the heart of this undertaking remains the imperative need of confronting the challenges created by the development of ICT.

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Keywords: INFORMATION AND COMMUNICATION TECHNOLOGIES; HIGHER EDUCATION; TEACHING AND LEARNING; INSTITUTIONAL STRATEGY.

RESUMO

Nome: Doroteia Ferreira Pita
Título da dissertação: *Ensinar com as novas tecnologias: uma procura de soluções para a Universidade da Madeira*

O presente estudo visa analisar o contexto da integração das novas tecnologias de informação e comunicação (TIC) nas actividades docentes da Universidade da Madeira (UMa), em Portugal. A relação entre a tecnologia e a educação tem sido objecto de debate e diferentes perspectivas têm surgido quanto às vantagens que a primeira poderá trazer à docência no ensino superior. Apesar dos consideráveis investimentos e das medidas tomadas, a integração das TIC continua a ser uma questão fulcral para os docentes do ensino superior (GREEN, 1999). Os principais aspectos considerados neste estudo são (1) a utilização e atitude dos docentes frente às TIC e às consequentes mudanças profissionais e (2) a contribuição dos serviços, recursos e instalações físicas da universidade para a integração das TIC no ensino. A metodologia utilizada foi a do Estudo de Caso. A análise dos dados, à luz do contexto teórico apresentado previamente, permitiu a descrição do processo da integração das TIC na UMa e a elaboração de uma lista de recomendações. Os resultados deste estudo sugerem que as medidas a tomar neste processo de integração, incluem, entre outras, (1) fomentar o envolvimento de toda a comunidade académica, particularmente dos docentes, (2) estimular uma maior flexibilidade no exercício das actividades pedagógicas, e (3) introduzir ajustamentos na organização dos espaços, em consonância com as perspectivas actuais sobre o ensino e a aprendizagem. Embora sejamos de opinião que não é viável para esta jovem e pequena universidade pública transformar-se a curto prazo numa universidade digital, concluímos que a UMa tem ainda que percorrer mais uma fase importante no seu desenvolvimento, a fim de cumprir com sucesso a missão indicada nos seus estatutos. No cerne deste processo evolutivo está a necessidade imperativa de confrontar os desafios criados pelo desenvolvimento das TIC.

Palavras-chave: TECNOLOGIAS DE INFORMAÇÃO E COMUNICAÇÃO; ENSINO SUPERIOR; ENSINO E APRENDIZAGEM; ESTRATÉGIA INSTITUCIONAL.

RÉSUMÉ

Nom: Doroteia Ferreira Pita
Titre de la dissertation: Enseigner au moyen des nouvelles technologies: la recherche de solutions pour l'Université de Madère

Cette étude a pour but d'examiner le contexte d'intégration des nouvelles technologies d'information et de communication (TIC) dans le cadre d'enseignement de l'Université de Madère (UMa) au Portugal. Le rapport entre technologie et éducation a fait l'object de débat; des perspectives différentes sont apparues concernant les avantages que la technologie pourra apporter à l'enseignement au niveau des études universitaires. Malgré les investissements considérables et les mesures prises, l'intégration des TIC reste une question essentielle pour les enseignants universitaires (GREEN 1999). Tels sont les principaux aspects considérés dans cette étude: (1) l'utilisation et l'attitude des enseignants vis à vis des TIC et les changements professionnels qui en découlent et (2) l'apport des services, des ressources et des installations de l'université dans le but d'intégrer les TIC dans l'enseignement. La méthodologie utilisée a été celle de l'Etude de Cas. L'analyse des données, à la lumière du contexte théorique présenté auparavant, a permis la description du processus d'intégration des TIC dans l'UMa et l'élaboration d'une liste de recommendations. Les résultats de cette étude suggèrent que les mesures à prendre dans ce processus d'intégration contiennent, entre autres, (1) encourager la participation de toute la communauté académique, en particulier celle des enseignants, (2) stimuler une plus grande flexibilité dans l'exercice des activités pédagogiques, et (3) introduire des mises au point dans l'organisation des espaces, en rapport avec les perspectives actuelles d'enseignement et d'apprentissage. Bien que nous soyons d'avis qu'il n'est pas possible pour cette université publique, récente et modeste, de se transformer à court terme en une université digitale, nous sommes arrivés à cette conclusion: l'UMa a encore un long chemin à parcourir avant de parvenir à une phase importante de son développement à fin d'atteindre avec succès la mission indiquée dans ses statuts. Au coeur de ce processus d'évolution se trouve le besoin impératif de confronter les défis issus du développement des TIC.

Mot-clés: TECHNOLOGIES DE L'INFORMATION ET DE LA COMMUNICATION; ENSEIGNEMENT SUPÉRIEUR; ENSEIGNEMENT ET APPRENTISSAGE; STRATÉGIE INSTITUTIONNELLE.

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1. INTRODUCTION

Our choice of the University of Madeira (UMa) as the focus of our study was determined by our ten years of work there, during which we witnessed the growing impact of social and economic change on the working conditions of the university, in particular, the growing importance of technology. Signs of these societal transformations in the professional life of teaching staff became obvious in their work overload and increase in administrative duties. A most noticeable fact during this period was that the considerable investments made in ICT apparently did not affect academic activities in the same proportion, nor did they produce any significant change in the way teaching was implemented. These circumstances convinced us that it was important to examine in a more comprehensive way the context of ICT integration at UMa.

Information has become a central issue in contemporary society. Roughly up to the middle of this century, society progressed by means of a gradual search for satisfying answers in its pursuit of knowledge. In recent decades and quite suddenly, instead of a bit of information at a time, millions of bytes' worth became available practically all at once, making the job of knowing what to look for, contrary to what one would expect under the circumstances, more difficult than it had ever been. The value of information also increased despite having suddenly become plentiful. Long before the advent of this Information Society, universities have been predominantly the centres for information and knowledge development. Notwithstanding the different ideas as to the mission of a university, it is "one of the world's most ancient institutions [...] Needless to say, no institution lasts nine centuries without adapting" (David, 1997).

Perspectives are polarised between those who consider that technology will benefit higher education (DUDERSTADT, 1999) and those who think it will have the adverse effect of lowering standards, by changing the nature and roles of academic staff towards a

more compliant adaptation to societal needs and away from their traditional intellectual independence and freedom (NOBLE, 1997). Notwithstanding the on-going debate, technology continues to pervade academic environments and challenge the traditional organisation of its professional activities. The development of new educational technology has impelled teachers to perform in a continuous learning environment and face the ever-changing professional milieu that surrounds them. These circumstances have emphasised the need and importance of continuous development of teaching staff, as a means of confronting the challenge of ICT integration (BOWDEN and MARTON, 1998).

The point of departure for our study was recognising the fact that, in higher education, ICT integration in teaching is a critical global issue (THOMPSON, 1997; BOWDEN and MARTON, 1998), but that the answer to present challenges has not been nor needs to be necessarily a unique model for all higher education organisations (GORDON, 1999). In the first section of Chapter Two, we attempted to draw together the multiple factors and perspectives concerning the changing idea of the university. We investigated the most important changes taking place today in Higher Education and their expected outcome. The fact that organisational structure and the way work is done are among the impacts of technology on the conditions of work (MORTON, 1996), led us to wonder how this would affect teaching scenarios in higher education, in particular at our own university. Aware that pedagogical issues should be the starting points for ICT integration in higher education (GILLESPIE, 1998a; DONOVAN, 1999), and that the way technology is used, not technology itself determines how useful and effective it may become (LAURILLARD, 1993; RAMSDEN, 1992; BALDWIN, 1998), we attempted in the second section of Chapter Two to portray the current trends in how teaching and learning should be organised, particularly in higher education.

While pedagogical approaches should determine the choice of technologies, the latter do require and suggest new approaches to teaching and learning (JACOBSEN, 1998). This dilemma prompted us to investigate the findings on impacts, barriers and critical factors relating to the integration of new technologies, which we then presented in the last section of Chapter Two. In the following three chapters we went on to describe the design of our study, which follows a case study methodology (YIN, 1994); to describe the University of

Madeira and the context of its creation and development, particularly regarding ICT integration; and to present and discuss the results of our study.

Regarding the terminology used in our study, some variants were used for the same idea. Thus, the terms 'technology', 'information and communication technologies', 'new technologies' or 'ICT', all refer to the same concept, and we used as GILLESPIE (1998a) defined it: "the hardware, software, and actualised capabilities of the computer and audio/video communication technologies as we know them in the late 1990's – e-mail; listservs; intranet; Internet; World Wide Web; CD-ROMs; audio, computer and video conferencing; multimedia - and probably some terms of which we have not yet even thought". The terms 'higher education' and 'university' are also used indistinctively. The term 'teacher' is used within the broad context of a person who teaches. Thus, it refers to both Professors and Lecturers (according to Portuguese higher education hierarchy for teaching staff). The same applies to the terms 'academic staff' and 'teaching staff'.

This study does not intend to discuss or endorse any particular view concerning the mission of UMa or the consequences that ICT development and integration there will bring about. Neither does it intend to suggest or conclude the manner in which the particulars of teaching and learning should be developed, nor which strategic style the university should follow. Thus, it is not a study in Pedagogy or Organisational Change, although obviously references have been made to these fields of study.

This study is an attempt to assist the University of Madeira in facing the challenge of ICT integration in teaching and its purpose is to examine the context of this process of integration and to draw up a list of recommendations based on the findings. The investigation will focus on teaching staff's use of and attitudes to ICT and towards associated professional changes and on the contribution towards integration of ICT in teaching by the teaching services, resources and facilities of the university.

The main assumption of our study is that technology is and will continue to be an omnipresent feature in our society, affecting our private and professional lives. Therefore, it is necessary for individuals, particularly those involved in education, to develop at least elementary computing skills and learn the basics of technology as a means of access to information which in turn will lead to the enhancing of their quality of life and the opening

up of life-chances, to which they are entitled as citizens in a Learning Society (BARNETT, 1998, as cited in YORKE, 1999).

The obvious need to increase individuals' computing skills, which we referred, is not an end in itself, but a way of achieving more important individual and societal aims, in the context of the democratic idea of equal opportunities for all. Therefore, learning to use ICT should not be a nightmarish and compulsory undertaking, but a voluntary, useful and enjoyable experience, fuelled by the potential benefits and rewards to the private and professional lives of individuals. It is this vision of ICT that underlies our study.

Recommendations and suggestions for action are presented in the last part of our study. They are based on the background information, presented in Chapter Two, and on the findings of our research. They are not definite and final verdicts, but simply recommendations and suggestions, aimed at assisting UMa during the difficult stage when dealing with the essential adjustments required for integration of ICT in teaching and enabling it to fulfil its mission as defined by the statutes: a "centre for the creation, transmission, review and diffusion of culture, science and technology in the service of humankind". As such, they represent the outcome of our search for solutions to the difficulties faced by teachers at the University of Madeira.

2. BACKGROUND TO STUDY

2.1 The Changing Idea of the University

> The real question is not whether higher education will be transformed but rather *how* and *by whom*. It is my belief that the challenge of change before us should be viewed not as a threat but as an opportunity for a renewal, perhaps even a renaissance in higher education. The decade before us could be - should *be* – one of the great adventures of our times.
>
> (DUDERSTADT, 1999)

> Quality higher education will not disappear entirely, but will soon become the exclusive preserve of the privileged, available only to children of the rich and the powerful. For the rest of us a dismal era of higher education has dawned. In ten years, we will look upon the wired remains of our once great democratic higher education system and wonder how we let it happen. That is, unless we decide now not to let it happen.
>
> (NOBLE, 1997)

The University of Bologna was created in the 11th century and is usually referred to as the first European university. In the following century, the universities of Paris and Oxford were founded. Throughout the centuries, since its emergence in the Middle Ages, this institution, despite retaining its designation of "university", has undergone changes in its core mission. Whilst teaching was the primary mission of the medieval universities, research became their fundamental mission in the nineteenth century, following the ideas of Wilhelm Humboldt. Towards the end of the century, with the publication in 1873 of John Henry Newman's *The Idea of a University*, both teaching and research were asserted as the important mission of universities:

> The most passionate statement made about the idea of the university was formulated in 1873 by John Henry Newman, often referred to as 'Cardinal Newman'. In *The Idea of a University* he declares that a university is 'a place of teaching universal knowledge', thereby thoroughly challenging the Humboldtian notion of the research university.
>
> (BOWDEN and MARTON, 1998, p.4)

According to BOWDEN and MARTON (1998, p.4), both learning, research and community services are all forms of learning and the authors suggest that the university of the 21st century should be termed the *University of Learning,* as opposed to the medieval *University of Teaching*, the Humboldtian *University of Research* and the 20th century *University of Teaching and Research:*

> Teaching contributes to student's learning, to their developing knowledge, which is new to them but not necessarily to others. On the other hand, research is about developing knowledge that is new in an absolute sense: nobody has developed it previously. We can therefore talk about two forms of *knowledge formation* - learning on the individual and learning on the collective level.

Although the core mission and curricula of universities have changed throughout the nine centuries of their history, since their creation to the present century, this fact has never led to a radical institutional change and "the modern university is recognisably the direct descendant of the institution it was nearly a millennium ago" (DAVID, 1997). Academic traditions, such as those referred by LAURILLARD (1993, p.4), "the pursuit of research and scholarship (OECD 1987), the advancement of learning (Robbins 1963), the freedom to conduct a radical critique of knowledge claims (Barnett 1990)", have contributed to the establishment of this idea of a university. However, as NOBLE (1997) declares, "we have entered a new era in higher education, one which is rapidly drawing the halls of academe into the age of automation". This era has brought unprecedented changes that have been affecting the structure and way of operating of universities, particularly from the 1990's onwards, in response to external social and economic pressure, and as a consequence of technological developments.

The "triumph of science" and the "rise of democracy" are, according to DAVID (1997), the two fundamental forces responsible for the shaping of the 20th century university. The increasing importance of science contributed to the dethronement of the Humanities and led to government funding of higher education, in the belief that this would lead to national economic and cultural growth which, in turn, brought about the issues of accountability, external assessment and university autonomy. The rise of democracy also led to the demand for mass higher education, whilst student expansion raised issues concerning the quality of education (DAVID, 1997).

Although universities have always been centres for the transmission and advancement of information and knowledge, the recent political significance of the concepts of "information society" and "knowledge society" has catapulted higher education into a more fundamental social position and assigned to the university the role of "major agent of economic growth: the knowledge factory, as it were, at the centre of the knowledge economy" (DAVID, 1997). However, universities are no longer the only providers of education. Technology and the market-driven economy provide the conditions which enable other private and public institutions to perform, on a global scale, many of the functions expected of higher education. In order to face the competition of these new partners and of other new or high-tech universities, traditional higher education organisations have had to strengthen their capacity to provide for the diverse needs of an increased number of students, in the context of the lifelong learning society, while simultaneously maintaining the standards demanded by quality control mechanisms.

In recent years, noticeable illustrations of this new scenario are the escalating number of academic research and book publications on "teaching and learning in higher education", and the pressure put on academics for improving teaching methodologies and focusing on innovative learning developments. Thus, "the adoption of a more explicit market ethos has come to dominate working conditions, academic activities and the very character of higher education" (EVANS and ABBOTT, 1998, p.7).

ROTHBLATT (1997), as cited in BOWDEN AND MARTON (1998, pp. 4-5), defends that the term "multiversity" would better apply to the actual activities of an

American university, for its campuses are not isolated from the society around them and the activities are so varied. This *multiversity* aggregates several ideas of the university:

> From above by a central administrative system and a board of trustees, or outside in the form of public opinion or legislative pressure, it is carrying out ...on a single campus the functions of the polytechnic, a normal school, a college of arts and crafts, a technological college, law and medical schools, a business school, research institutes and departments, College of Letters and Science...

DUDERSTADT (1999, p.1-8), who points to financial imperatives, societal needs and technology drivers as the main forces of recent changes affecting higher education, asserts that the current tendency is irreversible and that only those universities which undergo profound change and adapt to the new societal needs will be able to survive. In an optimistic tone, the author declares that although the academic activities of teaching, research and service will remain the fundamental roles of universities, changes will affect the way they are accomplished:

> If we were to adopt the more contemporary language of computer networks, the college or university might be regarded as a "knowledge server", providing knowledge services (that is, creating, preserving, transmitting, or applying knowledge) in whatever form is needed by contemporary society.
> (DUDERSTADT, 1999, p.6)

Teaching based on societal needs in a market-driven context is not a consensual matter, especially when it raises the controversial issue of diminishing the institutional importance assigned to teaching staff. A very different attitude to the recent context of higher education is that of NOBLE (1997), for whom these factors of change, the "incessant pressures of 'progress'", are but a superficial explanation which hide the real motive for the present phenomenon: the "commercialization of higher education".

Whilst traditionally teachers had a reasonable control over their activities, NOBLE (1997) asserts that, particularly in many instances of recent institutional strategic conversion to distance learning, teaching staff is neither involved, nor gains with the new ventures. On

the contrary, it "robs faculty of their knowledge and skills, their control over their working lives, the product of their labor, and ultimately, their means of livelihood".

A process of conversion of "intellectual activity" into "intellectual capital" and "intellectual property" has taken place in the last two decades according to NOBLE (1997), who identifies two different stages of this crucial change, affecting in a successive way the research and the education functions of the university:

> The first, which began twenty years ago and is still underway, entailed the commoditization of the research function of the university, transforming scientific and engineering knowledge into commercially viable proprietary products that could be owned and bought and sold in the market. The second, which we are now witnessing, entails the commoditization of the education function of the university, transforming courses into courseware, the activity of instruction itself into commercially viable proprietary products that can be owned and bought and sold in the market. In the first phase the universities became the site of production and sale of patents and exclusive licenses. In the second, they are becoming the site of production of - as well as the chief market for - copyrighted videos, courseware, CD-ROMs, and Web sites.

The new context of uncertainty created by these overall changes has led to a series of studies, recommendations and interventions, in particular from central government organisations, for the purpose of providing some guidance on the present challenges to the mission and development of universities in the so-called Learning Society. According to BARNETT (1998), as cited in YORKE (1999), the four purposes of a learning society are the following:

> (1) The replenishment of human capital in order to strengthen society's economic capital.
> (2) An improvement in the quality of life of individuals.
> (3) The opening up of life-chances, in order that individuals can play a full part in society.
> (4) The development of a societal capacity for self-learning, thereby enabling the transformation of society to be a process of rational self-development.
>
> BARNETT (1998), as cited in YORKE (1999, p.15)

Because society relies particularly on higher education to meet these purposes, and taking into account that they differ considerably from the traditional ones, important changes have to be introduced in the organization of learning. The OECD knowledge codification lists four fundamental types of knowledge: the "know-what", the "know-why", the "know-how" and the "know-who" (MAIER and WARREN, 2000, p.9). Analytical and problem-solving skills and the key skills of communication, numeracy, use of information technology, teamwork and learning how to learn, should be embedded in the learning process, in order to facilitate the acquisition of the type of knowledge required by the new economic order.

Besides specific differences between them, the government reports referred above discuss major issues concerning higher education. They are instances of worldwide efforts in the definition of guidelines and agendas for change. The Portuguese report *Autonomia e Qualidade* (SEES, 1996) describes strategic policies regarding autonomy, evaluation and funding of Portuguese universities; the *Dearing Report* (NCIHE, 1997) presents a study and recommendations concerning the aims, roles and expansion of higher education in the UK, stressing the crucial importance of Learning and setting higher education in the context of the "learning society" and "lifelong learning"; the Australian *West Report* (DEETYA, 1998) identifies three necessary key changes (student centred funding, priorities in research and a world-class higher education industry) and also lists recommendations for the development of higher education in a lifelong learning context; and the report of the Boyer Commission in America (BOYER COMISSION, 1998) includes a list of directives for "reinventing" undergraduate education, stressing the importance of changes in learning methodologies.

Our literature review of the most important changes taking place today in Higher Education revealed the following worldwide tendencies:

- a substantial increase in the number of students in universities (EVANS and ABBOTT, 1998; THOMPSON, 1997; BOWDEN and MARTON, 1998);
- a substantially greater diversity of backgrounds of higher education students, from almost all sectors of society (EVANS and ABBOTT, 1998; THOMPSON, 1997; DUDERSTADT, 1999);

- students reveal different motivations for attending university: higher education no longer stands at the end of a educational journey, but is only a part of a lifelong process (THOMPSON, 1997);
- within a single university system, a greater diversity in the types and structure of degree courses offered, beyond that which traditionally was considered to be or not a university course (THOMPSON, 1997);
- a shortage of staff and other resources: these did not increase in the same proportion as students did (BOWDEN and MARTON, 1998);
- a rapid technological development, which is forcing higher education to review its form of educational delivery, with important electronically and international features (THOMPSON, 1997; BOWDEN, 1998);
- the straight association between funding systems and performance indicators, and the obligation to account for quality (EVANS, 1998; THOMPSON, 1997).

The changes listed above affect university institutions at different levels. Management of change demands that each institution "face choices in the context of five, often inter-related sets of issues: political, cultural, financial, pedagogical and organisational" (GORDON, 1999, p.144). On the other hand, the task of delineating a universal policy for universities is possible only at a very general level due to the context of change and uncertainty and to the great variance between the particular contexts of each university, according to the same author:

> It may mean that a search for universal, consistent definitions of the learning society and of lifelong learning could be unproductive and more significantly that it will prove to be difficult to achieve system-wide agreement over anything other than the most basic (essential) enabling frameworks [...] evidence suggests that substantial inter-institutional variation characterises the pace, process, nature and degree of change.

To outline or anticipate the design of the university of the twenty-first century is a difficult task, for the context of change evolves rapidly. After a decade of strategic implementation of transformative measures at the University of Michigan, DUDERSTADT (1999, p.18) concludes that "in a world of such rapid and profound change, the most realistic approach was to begin to explore possible futures through

experimentation and discovery, to actually build several prototypes of future learning institutions".

Although admitting that in the future there will be different types of universities, and some that "we might not recognize from our perspective today", DUDERSTADT (1999, pp. 22-23) suggests that the following features will dominate higher education: it will be accessible to all, the focus will be on the learner rather than on the faculty or the institution, there will be a greater diversity of students, to whom the conditions for a lifelong, asynchronous, interactive and collaborative learning will be provided, and "all levels of education will not only become interrelated but also will blend together, with learners no longer progressing in lock-step fashion from one level to the next".

ROWLEY et al. (1998), acknowledges the latter, arguing that "in the information age, these gateways to the academy are often dysfunctional and perhaps even irrelevant" (p.215) and that present trends are the focus on learning and the shift from the traditional passive student to the individual and active learner (pp. 21-22). The traditional course or discipline basis of degrees will likely give way to a modular design (p.226). The authors also admit that in the future there will be no single master model for higher education but that "certainly, individual colleges and universities will take a variety of shapes. Some may be like the pure models we describe here, and others will be hybrids or mixes" (p.231). A summary of the hypothetical models presented by ROWLEY et al. (1998, pp. 231-260) is as follows:

- the *Composite University*, in which a central administration manages resources and programs, and governs the units that are responsible for fostering successful academic activities (for instance, the Association of Governing Boards);
- *Student-Centered Colleges and Universities*, which promote affordability, excellence in teaching, and link learning to the needs of society (for example, the International Business Technology University and Rocky Mountain College);
- *Perpetual Learning Colleges and Universities*, characterised by a portable and continuous learning, and a holistic curriculum. The learner's goals determine the learning mode, the method of delivery and the content of the learning outcome (for example, the websites of the World Lecture Hall at www.utexas.edu/world/lecture/index.html and of the Global Network Academy at www. Gnacademy.org:8001/uu-gna/index.html);
- *Virtual Universities*, which provide learning by means of computer networks. Instances are the Virtual Online University and the Open University of Catalonia;
- *Market-Driven Colleges and Universities*, which are digital and global, focusing on the learners' needs (for instance, the IBM Global Campus and the Global Network Academy);

- *Specialty Colleges and Universities*, which attempt to provide answers to specific marketplace needs, as is the case of Theme Seven, a teacher training project which associates several Canadian universities and organisations;

- *Self-Directed Teams within Colleges and Universities,* which apply the self-directed team model from business management to the organisation of academic units, concentrating on problems, research interests, etc. and relying on teachers innovative ideas (for instance, the creation of transdisciplinary teams at Evergreen State College);

- *Assessment and Competency-Based Colleges and Universities*, which assign a crucial role to assessment, focus on designing courses according to the individual needs of learners, by replacing prerequisites for demonstrated competency and developing learning contracts;

- *Co-op colleges and universities*, which form associations to pursue common teaching and research interests, aim at avoiding the duplication of efforts of working independently and creating more favourable conditions to the development of excellence in particular areas.

In conclusion, economic factors, new social needs and technological development, are leading to unprecedented changes in the structure and way of operating of universities. Higher education institutions are now required to play a major role in the development of the present information and knowledge society and do so in a very competitive market-driven setting. The most probable outcome will be a greater variety of models of higher education institutions. Because change takes place very rapidly, it is difficult to anticipate the design of the university of the twenty-first century, but some trends may be taken for granted: the focus on learning, the shift from the traditional passive student to the individual and active learner, and a modular design for courses. In the midst of these overhauling changes, a most controversial issue is the changing nature of academic activities and roles of teaching staff, towards a more compliant adaptation to societal needs and away from their traditional intellectual independence and freedom.

2.2 The Changing Idea of Teaching and Learning

2.2.1 The focus on Learning and on the Learner

> It is not easy to penetrate the private world of someone coming to an understanding of an idea [...] I once caught myself wishing I could attach electrodes to students' heads to see what goes on when they learn. Never mind humanitarian principles of research investigation [...] about the nature of learning; it would be so wonderful to be able to see how their sense-making cognitive apparatus arrives at some of those weird outcomes. Retrospective interviews are a very unsatisfactory substitute. The fantasy deserves to be nothing more than that, but it does convey that sense of wanting to see the learning process from the students' perspective, in detail, in all its complexity, in such a way that we can make sense of it.
>
> (LAURILLARD, 1993)

During the last four decades, both European and American educational institutions have been subject to a great number of reforms, introduced for the purpose of improving quality and outcomes. However, the results have been disappointing apart from isolated cases of success (FULLAN, 1993).

During the 60's, the trend was to introduce changes in the curriculum and individualise instruction. The 70's brought a sense of frustration after it was generally acknowledged that the reform efforts had failed. Reaction to this disillusionment fuelled the research towards the context of educational change. The lesson learnt was that changes and innovations did not take place in a linear way. The 80's began with large-scale, top-down measures in an attempt to create the necessary background for successful change. Some years later, in the middle of the decade, a parallel movement of restructuring applied decentralised approaches, such as "school-based management, enhanced roles for principals and teachers, and other decentralised components" (FULLAN, 1993, p.2).

The 90's have been years of confusion, with two opposing perspectives on how education should be improved: on the one hand, the centralists who defend "greater top-down regulation, accountability and control of the educational establishment" and, on the other, the "restructionists" who "see greater control by school-based teachers and other educators as the basic solution". (FULLAN, 1993, pp. 2-3) On these three decades of decisions and implementations, this author says that:

> We have been fighting an ultimately fruitless uphill battle. The solution is not how to climb the hill of getting more innovations or reforms into the educational system. We need a different formulation to get at the heart of the problem, a different hill, so to speak. We need, in short, a new mindset about educational change.

One of the reasons why successful implementation of changes has been rare lies in the conservative nature of the educational system, in the midst of which change results in "defensiveness, superficiality or at best short-lived pockets of success" (FULLAN, 1993, p.3). On the other hand, although new approaches to teaching and learning have been put forward, many of the innovative measures are devised without taking into account the real needs and context of the day to day work of teachers and students (EVANS and ABBOTT, 1998) or "without any student and faculty involvement in the decision-making or despite it" (NOBLE, 1997).

Since universities were created, teaching and research have always been their core academic activities. With regard to teaching, the focus has always been on the teaching process itself rather than on the aspect of learning. For this reason, "discussions about optimal learning environments have been phrased in terms of pros and cons of different teaching methods, such as lectures, seminars" (BOWDEN and MARTON, 1998, p.12). Thus, the literature on teaching and learning in higher education has up to recent decades rendered mainly findings on teaching methodologies and techniques, such as how a lecture should be implemented or how to organise a practical lesson. Considerable variation in the implementation of these methods occurs, depending on factors such as who the participants are or which discipline is being taught:

> "The familiar methods of teaching in higher education are there to support learning as it is commonly understood to occur: through acquisition, so we offer lectures and reading; through practice, so we set exercises and problems; through discussion, so we conduct seminars and tutorials; through discovery, so we arrange field trips and practicals."
>
> LAURILLARD, 1993, p.97)

The recent social and economic pressures affecting higher education, which have demanded greater attention on issues such as quality and lifelong learning, have led to a focus on learning and on the learners as a means of achieving the desired goals. The quality of teaching is no longer framed in terms of how knowledge should be transmitted and information delivered, but on how the learner will "reach" and appropriate that same knowledge and information: "the fundamental question concerning teaching for an unknown future is about the kinds of learning experiences that will best enable students to develop an understanding of current knowledge and to acquire appropriate skills to be able to deal successfully with situations in the future" (BOWDEN and MARTON, 1998, pp. 134-5).

Curricular design has traditionally centred on the specific characteristics and needs of each discipline, such as its aims and contents, with less regard as to who the learners are or their reasons for learning. The so-called competency-based approaches to curricular design, developed from the 60's onwards, introduced a shift of importance from the discipline to the needed skills of the workplace, with a "focus on outcomes, greater workplace relevance, outcomes as observable competencies, assessments as judgment of competence, improved skills recognition, as well as improved articulation and credit transfer" (BOWDEN and MARTON, 1998, p.99). However, change now takes place in our society at a much more rapid pace. Both traditional and competency approaches to curricular design face the present dilemma of being unable to predict either the knowledge or the skills students will need in the future: university teaching and learning has a more difficult task at having to "prepare them [the students] for the unknown, by means of the known and we have to work out how that can be done" (BOWDEN, 1998, p.6).

The "variation model" described by BOWDEN and MARTON (1998, pp. 91-128) seeks to face this dilemma and improve these approaches to curricular design by stressing that learning goals should be formulated "in terms of capabilities for seeing certain situations in certain ways brought about through experienced variation in critical dimensions" and that connections should be established between the different types of knowledge, that of the discipline and that of the workplace:

> Students need to experience variation precisely because you cannot predict in advance what they will have to deal with as professionals [...] the only way to be able to use the disciplinary framework to explain and develop the professional framework, and vice-versa, is to integrate the two frameworks in the curriculum."

In recent decades, the trend towards learner centred approaches to teaching and learning in higher education has produced an extensive terminology around the more general concepts of "independent learning": problem-based, open, flexible, distance, resource-based, student-centred, collaborative, self-paced, etc., are all examples of this trend and illustrate the assertion that " a flexible mixture of learning opportunities is essential" (BOWDEN and MARTON, 1998, p.150). A random analysis of university web sites also reveals this concern with the learner and the learning process. Targeted both at teachers and students, many of these sites offer a plethora of information on learning skills and resources. The number of publications on the issue of teaching and learning in higher education has also increased considerably in recent years.

A crucial motive for the trend towards the focus on learning and the learners has been recent technological developments, particularly the convergence of information and communication media. Although there is a general agreement that information and communication technologies will benefit teaching and learning in Higher Education and that the rapid pace and importance of this technological change will certainly continue to take place (GILLESPIE, 1998a), no standard strategy has yet been designed to effectively guide it. Moreover, although it depends on significant investments in ICT, these do not guarantee by themselves successful results. Amidst the uncertainty of the present social

context, only the irreversibility of technological development and integration may be taken for granted. According to GILLESPIE (1998a), the implementation of technology in higher education has become a major question, affecting institutions worldwide, although:

> It is unlikely that the broad range of objectives of university education can be achieved by information technology alone. For many students in most areas of education, there is a need for "hands-on" activity, personal interaction with academic teachers and face-to-face discussion with other students.
> (BOWDEN and MARTON, 1998, p.139)

Influential works on teaching and learning in higher education and the use of educational technology have stressed that technology on its own is not a solution to educational problems and have pointed to the crucial role of interaction between teachers and students in the process of learning (LAURILLARD, 1993; RAMSDEN, 1992). Laurillard's "conversational model" is based on the assertion that "the learning process must be constituted as a dialogue between teacher and student" and that the process must be *discursive, adaptive, interactive and reflective* (p.94). Ramsden underlines the importance of dialogue, by specifying that "we cannot teach better unless we are able to see what we are doing from their [the students] point of view" (p.86).

In conclusion, the educational reforms aiming at the improvement of quality and outcomes have not yielded the expected results for reasons such as the conservative nature of the educational system and, in particular, because many of them were devised without involving teachers and students. Social and economic pressures and the consequent concern for quality and lifelong learning issues in higher education have led to a focus on learning and on the learners, away from the traditional discipline-centred curricular design. Under the umbrella concept of "independent learning", many more flexible and varied approaches to learning have been suggested. The development of technology has also strengthened the focus on learning and the learner. Findings from recent studies on teaching and learning in higher education underline the importance of interaction and dialogue between teachers and students, the need for more flexible and varied approaches to learning and the active engagement of the learner in the learning process.

2.2.2 The new teaching roles

> The average university or polytechnic teacher is now expected to be an excellent teacher: a man or woman who can expertly redesign courses and methods of teaching to suit different groups of students, deal with large mixed-ability classes, and juggle new administrative demands, while at the same time carrying a heavy research responsibility and showing accountability to a variety of masters as both a teacher and a scholar.
>
> (RAMSDEN, 1998)

The increased focus on the learning process and on the learner undermined the traditional prescriptive character of teaching theories. The improvement of quality in teaching and learning no longer has as its departing point the search for the best teaching methodologies, but starts by studying the process of learning itself. It is these studies that, in turn, are expected to yield the necessary findings that will determine the best pedagogies. Thus, different conceptions of teaching may be put forward and, as CENTRA (1993, p.43) refers "appropriate teaching behaviors are those that facilitate student learning in accordance with theory".

The shift of focus from teaching to learning has also led to recognition, for the first time, of the need and crucial importance of initial and continuous development of higher education teaching staff, as a means of addressing the new pedagogic dilemmas in higher education. In consonance with the modern conception of lifelong learning, an "increased interest in staff development and appraisal" (BOWDEN and MARTON, 1998, p.142) has soared in recent years, as part of the attempts to describe the new roles academics are expected to play in the present educational context.

The development of new educational technology has played a major part in accelerating this movement of reform and innovation of teaching. Despite the significant amounts of investment and action undertaken for the purpose of the integration of the new ICT, two of the recent National Survey of Information Technology in Higher Education conclude that the integration of technology is the "single most important information technology challenge" faced by teachers in higher education (GREEN, 1999) and that "IT challenges in higher education involve people, not products" (GREEN, 2000). The insufficiency of IT staffing is also a crucial problem, for it affects in a dramatic way user support, particularly to teaching staff (GREEN, 2000).

The impact of information and communication technology on the conditions of work has been compared to the one of the steam engine in the days of the Industrial Revolution (MORTON, 1996). The difference is that it "goes beyond this, however, as a technology that permits one to manipulate models of reality, to step back one pace from the physical reality" (p.148). In the past, technologies such as the telegraph and the telephone were partially responsible for the shaping of traditional organisational models. The fact that "information is the lifeblood of any organization" (p.148) together with the continuous dropping of costs of ICT justify the greater impact these technologies may have on the contemporary organisation.

The main impact of information technology on the conditions of work, according to findings from research summarised by MORTON (1996, pp. 151-160), are the following:

- changes in the way work is done;
- integration of business functions at all levels within and between organizations;
- shifts in the competitive climate in many industries;
- new strategic opportunities for organizations that reassess their missions
- changes in management and organizational structure;

The changes that affect work do so at the levels of production (physical, information and knowledge production), coordination (distance, time and memory of the organisation) and management (direction and control dimensions) and are the greater if that work is based on information (pp. 152-3). The electronic integration of business

functions is made possible within and between organisations. For instance, IT facilitates the formation of teams of personnel from different sectors within the organisation or the establishment of links with other organisations, making possible "the right resources to be at the right place at the right time" (p.155).

The major impact of information and communication technologies on organisations lies above all in "enabling a breakup, a dis-integration, of traditional organizational forms" (p.158). The success of this depends on both a thorough redefinition of the mission of the organisation, with all personnel involved, and investments in technology and human resources:

> Understanding one's organizational culture, and knowing what it means to have an innovative culture, is a key first step in a move toward an adaptive organization. This in turn seems to require innovative human resource policies that support the organization's members as they learn to cope with a changing and more competitive world.
>
> (MORTON, 1996, p.160)

According to DRUCKER (1998), ICT will lead to a new type of organisation which will loose many of its levels of middle management and become a flatter organisation, similar to the one of a hospital, a university or a symphony orchestra. Any of these organisations are information-based and have little or no middle management. Instead, they depend on specialists who convert data into information by means of their knowledge. The knowledge worker in an information-based organisation is simultaneously responsible for his own need of information and for the needs of others, to both superiors, subordinates and, especially, to his colleagues. Teams made up by specialists from different areas will play an important role in this new form of organisation, as meeting points for the flow of important information.

In the context of this paradigm shift of teaching and learning amidst a context of organisational change, the grounding ideas which support lifelong learning are strengthened and become most imperative in what regards the development of teaching staff in higher education. Teachers are impelled to perform in a continuous learning environment, in order to face the ever-changing professional milieu that surrounds them.

Among the theories of learning and approaches to teaching that have been put forward, the behaviourist, the cognitive and the humanistic theories of learning have been influential and to each of them is associated a different approach to teaching (CENTRA, 1998, p.43-45). Citing the literature, this author refers that behaviourist approaches establish clear objectives and procedures for the teaching process, assess its effectiveness by checking the achievement of the stated objectives and makes use of teacher-centred e approaches, of which the most frequent illustration is the lecture. Cognitive approaches stress the active engagement of students, by means of classroom procedures that develop problem-solving and critical thinking skills. Its approaches are student-centred and their most frequent illustration are collaborative learning techniques.

Teaching a course has always involved manifold tasks: research of syllabus contents, production of teaching materials, planning class implementation, presenting the class, tutoring and assessing students. Thus, teachers have always played different professional roles: information and knowledge managers, producers of materials, writers of lessons, information transmitters, learning facilitators, evaluators, and so on. The present context, and particularly the development of ICT, allow for changes in the way these teaching tasks and roles are played (i.e., tutoring students through electronic mail or using educational software or the Internet for teaching). These new possibilities have led to a shift in the comparative importance of the traditional roles, reducing, for instance, the importance of oral presentation:

> In this new environment, the professor's function will be to create conditions conducive to learning, to engage students actively in the learning process, and to monitor behaviors and adjust strategies as needed to facilitate subject mastery and personal growth [...] Compelling evidence shows that the teaching duties of the college professor are gradually changing.
>
> (BALDWIN, 1998, p.10)

A crucial concept, which lies at the basis of this move towards the improvement of quality in teaching, is that of flexibility. According to COLLIS (1998, p.376), "flexibility means allowing the learner some critical choices in the learning situation so that it better meets his or her needs and individual situation". Among the many aspects of teaching and

learning which may become more flexible, this author lists the following as the most important: flexibility in location, in programme, in types of interactions, in forms of communication and in study materials (p.377).

Improving flexibility in any of these aspects does not necessarily imply a radical change: the degree of transformation depends on the whole educational context, in particular the needs of the learner and the characteristics of the discipline. For instance, flexibility in location does not mean that face-to-face setting should be totally rejected (p.377). The amount of time for the different types of settings should be decided after taking into account the learning context, as referred above. Likewise, flexibility in study materials does not imply that teachers must make use of many different materials, but that decisions concerning this issue should be taken according to the circumstances whilst recognising that, for instance, "one set of reading materials or exercises is not likely to be a good response to the fact of increasingly diverse students in our courses" (p.377).

The literature on effective teaching up to the advent of ICT does not contribute much to the more practical aspects of teaching implementation for "discussion about how good staff are at teaching tends to be phrased in general terms" (BOWDEN and MARTON, 1998, p.143). It either focuses on overall characteristics of the teacher, such as "being good at structuring and presenting the message, appealing to the students' interests, lively presentation, skilled use of technical facilities etc" or on the overall qualities of the teaching process. Furthermore, the same teaching methodologies do not necessarily produce the same learning outcomes in different educational contexts (LAURILLARD, 1993, p.70). RAMSDEN (1992) asserts that "while there are no 'best' teaching methods, some methods and combinations of methods are indisputably better than others at realising the sort of constructive engagement with learning activities that leads to changes in understanding" (p.152).

Notwithstanding these observations, CENTRA (1993, p.43), COLLIS (1998, p.375) and RAMSDEN (1996, p.96-103) suggest the following key principles as important guidelines for the ultimate and necessary decision-making processes required from teachers at all times of their professional activity:

- Teaching should be intellectually challenging, with a clear presentation of goals and subject matter;
- Teachers should have a sound knowledge of course contents and a genuine interest in them;
- Class interaction should be based on an intensive and targeted communication, involving students in a reflective, active and responsible manner;
- Teachers should develop positive attitudes of concern and respect for students and their learning, and use fair and appropriate assessment techniques;
- Teaching should be improved in a continuous manner, drawing on students feedback and evaluation;
- Teaching must rely on flexible approaches.

These guidelines are a clear indication that changing teaching roles is a necessary feature in the new context of higher education: from rigid teacher-centred models to more flexible student-centred ones.

In conclusion, the increased focus on the learning and learners is changing higher education teaching and emphasising the need and importance of initial and continuous development of its teaching staff. The development of new educational technology has impelled teachers to perform in a continuous learning environment and face the ever-changing professional milieu that surrounds them. The integration of ICT in higher education requires, besides investment in technology, greater attention to organisational matters. Teaching has always involved manifold tasks and thus teachers have always played different professional roles: information and knowledge managers, producers of materials, writers of lessons, information transmitters, learning facilitators, evaluators, and so on. The integration of ICT in teaching and learning will require a reformulation of these tasks and roles. Although much of the literature on effective teaching is described in general terms, and not all teaching methodologies are effective in different contexts, some key principles may guide teaching, among which the idea of flexibility (in location, in programme, in types of interactions, in forms of communication and in study materials).

2.3 The Changing Educational Technology

> When I became a professor only fourteen years ago, I prepared class notes on a yellow legal pad and revised them with an eraser. When time permitted, I actually typed them on a state-of-the-art IBM Selectric. I communicated with colleagues elsewhere via telephone and mail. When I needed information for a class or research, I walked across campus to the library and thumbed through the card catalogue. Today this account of my early career sounds more like an excerpt from a Victorian era Dickens novel than a description of academic life as recently as the mid-1980's.
>
> (BALDWIN, 1998)

Although not in a definite or uniform way, educational scenarios have undergone changes during the last four decades following the development of information and communication technologies. Throughout this period, since the emergence of computers in the 60's, it is possible to discern five different phases in the history of teaching and learning with computer technology: as a mere content to be learnt, as a means to improve learning, as a personal support tool, as a hypertext and multimedia resource and, finally, as a communication technology (GILLESPIE, 1998b, p. 41).

The 60's were characterised by the use of early mainframes for delivering learning along behaviourist models. At the end of the 70's and in the early 80's, the first microcomputers allowed for campus-wide experimentation. No longer dependent on programming skills or systematic instructional design, the development of tools, such as word processors and spreadsheets, and the production of learning resources, were delivered via the computer (GILLESPIE, 1998b; WHITE, 2000). The majority of the initiatives were "mainly top-down and sector-wide, rather than focussing on developments at individual institutions" (WHITE, 2000, p.10). From the mid-80s onwards, hypertext and multimedia contributed to the improvement of educational resources, namely CD-ROMs, which could include text, graphics, animation, video and interactive features (GILLESPIE, 1998b, p.43).

The development of constructivist views on education led to a "greater emphasis on uses which exploit the potential of the technology to enable and enhance communicative and collaborative interactions" (WHITE, 2000, p.10). This trend is evident in the Dearing Report (NCIHE, 1997), which underlines the place of "learning in front of the teaching [...] communications firmly in front of information technology" (WHITE, 2000, p.10). More radical changes to educational environments have been encouraged by the ground-breaking development of networking and the Internet during the 90's, which has led to a greater awareness of technology issues on the part of teachers and a modification of initial scenarios concerning their attitudes and expectations:

> As the Web has pushed technology into the educational mainstream, these early adopters, have been replaced by "wary adopters" looking for easy ways to bring technology into their teaching but unwilling to match the time commitment of the pioneers... Representing the mainstream of educators, wary adopters are willing to use technology when it can be demonstrated that doing so will add value to their teaching without significantly reducing the time already allocated to teaching, research and service activities
>
> (DONOVAN and MACKLIN, 1998)

Debates on technology and education have been taking place and different perspectives have ensued with regard to the benefits to teaching and learning in higher education. Arguments are usually polarised between those who consider technology to be extraordinarily beneficial to universities and those who regard it as useless and even debasing education. The former, embodied, for instance, in associations such as EDUCAUSE, usually "employ the rhetoric of business" (GANDOLFO, 1998, p.24) and concentrate their efforts on exploring successful models for managing and implementing ICT in higher education and instruction. The latter, on the other hand, support their arguments with radical different assumptions concerning the concept and values of education, asserting that technology does not improve teaching and is a mere "vehicle and a disarming disguise" of economic interests far removed from genuine cultural ideals (NOBLE, 1998). In between these extreme perspectives, a more general consensus is that it is not technology itself which will improve teaching and learning, but the way it is used

that will determine how useful and effective it may become (LAURILLARD, 1993; RAMSDEN, 1992; BALDWIN, 1998):

> From our vantage point in the late 1990's, we cannot be certain where technology will take the academic profession. Based on experience to date, however, we can be certain that technology enlarges academic life and makes it more flexible and dynamic. It is important to monitor future technological developments with the rigor of a skeptic. Higher education and the academic profession should adopt only those technological advances that enable us to enhance educational quality and better serve society. At the same time, professors and the organizations that represent them (for example, the American Association of University Professors) should resist defensiveness and remain open to positive changes that new information technologies make possible
>
> (BALDWIN, 1998, p.19)

These debates are reflected on campus in the opposition between the "technology enthusiasts" and the "traditionalists". BALDWIN (1998, p.18) answers his own question on "Should all faculty be encouraged to incorporate technology in their work?" by referring that nowadays there is scope for very diverse types of pedagogic activities, both technology based and more traditional ones. Furthermore, citing the literature, the author asserts that traditionalists may play an important role in many campuses by balancing decisions and demanding more rigorous arguments concerning the acquisition of new technologies or other changes, questions which must be asked when this type of decision is made. DONOVAN (1999) refers to the advantage that "we also frequently meet with faculty who are new to technology yet apply it with a fresh, creative approach".

The four decades of technological developments have affected at different rates institutions, individuals and fields of study (BALDWIN, 1998, p.8). According to the model of diffusion of innovations described by ROGERS (1995), cited in JACOBSEN (1998), there is a marked variation in the rate of adoption of innovations by individuals, as in the case of the adoption of new educational technologies by teaching staff. The categories of this rate of adoption are the innovators (2.5%), the early adopters (13.5%), the early majority (34.0%), the late majority (34.0%) and the laggards (16.0%). ROGERS (1995), cited in DONOVAN (1999) refers the five determinant factors in the diffusion of innovation, which should guide projects for innovating academic activities:

- Advantage: does the innovation convey an advantage over existing ways of doing things?
- Compatibility: is the innovation compatible with existing needs and expectations?
- Simplification: does the innovation make life simpler or at least not more complex?
- Trialability: can the innovation be tried without a commitment to overhaul one's way of doing things?
- Observability: is the innovation observable and visible to would-be adopters?

(ROGERS, 1995, cited in DONOVAN, 1999)

Studies of the impact of ICT within educational environments have confirmed that investments in hardware and software alone do not yield the expected results: "what is involved here is more than just the substitution of traditional learning media with new ones, but a revolution in what teachers understand to be the methods and goals of instruction and the standards for student accomplishment (BECKER, 1996, p.191). Besides investment in technology, educational organisations have to invest in a redefinition of their mission and in the involvement of their human resources in the transformation they pursue. Indeed, alongside investments in technology, significant action has been taken towards its effective integration in pedagogical practices: research, implementation projects, publications, seminars, electronic discussion groups, etc. (WHITE, 2000, p.8).

Research studies have listed features of the teaching environment of "exemplary" computer-using teachers, namely schools with many computer-using teachers, with full-time technology coordinators, substantial staff development sessions, smaller class sizes for computer-using teachers (BECKER, 1996, p.192). However, exemplary cases are usually exceptions. According to BALDWIN (1998, p.9), "most professors use technology to supplement traditional instruction, not to redefine the instructional process". The majority of attempts at the effective integration and assimilation of technologies in higher education has not affected the core of teaching and learning activities. In a study of how Australian higher education educators use information technology, ADAM, S. and WILSON, D. (1996) found that "individual educators seem to be laggards in their planned adoption of information technologies in the classroom". In what regards research activities, technological developments and innovations have had greater impacts on these than on the design and implementation of teaching (BALDWIN, 1998, p.10). Although data from the 2000 National Survey of Information Technology in US Higher Education indicates that

there has been a rise in the use of technology in instruction (e-mail, internet resources and web pages for courses), it also suggests a slowing down of the rate of technology integration in teaching and learning:

> Although the survey data continue to show gains in the use of technology in the classroom and the role of technology to support instruction and learning, it may be that we are about to reach a temporary plateau [...] The number of faculty energized by the Web and willing to invest time and effort to infuse technology into their instructional activities, often absent adequate institutional support and recognition for their efforts, may begin to level off, at least for a little while.

According to HODAS (1996), after a whole century of attempts at integration, the technologies which "have had a defining influence on the general organization and practice of schooling were the textbook and the blackboard" (p. 197). The factors which account for this phenomenon, according to the author, are the threat of upheaval to the routine of professional life and to the competence and power of teachers that new technologies represent. Only those such as the blackboard, the duplicating machine or the overhead projector, which do not appear as a threat but as factors of reinforcement and help for teachers' professional duties and authority, do successfully overcome the resistance of teachers and schools:

> This type of technology seldom poses a threat to any of the teacher's functions, is fundamentally supportive of the school values mentioned earlier, and reproduces locally the same types of power and information relationships through which the teacher herself engages her administrators.
>
> (HODAS, 1996, p.209)

However, findings from research on the impact of incorporating educational technology in higher education institutions also show an increase in the awareness of teaching staff concerning their role as learners (GILLESPIE, 1998a) and pedagogical issues, which leads to a concurrent interest in learning how to teach better (ELLIS, 1997, p.259). Student's roles also undergo changes, becoming more active. Teamwork and interdisciplinary collaboration between teaching staff and students were also found to be

important impacts, "fostered through shared resources, electronic discussion groups and 'show-and-tell' sessions (p. 261).

On the implications of the growing use of technology, BALDWIN (1998) refers that flexibility and diversity will change academic careers, allowing teaching staff a greater choice of roles to play, for "no longer must professors be limited to the traditional lecture and instructional techniques that depend on a teacher and students coming together in a space and time on a regular basis" (p.14), a fact which higher education institutions will have to acknowledge. Referring to the literature, BALDWIN (1998) lists some of the factors which act as barriers to the integration, such as "insufficient or obsolete hardware and software, inadequate facilities and support services, lack of time and money, an appropriate reward system, lack of information about good practice, and underestimation of the difficulty in adopting new technologies" (p.13).

In a seminal research study, LAURILLARD (1993) points out critical factors in the effective integration of technology in teaching and learning in higher education, stressing the importance of institutional support and referring that "the implementation of new technology methods cannot take place without the system around it adjusting to the intrusion of this new organism" (p. 223). The adequate organisational infrastructure should be developed by means of collaboration and cyclical reflection on its actions, and should address the whole context of learning and teaching (p.226). Teamwork is also a key factor of effectiveness in integrating technology in educational settings. On this matter, the author cites DANIEL (1991), who refers that "the mechanism of the course team, through the collective work of the specialists it brings together, is considered to give the content of the materials they produce a special authority" (p. 225).

According to GRANDGENETT et al (1997, pp. 253-5), the three most important critical factors for the effective integration of technology are to "encourage and train faculty, to support student productivity and to design technology integrated curricula". HAMILTON (1997) refers to "institutional support, faculty support, a well-defined mechanism regulating computer-assisted learning (CAL) production and teamwork" (p.263). Reporting to findings from an online project, BALDWIN (1998, p.14) refers that adoption of new educational technologies is a function of "available resources, perceived

value the individual places on the innovation, and communication with other adopters". ELLIS (1997, p.261) refers the importance of valuing and acknowledging teaching at the institutional level and the need to develop an overall strategy:

> Unless suitable reward processes can be put in place, there is a real danger that the present widespread interest in technology-assisted instruction among faculty will fade [...] A second, and even more important, issue is the need for each institution to agree on an overall strategy for developing and incorporating educational technology into the curriculum.

Thus, findings have revealed that there are two crucial factors associated with the successful integration of technology in teaching and learning: on the one hand, an overall institutional strategy and, on the other, unwavering support to teaching staff. In the field of institutional strategy, HARDY (1990) developed research on strategy making in higher education organisations, by means of a comparative study of six Brazilian universities. Her aim was to "examine how the universities formed strategies; explore the relationship between strategy making and structural and contextual variables; and assess the implications and outcomes of these strategy-making processes" (p.19). Although the sample included only Brazilian universities, the overall aim was to draw conclusions which could then be generalised for other universities and organisations. Arguing that the literature on higher education has been unable to "capture much of the institutional diversity that exists" (p.19), HARDY (1990) developed a broader theoretical framework, by means of the concept of *configuration*, which included the relevant business literature and consists of a "gestalt that incorporates formal structure, power and decision-making style" (p.165). Throughout her analysis of all six universities, HARDY (1990) developed the concept of strategic style, i.e., "how the universities were characterized by different configurations, patterns of strategy making, and leadership orientations" (p.211), concluding that "certain strategic styles are particularly appropriate to success" (p.220). Different configurations of universities may be equally successful if part of an "internally consistent strategic style that encompasses, not only structure, but also leadership orientation and strategy making" (p.220). Findings of this study revealed that the success

of two higher performing universities, although with different strategic styles[1], was associated "with an academic focus and ideology":

> In other words, the commitment was to research and teaching. In this way, the entire institution had an academic focus, and a clearly articulated and shared academic strategy [...] it also defined the institution, provided consistency, and focussed collective action.
>
> (HARDY, 1990, p.223)

A less effective configuration of a research university was characterised by "centralization of power, emphasis on control, and the pursuit of efficiency" (p.223). Thus, depriving professors of decision power led to a failing strategic style, although the latter was internally consistent. In configurations characterised by interest groups and dispersed power, HARDY (1990, p.225) suggests that it is very important to strive towards an equilibrium between the power of professors and that of central administration. According to this author, this type of configuration is common because:

> Universities are prone to political activity, however, due to loose coupling, different disciplinary traditions, and decentralized power; all of which provide significant potential for conflicting interests, particularly in the absence of a binding ideology.

Findings obtained from this study revealed that the more effective strategic styles were the "visionary", the "catalyst" and the "colleague": the first is characterized by a charismatic leader and an entrepreneurial and ideological academic strategy; the second, by consensual strategies, a balanced distribution of power among central administration and professors and a commitment to innovation; and the third, by a symbolic or cybernetic[2] leader and an ideological and consensual academic strategy (p.231). These findings show that there is no single successful strategic style for universities. It is the understanding of the configuration of individual universities, in the light of the theoretical framework described by HARDY (1990), that will lead to the identification of the necessary changes:

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[1] For instance, considerable differences in the roles played by central administration.

[2] "Cybernetic leaders can have a limited role in decision making and yet still preside over effective institutions" (HARDY, 1990, p.202).

> And understanding of the individual university, on the other hand, helps to bring about ideas for working towards change. The focal point for change in each university configuration has to be located. There are some stable, less manageable, and some changeable features in any institution. Change agents have to locate and mobilize the latter, while accommodating the former.
>
> (HARDY, 1990, p.237)

According to BADLEY (1999), there is a widespread effort on the part of higher education institutions towards introducing necessary changes and reformulating academic strategies. Many of these institutions have their own teams working on the improvement of teaching and learning within the institution. Usually these central units are responsible for disseminating information and best practices, conducting research, organising workshops and offering support:

> Possibly the most visible manifestation of an institution's commitment to the improvement of teaching and learning is the presence of a central unit - variously described as a Centre for Educational Development or a Centre for Teaching and Learning, or a Centre of Academic Practice.
>
> (BADLEY, 1999, p.38)

Based on a successful experience of implementation at a higher education institution, HAMILTON (1997) proposes key strategic models for computer-assisted learning (CAL) development, admitting that these do not exclude each other and that hybrid models are possible. The four models described were the "centralized institutional model", the "on-site faculty model", the "department model" and the "solo model". The latter model, "perhaps the most common, and in our opinion the least desirable" (p.265), refers to efforts in the development of CAL by individual teachers, working in isolation. The three first models have in common the creation of a central unit, assembling both subject and technology experts, supporting the whole institution, a faculty or a department. Teamwork is an important feature in these models: "without teamwork it is likely that the CAL produced would have been of poor quality, poorly integrated into the curriculum and likely to have been viewed as a disparate set of novelty items by students" (p.265). Crucial for the success in this case of CAL development were both the library and the computing centre services: "In our own case (The Faculty Model) we relied heavily upon our computing

centre as providers of an information delivery infrastructure (most importantly the computer networks) and the library as mediators and coordinators of information provision" ((HAMILTON, 1997, p.264).

However, according to DONOVAN and MACKLIN (1998), these familiar models for supporting teaching staff in their use of technology, by means of the creation of a central unit which offers its services to interested teachers, do not render the expected results and "for the most part, this has proven to be a poor strategy for promoting educational transformation through the sober incorporating of technology". Supporting his argument on the experience of developing Catalyst, a project to support technology use by teaching staff at a higher education institution, the authors explain in a detailed way why and how a previous project was re-examined and altered to a web-based project, including five core components:

> We have moved away from working intensely with a few educators toward providing a central clearinghouse for the information, resources, and tools needed by a broader population to effectively incorporate technology in their teaching and learning. We have involved educators in every step of design and development and have worked to link meaningful information about the instructional uses of technology with the technical support required to implement technology. Through our Quick Guides we have tried to develop an enduring framework for the *process* of using technology in teaching. By focusing on highly modular technical documents and a centrally administered suite of tools, we have begun to reduce the burden of supporting faculty thereby leveraging our resources to allow us to help more people with only a marginal increase in our own capacity.

The strategic model thus presented comprises the creation of online portals for teaching and learning and may constitute an answer to overcoming the "temporary plateau" referred by GREEN (2000) and quoted above. Although many of the so-called older technologies never became routine educational resources, namely radio, video and television, the present trend of technological development and the new educational scenarios may lead to their effective integration in teaching and learning. Both the traditional technologies and the so-called new information and communication technologies can be used by educators as tools, communication or resources. A possible

classification of the latter is presented in the following diagram (MAIER and WARREN, 2000, p.37):

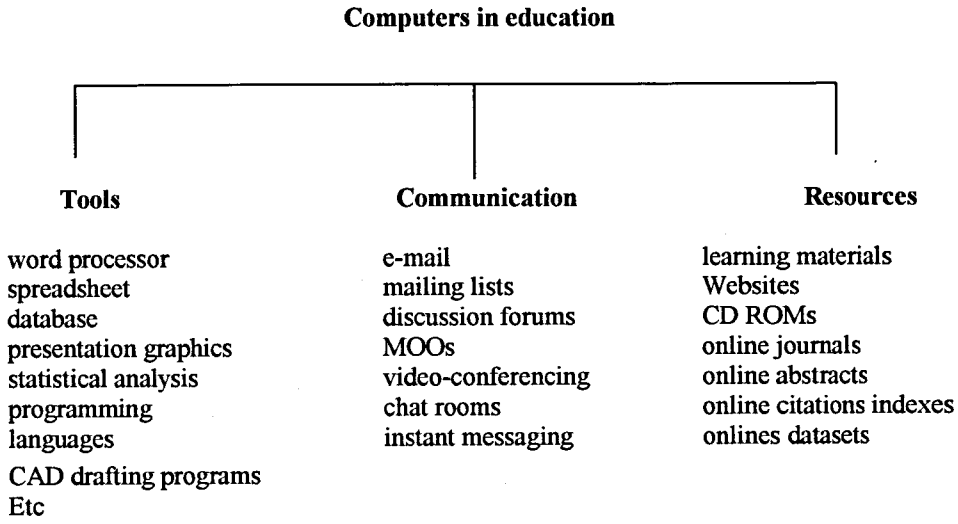

Figure 1 - Computers in Education: tools, communication and resources
Source: MAIER and WARREN (2000, p.37)

This diagram may prove useful to teaching staff when considering how to improve their professional activities with new or traditional technologies. The literature shows that questions on teaching and learning should be the starting points to determine choices from among different technological options (GILLESPIE, 1998a; DONOVAN, 1999). The answers to these pedagogical questions should be considered in the light of existing technologies, in an attempt to select the ones that will effectively assist in achieving the stated pedagogical aims.

In an attempt to find out how to effectively help teachers, DONOVAN (1999) states that the two questions teachers were asked in the survey focus groups, which aimed at providing data for the organisation of their web-based project, were "what are your biggest teaching challenges" and "what concerns do you have about using technology". In a similar fashion, in his New Model of Instructional Design, GILLESPIE (1998b, p.47) suggests that teachers should begin by asking themselves the questions "what do I want to do differently" and "how can I use the new tools to accomplish what I want", in order to

avoid the common mistake of transferring traditional conceptions of teachings to the new technological settings.

The integration of new information and communications technologies in teaching and learning should not be approached with the aim of radically reinventing teaching but of rethinking it in a much broader framework of possibilities. According to WHITE (1997), the major change necessary to the integration of ICT in teaching is a "change in perception", through the acknowledgement that "the application of new technology in teaching and learning is not so very different from what we do already" (p.20).

In conclusion, educational scenarios have undergone changes during the last four decades following the development of ICT. Polarised perspectives have pointed to the advantages and disadvantages of technology. More consensual perspectives defend that the effectiveness of technology depends more on the way it is used than on the technology itself. Although significant investments and actions have been taken towards the integration of technology in teaching and learning, the results have not been proportionate to the measures taken and the majority do not affect the core of those activities. The two most important critical factors in the integration of ICT were found to be the development of an overall academic strategy and the institutional support and training of teaching staff. Teaching and learning issues should be the starting point for effective integration of ICT in higher education and the answers to these questions should then be considered in the light of the existing technologies.

This chapter described the background to the present study. The following chapter will present an overview of the study, including its purpose and design.

3. OVERVIEW OF THE STUDY

3.1 Purpose of the study

The purpose of this study is to examine the context of the integration of new information and communication technologies (ICT) in teaching at the University of Madeira (UMa), and to draw up a list of recommendations based on the findings. The main aspects considered are (1) teaching staff's use of and attitudes to ICT and towards associated professional changes and (2) the contribution towards integration of ICT in teaching by the teaching services, resources and facilities of the university.

Our ten years of work as lecturer at the University of Madeira determined the choice of this higher education institution as the focus of our study. We were a baffled witness to a whole decade of investments in technology that apparently did not affect academic activities in the same proportion, nor produced any significant change in the way teaching was implemented. Although it is our opinion that it would not be feasible for a young and small-scale publicly funded university, as is the case of UMa, on the Portuguese Island of Madeira, to be transformed immediately into a digital university, our conclusion was that UMa has still to achieve a major stage in its development in order to successfully fulfil its mission as set out in the statutes. At the heart of this undertaking remains the imperative need of confronting the challenges created by the development of ICT.

The answer to present challenges has not been nor needs to be necessarily a unique model for all higher education organisations (GORDON, 1999). The integration of ICT in teaching in higher education is a critical global issue (THOMPSON, 1997; BOWDEN and MARTON, 1998), involving different areas, such as organisational change and information and knowledge management. Although it does not consist of a mere technological task, the integration of technology is often imposed on teachers in this manner, which accounts for,

among other factors, the high percentage of failure of many such endeavours (FULLAN, 1993; HODAS, 1996; NOBLE, 1997; EVANS and ABBOTT, 1998).

Our study focuses on the involvement of the teachers at the University of Madeira in the integration of ICT in their professional activities and its primary objectives are as follows:

1. to examine the working scenarios of teaching staff at the University of Madeira, in particular the characteristics of their teaching and the issues relating to ICT;
2. to assess the availability of teaching services, resources and facilities at the University of Madeira, in particular their role in the process of integration of ICT in teaching;
3. to outline the main problems of the integration of ICT in teaching at the University of Madeira, with special reference to the teaching staff's perspective on the issues;
4. to draw up a list of recommendations for the integration of ICT in teaching at UMa.

3.2 Design of the study

3.2.1 Research questions

Our dissertation addressed the following research questions, which emerged from the literature review and from the primary objectives of our study, as described above:

1. What main features characterise the professional life of teachers at UMa? What main features characterise teaching at UMa? To what extent are teachers familiar with ICT? To what extent do they integrate ICT in their teaching? How do they react to changes to their professional activities?
2. What teaching services, resources and facilities are available at the University and to what extent do they contribute to the integration of ICT in teaching?
3. How has the integration of ICT in teaching at UMa been promoted and developed? How successful has that process been? What problems have arisen?
4. How might the process of integration of ICT at UMa be improved?

3.2.2 Methodology

Our research questions were studied following the case study methodology described by YIN (1994), since our purpose was to examine the context of the integration of technology in teaching at UMa and, according to YIN (1994, p.13), "you would use the case study method because you deliberately wanted to cover contextual conditions - believing that they might be highly pertinent to your phenomenon of study". Furthermore, this methodological approach was considered the most appropriate to our study because the three conditions of case studies are fulfilled by our research questions: they are of the "how" and "why"[3] type and about contemporary events, "over which the investigator has little or no control" (YIN, 1994, p.9).

The design used for our case study is of the single-case type (YIN, 1994, p.38-44), the rationale of which lies in the exploratory purpose of our study and our ten years of teaching at UMa. It is a holistic case study (p.42) since a single unit of analysis was selected: the process of integration of ICT in teaching by teaching staff at UMa.

3.2.3 Data Collection and Analysis

3.2.3.1 Validity and Reliability

The collection of data for our study will take place at the Penteada campus of the University of Madeira. Following the recommendation of YIN (1994), different sources of evidence were selected: (1) documents, (2) archival records, (3) direct observation and (4)

[3] Although none of our research questions is actually initiated by "why", the majority of those initiated with "what" belong to the exploratory type of "what" questions, as classified by YIN (1994, p.5).

interviews. The use of multiple sources of evidence is the first of the three principles of data collection[4] described by YIN (1994, p.90-101) and is "a major strength of case study data collection" (p.91).

Besides the advantages of the triangulation of data, which occurs particularly if "converging lines of inquiry" (p.92) are developed, the use of multiple sources of evidence is also a tactic for the design test of "construct validity". We shall also ask some of the participants in the study to review our draft of the case study. This procedure is one of the two[5] other tactics recommended to address validity problems (YIN, 1994, p. 34-5).

As to the design test of "reliability", YIN (1994, p.36-38) suggests the tactics of using a case study protocol and developing a case study database, in order to "minimize the errors and biases" of the study (p.36). In the following section, we present a detailed description of the procedures followed in our case study as a means to meet these requirements. The data collected for our study was analysed following a general analytic strategy of developing a "descriptive framework for organizing the case study" (YIN, 994, p.104), also presented in the following section.

3.2.3.2 Description of procedures

As referred above, the data collection of our study takes place at the University of Madeira from (1) documents, (2) archival records, (3) direct observation and (4) interviews. These three different sources of evidence address, in a convergent manner, the single process of the "integration of ICT in teaching by teaching staff at UMa", which is the unit of analysis of our study, in order to explore our initial research questions. According to YIN (1994, p.19),

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[4] Given the exploratory nature of our study, the two other principles (creation of the case study database and maintaining a chain of evidence) were only partially followed.

[5] The second is to "establish a chain of evidence" (YIN, 1994, p.34)

> Colloquially, a research design *is an action plan for getting from here to there*, where *here* may be defined as the initial set of questions to be answered, and *there* is some set of conclusions (answers) about these questions. Between "here" and "there" may be found a number of major steps, including the collection and analysis of relevant data.

The purpose of this section is to describe these major steps in a detailed manner, by means of a report on procedures undertaken for the collection and analysis of data from the four different sources of evidence selected for our case study.

(1) Documents

The reason for selecting this source of evidence was to "corroborate and augment evidence from other sources" (YIN, 1994, p.81). The documents were collected from different sections within the University, from a local library and from our personal archives. The following types of documents were used:

- **legal documents** (i.e., the Decree-Law 108/88 of 24th September, on the autonomy of universities - *Lei da Autonomia das Universidades*);
- **university administrative documents** (i.e., the Development Plan for UMa and the 1998 revised version of the University Statutes);
- **university internal newsletters, correspondence and informative leaflets** (i.e., newsletters published on special occasions, inter-departmental correspondence on the acquisition of computer resources, the *Guide Book of the University* and the library information leaflet),
- **newspaper articles on university matters** (i.e., an interview with the former Rector).

The data collection stage comprised the assembling and reading of the documentation, in order to select all relevant information. The former was then organised in three main groups of subject matters: (1) history and organisational structure of UMa; (2) administrative framework of teaching at UMa and (3) miscellaneous information relevant to the purpose of the study (i.e., regarding the growing number of students or ICT issues).

The data analysis stage was continued with the drawing up of an overall picture of UMa, presented in the following chapter. This information was important in adding further

perspectives to our study. Concurrently with the three groups of data referred to above, this new data was compared with that collected from the other sources of evidence.

(2) Archival Records

The same reasons as those described above led us to select Archival Records as a second source of evidence for our study. This data was also collected from different sections within the UMa and authorisation was requested from the University administration for access to some of the records (Appendix 5). The main types of archival records used were the following:

- architectural plans and photos of Penteada;
- list of teachers at UMa;
- students and teachers timetables;
- list of teaching rooms at UMa, including their max.capacity

The records were assembled and analysed in a similar way to the Documents, and the data collected was classified as either "physical" or "human" data. The data analysis stage involved confronting the two former aspects of UMa and extended our previous research. The new data was then compared to data collected from the other sources of evidence.

(3) Direct Observation

Our selection of Direct Observation as a third source of evidence was determined by the possibility of observing closely the object of our study. Both formal and casual data were collected during a field visit to the Penteada campus and on the same occasions as the interviews were held. The focus of our observations were the following locations:

- teaching rooms, including laboratories
- the computer centre
- the library
- teachers' offices
- departmental areas
- open spaces

All observations were recorded and analysed in the same manner as described for Documents and Archival Records. Data was both of a qualitative (i.e., the atmosphere and layout of classrooms and offices) and of a quantitative type (i.e., the number of classrooms), and was an important complement to our previous research. Many new perspectives and questions turned up during these procedures. All data was compared to that collected from the other sources of evidence, in particular to data from the interviews and the questionnaire.

(4) Interviews and Survey

Interviews played a most decisive role in our study. The main reason why we selected this source of evidence was that, as observed by YIN (1994), "well-informed respondents can provide important insights into a situation" (p.85), and, furthermore, that interviews would allow a more flexible approach to the subjects under discussion, this being an important factor in an exploratory study such as this one.

Besides several informal interviews of an "open-ended nature" (YIN, 1994, p.84), which took place when visiting the campus or whilst collecting documentation, the main interviews formally designed for our study were of the semi-structured and "focused" type and of the structured type, "along the lines of a formal survey" (YIN, 1994, p.84).

The semi-structured interviews involved the following participants:

1. the Director of the Computer Centre
2. the Director of the Library
3. a sample of teachers representative of different departments at UMa

These semi-structured interviews were arranged by appointment and the topics followed through are described in the interview schedules (Appendix C). On average, each interview lasted forty-five minutes. It was decided not to use a tape-recorder in order to facilitate the conversation and avoid institutional constraints, and great care was taken to follow the advice given by STAKE (1995, p.66):

> Rather than tape-record or write furiously, it is better to listen, to take a few notes, to ask for clarification. Perhaps the most important thing is to insist on ample time and space *immediately* following the interview to prepare the facsimile and interpretive commentary.
>
> (STAKE, 1995, p.66)

Although different questions and topics were prepared for the interviews to the Director of the Computer Centre and the Director of the Library, the data collected was organised in similar groups of subject matter: (1) mission and activities of the organisational unit; (2) main successes and failures; and 3) contribution to the integration of ICT in teaching and contacts with teachers.

In what regards the interviews to the teachers, these were scheduled for different days so as to allow for a careful registering and analysis of the data collected in each interview. Although a single interview schedule was designed to prompt the discussions (Appendix C), these key topics and questions allowed variation according to each interviewee. The questions related to the main issues of our research questions, as well as the most significant topics of the questionnaire. The data collected was organised according to the former.

As referred above, our data collection also included a self-completed questionnaire survey of all teachers at UMa. The questionnaire was carefully developed so as to include the most important questions and at the same time be as quick and easy as possible to complete. Although "it is probably true to say that internal checks would not detect a respondent who was really determined to mislead" (OPPENHEIM, 1992), the reliability of the questionnaire was ascertained by verifying the consistency between the answers to two similar questions: one on "computing skills" and the other on "computer activities" (Appendix 2, Questions 11 and 14).

The validity of the questionnaire was ascertained by means of a pilot study entailing six teachers. Following the interviews with the pilot respondents, a few changes were introduced to the wording of some of the questions. The six teachers had been asked to complete the questionnaire and answer the following questions:

1. How long did it take to complete the questionnaire?
2. Please mark in the questionnaire any:
   - grammatical mistakes;
   - graphical layout problems;
   - sentences which are difficult to understand;
   - and add any suggestions for introduction of changes.
3. Did you find the questionnaire unbiased?
4. Any other comments are welcome!

The questionnaire filled three A4 one-sided sheets of paper, and a covering letter was attached and half inserted in a blank return envelope. The covering letter described the aims of the study, guaranteed anonymity, explained the return procedure, acknowledged teachers participation and gave a contact for further discussion or summary of results. The questionnaire was divided into four sections and included seventeen close-ended questions, which aimed at providing data for the following topics:

- Section 1 - **Professional situation of teachers:** work experience and scientific area of expertise (questions 1 and 2);
- Section 2 - **How do teachers organise their teaching:** work load, individual or team work, time assigned for lesson preparation, research and administrative tasks, use of oral presentation and group or individual work, etc. (questions 3 to 8);
- Section 3 - **Teachers and ICT:** teachers' access to computers and their computing skills, rate of use of technology, what teaching materials do they use more frequently, how willing are they to undergo technological training (questions 9 to 14);
- Section 4 - **Teachers and professional change:** how do teachers react to change in their professional careers, what type of compensation do they consider necessary for adapting to these changes, which type of new teaching techniques would they prefer (questions 15 to 17).

Authorisation was requested from the University administration (Appendix B) for access to a list of the names of all teaching staff at UMa, which constituted our sample of teachers. The questionnaire was distributed to 130 teachers, out of the 150 working at the time at the University of Madeira[6]. Respondents were asked to return the completed questionnaire by inserting the closed enveloped in one of the thirteen boxes placed in each

of the departments. As shown in Table 1, a total of 110 questionnaires were completed, representing a response rate of 85%:

Table 1 - Questionnaire distribution

Group	Department/Section	Teachers per Dep/S.	Teachers per a), b) or c)	Distribution per Dep/S.	Distribution per group	Response rate
A	Art and Design	11	51	10	45	38
	Sciences of Education	16		15		84%
	Physical Educ/Sports	8		6		b)
	Systems Engineering	8		7		
	Management and Econ	8		7		
B	English and German	11	37	9	30	23
	Classical Studies	6		5		77%
	Portuguese and French	16		12		b)
	History	4		4		
C	Biology	19	62	15	55	49
	Physics	8		8		89%
	Mathematics	19		16		b)
	Chemistry	16		16		
TOTAL	13	150		130 a)	130 87%	110 85% c)

a) questionnaires were not sent to 20 teachers (on leave or non-Portuguese speakers)
b) in reference to the number of questionnaires distributed per group
c) in reference to the total number of questionnaires distributed

In conclusion, we selected documents, archival records, direct observation and interviews as our different sources of evidence, in order to explore the initial research questions of our study and address, in a convergent manner, the integration of ICT in teaching by teaching staff at UMa. The following figure summarises our methodological approach:

[6] It was decided not to distribute the questionnaire to teachers who did not speak Portuguese or who were on leave at the time.

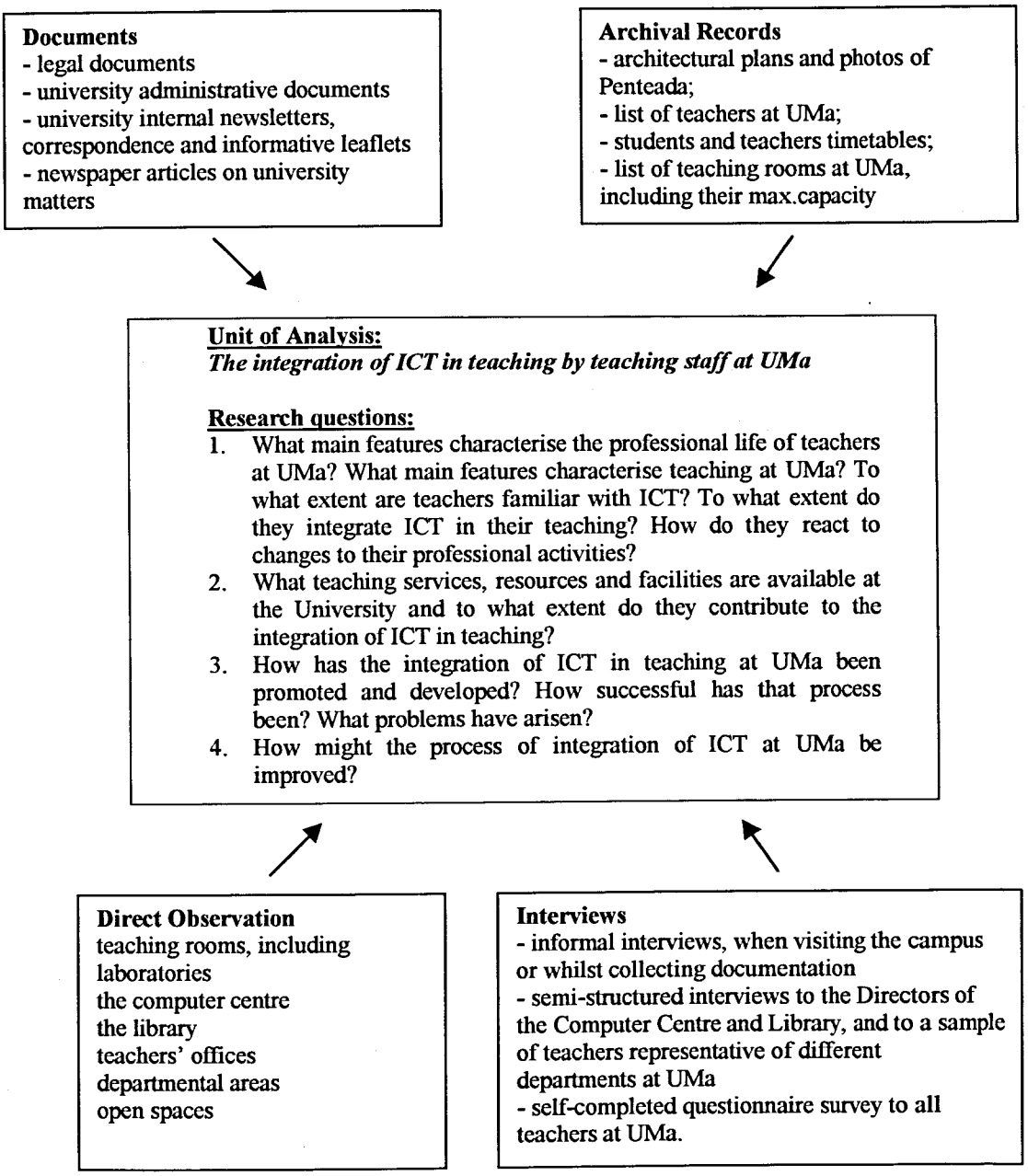

Figure 2 - Sources of Evidence for the Case Study
Adapted from YIN (1994)

This chapter presented an overview of the study, including its purpose and design. The following chapter shall describe the University of Madeira.

4. THE UNIVERSITY OF MADEIRA

4.1 Creation of the University

The Island of Madeira and the smaller Island of Porto Santo, together with the uninhabited islands of the Desertas and the Selvagens, form the Portuguese Archipelago of Madeira. Since their discovery in the 15th century, these islands have been ruled by the central Portuguese government, except during the Spanish occupation (1580-1640) and during two short periods, between 1801-1802 and 1807-1814, at the time of the Napoleonic wars, during which they remained under British administration (SILVA, 1984, pp. 5-7).

In 1976, the archipelago gained considerable autonomy in political and administrative matters and was granted the status of autonomous region (*Região Autónoma da Madeira* - RAM). The integration of Portugal in the European Union represented an advancement, for the region, at all levels (political, economical, cultural and social) as a result of the increased importance currently assigned to insular and ultra-peripheral areas such as Madeira (UMa, 1999).

At a distance of about 978 Km from the capital city of Portugal and surrounded by the Atlantic Ocean, the Island of Madeira has a very high population density of about almost 400 per km². A considerable percentage of its population works in public sectors and administrative services, and the average income per-capita is one of the lowest in Europe. These factors, together with its insularity, have also contributed to the average low cultural level of its population; however, the fact that Madeira has a strong tradition of emigration and tourism has created a heterogeneous society, in which traditional rural and urban cosmopolitanism coexist (UMa, 1999). All this, allied to the context of change in recent technological development, justified the great demand for qualified human

resources and the obvious need for creating an institute of higher education to undertake that task and promote the overall development of Madeira.

Apart from courses in Theology and Humanities, organised by the Jesuit priests between 1570 until their banishment from the country in 1760, the only other instances of higher and further education based in Madeira were the *Escola Médica e Cirúrgica do Funchal*, which attempted to overcome the shortage of trained doctors between 1837 and 1910, the *Escola do Magistério Primário*, founded in 1943 for the purpose of training primary teachers, and the *Academia de Música e Belas Artes* (COSTA and BRANCO, 2000, p.6).

Only after the political revolution of the 25th April 1974, which led to the political and administrative autonomy of Madeira in 1976, were the conditions met for the creation of higher education institutions, namely the *Escola Superior de Educação da Madeira*, the *Instituto Superior de Administração e Línguas*, the *Escola Superior de Enfermagem* and the *Instituto Superior de Arte e Design*.

Prior to the establishment of the University of Madeira, students who wished to graduate in different courses from those listed above, had to travel to mainland Portugal, usually at their own expense. The first move in response to the needs of these students came in the eighties, both from the Universidade Aberta[7] and the University of Lisbon. The former operated by means of the television network and the latter, by sending its own teachers on a part-time basis to Funchal, run for some time the so-called *Centro de Apoio da Universidade de Lisboa*. Albeit these educational efforts, there remained a great shortage of qualified professionals in most areas, in particular of teachers at all levels of education. Likewise, the need for the development of research institutes led the local government to create research laboratories, with a view to solving the immediate problems in areas such as wine quality, biology and forestry (COSTA and BRANCO, 2000, p.10).

Thus, emerging from three of the existing higher education institutes (the *Escola Superior de Educação da Madeira*, the *Instituto Superior de Arte e Design* and the *Centro de Apoio da Universidade de Lisboa)*, the University of Madeira was established in 1988[8]. The 6th May was chosen as 'University Day', for it was the date on which the courses run

[7] The Portuguese equivalent to the UK Open University, based in Lisbon.

by the Jesuits in 1570 started and is the day of Saint John the Evangelist, whose name was given to the beautiful Jesuit Convent where the University is based.

The first course to be run at the University of Madeira (Sports and Physical Education) was started in 1989 and in the following year several other courses were initiated, the majority of which were for teacher training, in the areas of Primary Education, Modern Languages and Literature, Classical Languages and Literature, Mathematics, Biology, Chemistry and Physics. Two years later, the courses of Systems Engineering and Hotel Management were started (UMa, 1999).

According to the national law, *Lei da Autonomia das Universidades*, which regulates the management of Portuguese universities, decisions concerning funding and accreditation of courses are the responsibility of the Ministry of Education, and are based on criteria such as number of students, courses run by the institution, type of research, size and normal expenses of the institution. All other decisions are taken by the universities themselves, although the former have to be submitted to and authorised by the Ministry of Education and can never violate these general national educational laws[9]. Universities are required to draw up their own statutes, which must list the fundamental rules, which govern the institution, at scientific, pedagogic, financial and administrative levels.

Up to 1994, the Regional Government of Madeira funded the University. However, from 1994 onwards, the University of Madeira has been dependent on the central government and the Ministry of Education for its funding and accreditation (UMa, 1999). Right from the start and due to the political autonomy of the Madeira Islands, there has always been some uncertainty as to where the University of Madeira stands in relation to these two authorities: on the one hand, the Portuguese Ministry of Education and, on the other, the Madeira Regional Board of Education, with whom certain important policy decisions should be discussed and agreed. This fundamental issue has yet to be clarified. Its outcome will naturally affect, in a crucial way, the future of the University of Madeira, as different policies and a different working atmosphere will follow, according to which institution retains tutelage over the university.

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[8] By the Decree-Law 319-A/88 of 13th September.

[9] For instance, the *Lei de Bases do Sistema Educativo*, Decree-Law 46/86 of 14thOctober, and the *Lei da Autonomia das Universidades*, Decree-Law 108/88 of 24th September.

Currently, a "double tutelage" has been suggested as an intermediate solution. The parties involved recognise the importance of maintaining a harmonious relationship as a prerequisite for successful achievement on both sides. At the heart of the few conflicts which have arisen in recent years are different political perspectives as to what exactly is the mission of the University, issue that heads the agendas of the majority of universities worldwide.

During its first eight years, between 1988 and 1996, the University of Madeira was managed by foundation committees (*Comissões Instaladoras*), consisting of temporary boards of directors, whose objective was the management of the University while preparing it for effective autonomy. According to COSTA and BRANCO (2000, pp. 16-19), the fact that the University of Madeira emerged from the three existing institutes referred above, influenced in great measure its establishment and further development. The integration of the three groups of teachers into one common staff framework has proved to be a very difficult task, not yet fully achieved. Furthermore, the impact of the conflicting interests and policies of each of the three institutions has been one of the most important factors affecting and contributing to the troubles in UMa's first years of existence.

Under these circumstances, it has been difficult to establish common goals for all those involved in the development of UMa. Although previous consultancy studies have suggested that UMa should follow a flexible and innovative university model, capable of adapting to the changing social and economic context (COSTA and BRANCO, 2000, p.30), the conflicting interests and policies have pushed UMa into following a very traditional model for its development. Moreover, the presidents and many of the other members of the three successive foundation committees (1988-91; 1991-93; 1993-96) never actually resided on the island, which may account in part for the turbulent atmosphere which characterised this period, as described in the following extract:

> Contudo, o que marca este período, muito para além do modelo, é a prática do dia a dia das Comissões Instaladoras. Uma prática circunstancial, com objectivos pouco claros, que, como consequência, conduziu a um crescimento descontrolado, a

> gastos excessivos (sobretudo com professores coordenadores e visitantes) sem sentido de futuro. [10]
>
> (COSTA and BRANCO, 2000, p.52)

The number of students rose very quickly during these first years, due to the extremely liberal admission policy followed in an attempt to stem the local shortage of qualified professionals, especially teachers. The following figure shows the growth in number of students during this period:

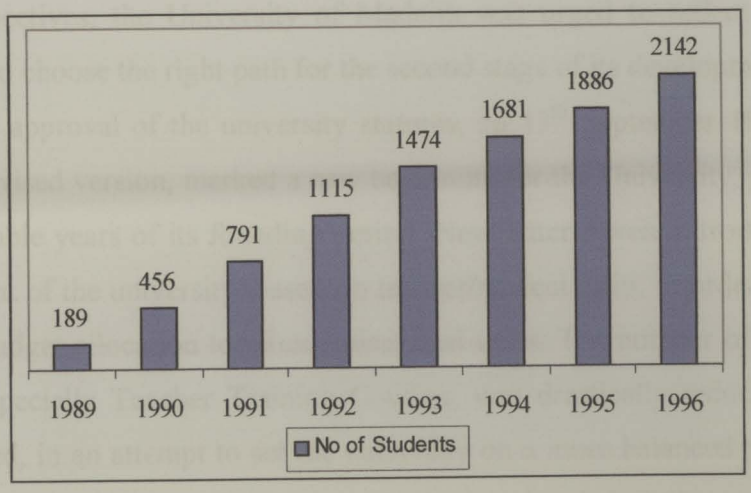

Figure 3 - Growth of number of students at UMa (1989-1996)
Adapted from UMa (1999)

As a consequence of this irregular expansion, the university went through an intensive period, having to cope with large classes with a limited number of human resources. At the end of this first phase of development, UMa had attained one of its initial

[10] However, what characterises this period, far beyond the model itself, is the everyday practice of the Foundation Committees. A circumstantial practice, with unclear objectives and which, as a consequence, led to uncontrolled development, to excessive expenditure (especially with regard to Coordinating and Visiting professors) with no view to the future. (Our translation).

aims: it had overcome the excessive demand for qualified teachers. Moreover, it became difficult to place all teacher-trainees in the training posts of local schools and, more dramatic and rather ironically, for the first time 'qualified unemployment' became part of the regional agenda on labour issues. At a first glance, it seemed that UMa had solved one problem by creating a new one.

Two very different perspectives ensued on this issue: the first, a more traditional one, maintained that universities were entitled to proceed with their mission of research and teaching in an independent manner, without regard to the particular needs of the social milieu surrounding them; a second one argued that the university should decide its policies according to the demands of society, thus ensuring jobs for its graduates. Midway between these perspectives, the University of Madeira was urged to reflect on its mission and policies, and choose the right path for the second stage of its development.

The approval of the university statutes, on 13th September 1996, and particularly the 1998 revised version, marked a new beginning for the University, putting an end to the rather unstable years of its founding period. New criteria were introduced in the financial management of the university, based on teacher/student ratio, in order to allow for a more balanced budget allocation to all organisational units. The number of admissions in many courses, especially Teacher Training Courses, was drastically reduced and new courses were offered, in an attempt to set the university on a more balanced path of development. The number of Visiting Professors was also reduced and, in order to persuade teachers to remain on the island on a permanent basis, training development for teachers was promoted (COSTA and BRANCO, 2000, p.71).

Several changes were also introduced in the organisational structure of the university, the aims of which were, among others, to reduce bureaucracy, promote cooperation between different sectors and departments within the university and involve teachers, with experience in school management, in the running of the university (UMa, 1999, pp. 4-5).

With regard to physical resources, this first stage of development also proved to be a rather difficult one. At the end of its third year as a University, the Jesuit College was no longer large enough to contain the growing number of students and teaching staff. For a

couple of years there was no other alternative than to rent extra buildings, despite the obvious inconveniences of additional costs and of inadequate classrooms and offices. Meanwhile, construction of the new building to house the University of Madeira had begun. In February 1998, during its 'transition stage', which had begun in 1996, with the approval of its statutes, the University moved to its new campus at Penteada (Figure 4).

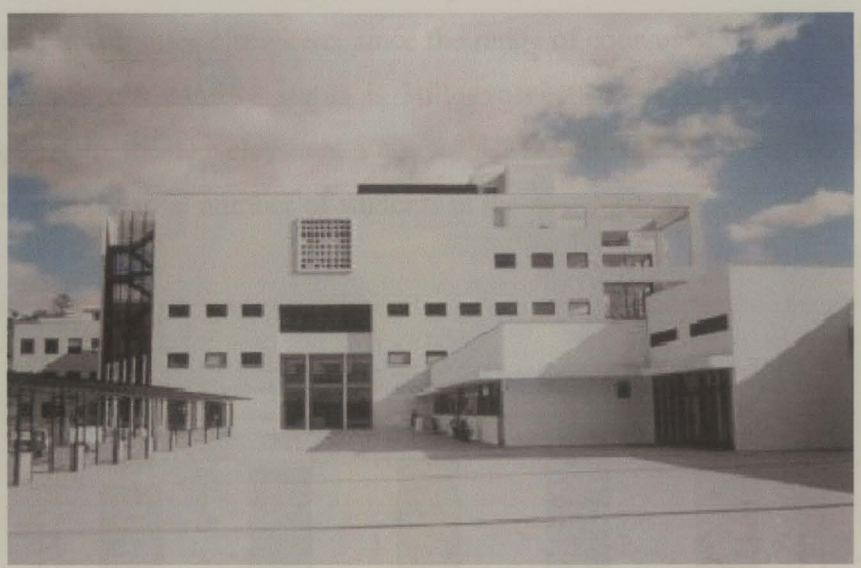

Figure 4 - The new Campus at Penteada
Source: Web site of UMa

4.2 The University at Present

4.2.1 Organisational structure

At the time of our study there were about 2500 students attending the University of Madeira, the majority of whom Madeireans, although in recent years the number of applicants from the mainland has increased. Many of the students who can afford to do so continue to attend universities elsewhere, since the range of courses at UMa is still limited. Furthermore, UMa's creditability status is still evolving, as is natural with any new venture. According to the Development Plan for UMa, the following figure shows the proposed increase in the total number of students in the near future:

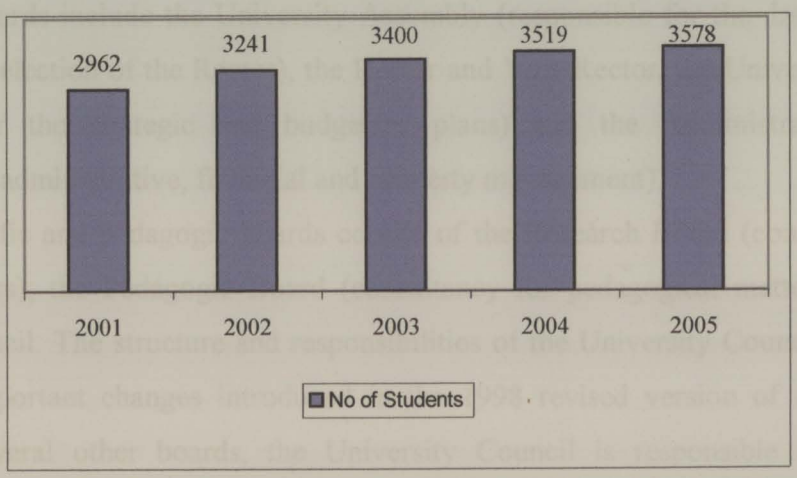

Figure 5 - Proposed increase in the total number of students (2001-2005) Adapted from Uma (1999)

Although geographical distance is a lesser problem nowadays, due to the improvement and construction of a large network of roadways covering great part of the island, many students either spend a great deal of time travelling to and from classes, or they have to move from rural areas, Porto Santo or the mainland, into Funchal. Greater awareness of this problem has determined that the building of a proper canteen and more residential halls for students, as well as accommodation for visiting professors be included in the university's Investment Planning Proposal (UMa, 1999, p.28).

The campus at Penteada is a seven storey purpose built modern construction, with a capacity for 3500 students (24000 m^2). Although it is very well equipped with laboratories for the Sciences, it still lacks proper rooms for subjects such as Sport, Music and the Arts, which in the initial building plans had been allocated to a separate campus. Thus it has not been easy to adapt the present building to the very specific needs for the teaching of these subjects. Some solution will have to be devised if UMa chooses to continue with these courses, particularly for those of Sports and Physical Education and Initial Teacher Training for the Primary School.

The organisational structure of UMa underwent a few necessary changes after the revision of the university statutes in 1998. The main governing bodies of the university comprise the top management boards and the scientific and pedagogic boards. The top management boards include the University Assembly (responsible for the drafting of the statutes and the election of the Rector), the Rector and Vice-Rector, the University Senate (responsible for the strategic and budgetary plans) and the Administrative Board (responsible for administrative, financial and property management).

The scientific and pedagogic boards consist of the Research Board (consultancy for scientific matters); the Pedagogic Board (consultancy for pedagogical matters) and the University Council. The structure and responsibilities of the University Council were one of the most important changes introduced in the 1998 revised version of the statutes. Advised by several other boards, the University Council is responsible for policies concerning all the most important institutional matters. It comprises six subcommittees which are accountable for research and cultural matters, teaching and professional development, external relations and planning, infrastructures and investments, human

resources and training, and budgetary matters. Consultancy on the strategic plan of the university and interaction with the community are responsibilities of a Consultancy Board.

According to its statutes, the University of Madeira follows a management model based on the interaction between projects (research, teaching and services for the community projects) and organisational units (academic Departments or Autonomous Divisions and the Sectors).

The research projects are developed by the Research Centres, which promote studies in a chosen scientific area and are allocated a specific budget for this purpose. To date, four Research Centres have been created, in the areas of Psychology, English Language and Literature, Mathematics and Biology. The teaching projects are under the direction of the recently created Course Committees, which are also allocated a specific budget and assemble teachers from the most important scientific areas of each course and representatives of its students. Their task is to manage all administrative and pedagogic matters concerning each course. The services for the community projects are the responsibility of the Institute for Continuing Professional Training, which is in its initial stage of development.

The academic Departments or Autonomous Divisions are responsible for the teaching of subjects, not necessarily of a whole course. The main difference between a Department and an Autonomous Division is that the former has at least three teachers holding a PhD. Departments / divisions share the responsibility for different courses, exchanging amongst themselves teaching and other services. For instance, the Biology department is responsible for the teaching of subjects pertaining to the Chemistry course and vice-versa. Within the university, although having to comply with the statutes, the various departments / divisions are granted scientific and pedagogic autonomy and are responsible for the planning of their own strategy for teaching, research and community services, as well as allocation of their own budget, the effectiveness of which may prove decisive to their future. Their organisational structure includes an Assembly of Representatives, a Board of Directors and a Scientific Board. A summary of the present organisational structure of the university is presented in Figure 6:

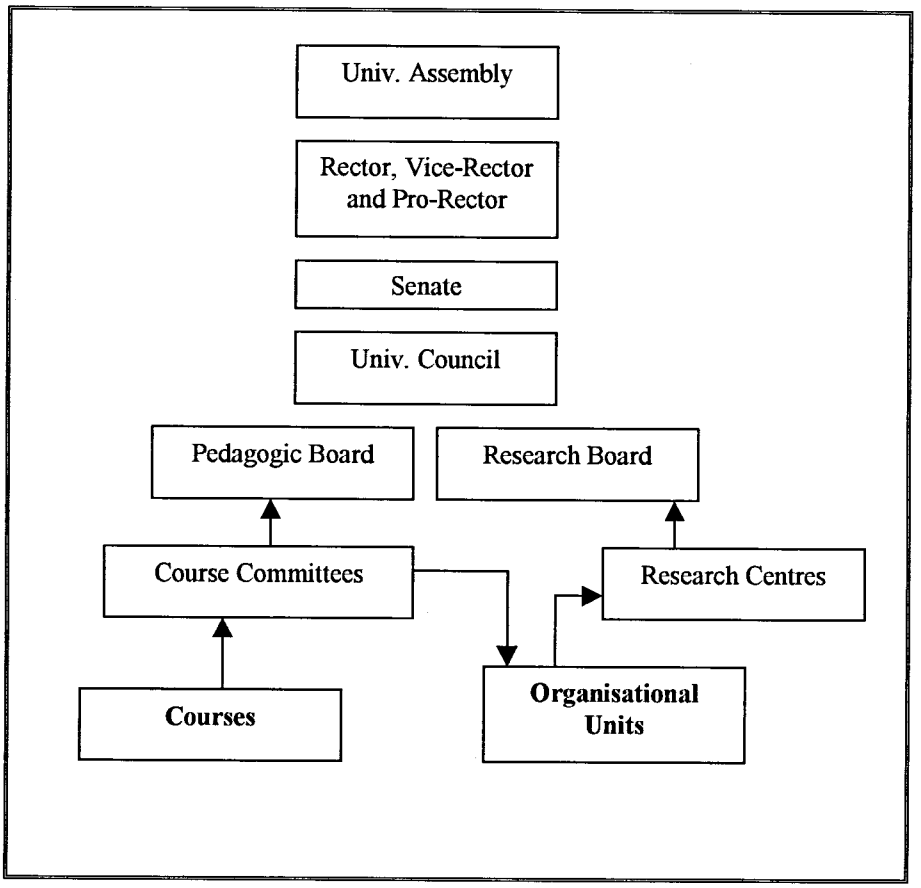

Figure 6 - Organisational structure of UMa
Adapted from Costa and Branco (2000, p.81)

The other organisational units of the university, the sectors, comprise two different areas: Resources Area (Human Resources, Budget, Purchasing, and Physical Resources Sectors) and Missions Area (Planning and Public Relations, Students Registrar, Communications and Computer, and Documentation and Archive Sectors).

The University of Madeira grants the regular undergraduate degrees and offers Master degrees in several fields. Appendix A-2 presents the list of courses run by the University of Madeira. The main scientific fields of its activities of research and teaching are as follows:

- Art and Design
- Biology
- Sciences of Education
- Sports and Physical Education
- Computing Systems
- Physics
- Chemistry
- Mathematics
- Management
- Humanities (Portuguese, French, English, German and Classical Languages).

According to the University statutes, the policy followed for teaching and research must take into consideration "as especificidades da Região Autónoma em que se insere, colaborando na formulação das políticas nacional e regional de educação, ciência e cultura"(UMa, 1998, 2°-3)[11]. Thus, since the first courses were initiated at the University of Madeira, many alterations have been introduced in their structure so as to ensure that its graduates fulfil the needs of the labour market in Madeira. As an instance of this, the majority of courses during the first years were teacher training courses, which were closed once teacher shortage had been stemmed.

On the other hand, and as also established in its statutes, the University of Madeira is a "centro de criação, transmissão, crítica e difusão da cultura, da ciência e da tecnologia ao serviço do homem" (UMa, 1998, 2°-1)[12], having developed projects in recent years which go towards achieving this aim. For instance, the Biology Department has been responsible in recent years for a project of research and protection of endangered species, namely the sea turtle.

[11] "[...] the specific characteristics of the Autonomous Region of Madeira and will concur in the definition of national and regional educational policies for education, science and culture" (Our translation).
[12] "[...] centre for the creation, transmission, review and diffusion of culture, science and technology in the service of humankind" (Our translation).

4.2.2 Academic staff

Since its creation, a most troublesome issue faced by the University of Madeira has been the quantity and quality of its teaching staff. No training scheme or other professional development plan was devised for teachers when the first courses were initiated. In view of the manifest shortage of qualified teaching staff at all levels of education in Madeira, allied to the natural circumstance of the island's physical isolation, special attention should have been given to this matter at the time, in order to guarantee adequate appointments for the teaching posts.

In what regards the main hierarchy ranks in Portuguese university teaching, a Lecturer on Probation has to complete a Master degree or similar study within the first three years of service and a Lecturer has to complete a course at PhD level. During its initial years, only a small percentage of the teaching staff at the University of Madeira held higher level qualifications (PhDs or above). More recently this percentage has increased and is nearer to the national average. The majority of teachers are graduates or hold Master degrees. The former are either young teachers from the mainland, who will remain on the island only if motivated by the possibility of developing their professional career, or Madeirean secondary school teachers who work at the university on a part-time basis.

In recent years, particularly after the 1998 revision of the university statutes, efforts have been made in order to tackle this issue: teacher development has been promoted by means of study leave and financial support and permanent teaching appointments have been encouraged and supported. The creation of the Research Centres and the granting of research subsidies are instances of these strategies. Within the same strategy framework, during this transition period which had begun in 1996, the ratio teacher / student suffered imperative changes, by means of a reduction in the number of visiting professors and part-time lecturers, in favour of the promotion of the professional development of the full-time teachers. At the time of our study, there were 150 teachers working at the University of Madeira.

The following table shows data from the Development Plan for UMa, which points to a more balanced and adequate picture of its teaching staff in the near future. It indicates the increase of the total number of teachers, according to their level of qualification:

Table 2 - Proposed increase of the total number of teachers (2001-2005)

	2001	2002	2003	2004	2005	%Final
Full Professor	14	16	22	28	31	11.5
Reader	29	34	36	47	52	19.4
Senior Lecturer	57	71	79	87	90	33.6
Lecturer	109	109	107	89	91	33.8
Lecturer on Probation	11	6	5	5	4	1.4
Total	220	236	249	256	268	100.0

Adapted from UMa (1999, p.25)

The professional advancement of university teachers is directly related to their research output. Scientific research and publications are given significant importance in the development of higher education teaching staff, as regulated by the legal statutes (ME, 1979). Both teaching and administrative or management tasks, although crucial and central to the routine duties of teachers, are of little or no consequence with regard to their career advancement. Therefore, it is only natural that research should hold a privileged place in teachers' professional priorities. As long as teaching did not involve any particular problem and there were few administrative matters to be dealt with, it was possible for teachers to dedicate great part of their time to research activities. However, with the recent social, economic and technological changes undergone by society as a whole, the context of work at universities has undergone drastic change. Besides teaching activities and research, teaching staff has had to become increasingly more involved in many tasks relating to management and administration. Having not received any specific training for them, these tasks have also little significance with regard to career advancement.

In this new context of higher education, teachers have lost part of their traditional authority in major decisions concerning the running of universities. Professors are obliged, according to the *Lei da Autonomia* (ME, 1988), to share management duties with lecturers, students and administrative staff (COSTA and BRANCO, 2000, p.38). Although teaching is a fundamental mission of the university, pedagogical matters, such as assessment and curricula structure, are not the sole responsibility of teachers, who have to submit their proposals for approval by several management boards, namely the Pedagogic Board, where students are represented and the Senate, where all the university community is represented.

Teachers are represented in the main management boards described above: the University Assembly, the Senate, the University Council, the Research Board, the Pedagogic Board and in the Course Committees. The Courses Committees which were created after the 1998 revised version of the statutes play a very important role in the management of each course, particularly as potential change inducers. Each Course Committee assembles an equal number of teachers and students of the course and may influence major strategic decisions concerning the running of the course.

Teaching staff report directly to the managing boards of their departments or divisions. Their career and professional choices are directly dependent on the agreement and understanding of their superiors, particularly the Board of Directors and the Scientific Board. However, the important issue of 'how to teach' is usually the teacher's responsibility, except in the case of a Lecturer, who may have to follow instructions concerning the contents to be taught. Thus, teachers are usually granted autonomy in choosing the techniques employed for their lessons.

According to the *Estatuto da Carreira Docente Universitária* (ME, 1979)[13], the three main activities of teaching, research and administrative tasks are listed as the roles of higher education teachers, who according to the same document are expected to work the same number of hours established for Civil Servants (thirty five hours a week). In the case of academics, this number includes home-based work, either lesson preparation, marking or other professional activity. The following distribution of working hours is fixed:

[13] Decree-Law nº 448/79 of 13th November (with some later changes).

- between 6 and 9 hours per week of teaching, according to the decision of the Scientific Board and based on academic qualifications or other considerations (in exceptional circumstances, teachers might be requested to teach more than 9 hours a week);
- between 3 and 5 hours per week (half the number of teaching hours) of assistance to students;
- the remainder of time to be dedicated to lesson preparation, research and administrative tasks (although there is no indication as to proportions, the total number of hours varies between 21 and 26 hours per week, after subtracting the teaching and student tutoring hours from the total of 35).

According to that established by the Portuguese Ministry of Education[14], university courses follow a system of credits, that is, students have to accumulate a certain amount of credits in order to graduate. In this credit system, each discipline is assigned a certain number of credits, which correspond to a certain number of teaching hours. Although the system of credits attempts to measure the amount of work necessary to the preparation of the disciplines (ME, 1980), the number of hours needed for lesson preparation is extremely difficult to estimate in general terms, for it is dependent on so many different variables, such as work experience, type of subject, number of students, etc. A distinction is made between 'theoretical', 'theoretical-practical' and 'practical' hours of teaching and one credit is thus equivalent to different numbers of hours, depending on the 'type of hour', according to the following table:

Table 3 - Number of teaching hours to 1 credit

ONE CREDIT =	a) Fifteen theoretical hours; or
	b) Forty practical hours; or
	c) Twenty two theoretical-practical hours; or
	d) Thirty hours of training modules or seminars.

Adapted from Decree-Law nº 173/80 of 29th May

Thus, from a legal (administrative) point of view, there is a clear distinction between these different types of classes, based on the interposition of theory versus practice. The teaching techniques of each type of class are expected to be quite distinct and the time

[14] Decree-Law nº 173/80 of 29th May

allowed for preparation is also different. A 'theoretical' class is typically taught through oral presentation and a 'practical' class is taught through group or individual practical activities performed by students, with the assistance of teachers. According to the *Estatuto da Carreira Docente Universitária*, 'theoretical' classes should be taught by staff holding a PhD and, for this reason, a discipline might be taught by two different teachers: the 'theoretical' hours by a Professor, Reader or Senior Lecturer, and the 'practical' hours by a Lecturer or Lecturer on Probation.

Notwithstanding the recent context of change and investments in technology and training, the integration of technology in everyday academic life, particularly in activities related to teaching, has been extremely slow. Since the installation of the first computers, training courses were offered to teachers only once at the very beginning, on a voluntary and individual basis, but had very little impact as they were not continued. Under the present organisational structure of the university, the professional development of teachers, although promoted and supported by the university, is the responsibility of the departments and is dependent on their decisions and strategic plans.

4.2.3 Technological infrastructure

The process of integration of technology at the University of Madeira has been slow but consistent. By means of FCCN and the *Programa Ciência*, in October 91, the first computing materials arrived at UMa. The list included the following items:

- 3 central computers (Servers) working on UNIX;
- 18 personal computers (2 Mb RAM, 40Mb hard disk, VGA monitor);
- 2 workstations;
- 2 matrix printers (400 cps) and 1 laser printer (6 ppm)

Source: University internal newsletter, 1991.

In June 1992, the first ETHERNET network was installed in the rapidly deteriorating environment of the old Jesuit College of Funchal, with the three UNIX servers and the personal computers distributed among the few existing departments and the original Library Room. Connection to the Internet was also effected but the integration of technology in all academic activities was discontinued due to the inadequate and temporary physical conditions under which the University functioned, to be resumed only after its definite installation in the new campus at Penteada in February 1998.

The physical networking at the campus of Penteada is adapted to the characteristics of the building. The network topology is organised in two levels: a horizontal and a vertical one. The horizontal level extends over each floor of the building and is made up of cables UTP cat.5, besides all other equipment needed for its management (hubs, switches, servers, etc.) The vertical level comprises fiber-optic cables, which establish the connections between each floor and the central node located on the ground floor (Floor 0). From this node, connections are established to the building of the Jesuit College and to the exterior (Internet).

Since 1998, the University of Madeira has made considerable investments in technology, in order to develop the required communication and computer resources. At present, some of them, particularly its servers, are already in need of updating. The computing services are provided to all teachers, administrative staff and students, and include Internet access, sharing facilities and e-mail accounts (these are not yet available to students). However, teachers' access to computing and other resources is not exclusively dependent on the CCS, but also on the strategic and budgetary decisions of the departments or divisions for which teachers work.

In this chapter, a picture of the University of Madeira was drawn. The following chapter will present the results of the study.

5. RESULTS OF THE STUDY

5.1 Teaching at the University of Madeira: the academic staff

5.1.1 Teachers and teaching

The first section of our questionnaire, entitled "Professional Situation", consisted of two close-ended questions, the aim of which was to learn about teachers work experience and scientific area of expertise. With regard to their work experience (Question 1), the teaching staff at UMa are evenly distributed: 32% of respondents have worked between 1 and 5 years as teachers; 34% for more than twelve years and the same percentage has worked for a number of years in between the first two groups, as shown in Figure 7.

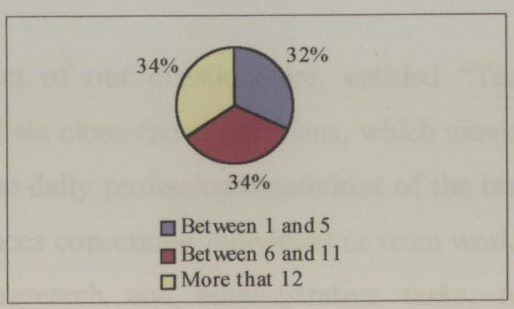

Figure 7 - Number of working years as a teacher

Such a balanced distribution was not found between the number of teachers working for each of the three groups of Departments or Divisions (Question 2). For methodological reasons the thirteen Departments or Divisions were grouped according to their scientific similarities. The reason for this grouping was to guarantee anonymity, as some of the

Departments or Divisions have as little as four or six teachers[15]. Group C includes all the Sciences departments (Biology, Mathematics, Chemistry and Physics), whilst group B includes the Humanities Departments (Classical and Modern Languages and Literatures) and group A aggregates the more specific departments, such as Physical Education, Sciences of Education, Art and Design, Systems Engineering and Management. The number of teachers in group C is considerably high, representing 44% of the total number of teaching staff at UMa, whilst group A represents 35% and group B represents only 21%. Figure 8 presents these figures:

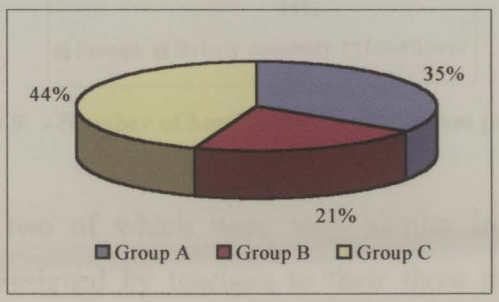

Figure 8 - Distribution by Department or Autonomous Section

The second section of our questionnaire, entitled "Teaching at present at the University", consisted of six close-ended questions, which aimed at obtaining information on the organisation of the daily professional activities of the teaching staff at UMa: their work load, their preferences concerning individual or team work, time assigned for lesson preparation, teaching, research and administrative tasks, teaching techniques, etc. According to EVANS (1998), although there are many studies on higher education and academics' work, "there are few which provide comprehensive accounts of the nature of academics' working lives and of their work-related attitudes" (p.81). It was this kind of more detailed information that was needed for our study.

The most relevant data obtained in this part of the questionnaire regards teachers' opinion on the time usually available for lesson preparation. Respondents were asked to

[15] For this same reason, respondents were not asked to identify their degree (PhD, Masters, etc.).

distinguish between 'enough', 'strictly necessary' or 'insufficient' time available for lesson preparation (Question 4). The time available for lesson preparation is considered 'insufficient' by 34 per cent of teachers, whilst 44 per cent declare having the 'strictly necessary' time and only 22 per cent say that the time they have for preparing lessons is 'enough'. Figure 9 presents this data:

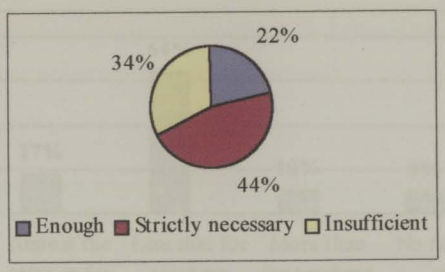

Figure 9 - Number of hours available for lesson preparation

Three questions, two of which were very similar in structure, were aimed at investigating the time assigned by teachers to their three main professional activities: teaching (Question 3), research (Question 5) and administrative tasks (Question 6). With reference to lesson preparation and teaching, our data reveals that 35% of teachers at UMa dedicate between 21 and 29 hours a week; 29% between 11 and 20; 22% between 30 and 35; 11% over 35 hours and only 3% between 1 and 10. Figure 3 presents this data. The calculated average is of 28.2 hours per week, which is equivalent to four fifths of the total number of expected working hours. The following figure shows this data:

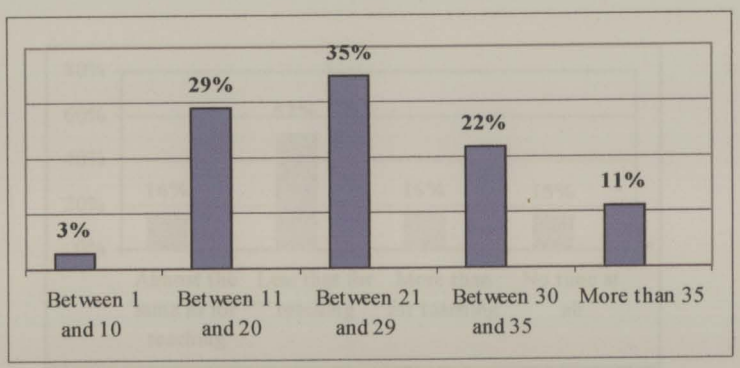

Figure 10 - Number of hours assigned to lesson preparation and teaching activities

In what regards research, and although teaching is not taken into account for career development, 64% of teachers spend less time with research than with teaching and lesson preparation, and 9% do not develop research activities at all (Question 5), as Figure 11 reveals:

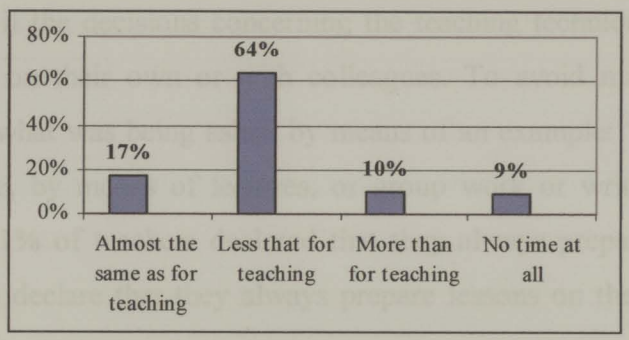

Figure 11 - Time assigned to research activities

16% of respondents admit spending more time with administrative and/or university management activities than with teaching and lesson preparation and 16% spend roughly the same amount of time with both type of activities (Question 6). Only 15% of teachers do not perform this type of activities, whilst 52% of teachers do so, although dedicating less time to them than to teaching. Figure 12 shows this data:

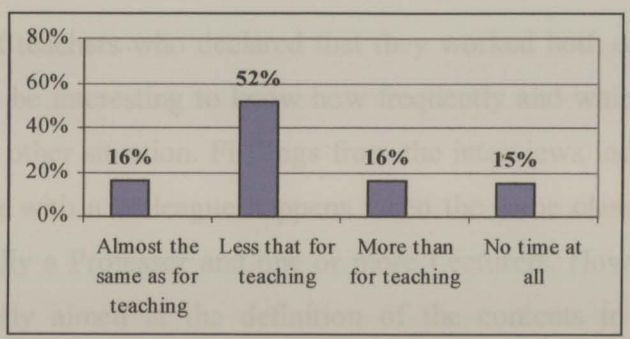

Figure 12 - Time assigned to administrative and/or university management activities

Our interviews to the sample of teachers, which took place at a later date, confirm this data. Interviewees were invited to describe a "normal" week at work: the percentage of work related to teaching and lesson preparation was, in general, significantly higher that the one related to the other professional activities of research and administration.

Question 7 inquired about the conditions surrounding decision making concerning lesson preparation: the issue of "how to teach", not the "what to teach" issue. Respondents were asked to state if the decisions concerning the teaching techniques adopted for their courses were taken on their own or with colleagues. To avoid misunderstandings, the question illustrated what was being asked by means of an example: "how you teach your lessons (for instance, by means of lectures, or group work or writing activities on the board, etc."). Only 1% of teachers declared that they always prepare lessons with their colleagues and 45% declare that they always prepare lessons on their own, as shown in Figure 13:

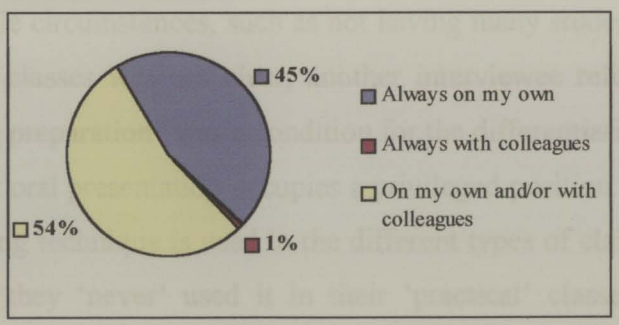

Figure 13 - Teachers decision making on "how to teach"

Of the 54% of teachers who declared that they worked both on their own and with colleagues, it would be interesting to know how frequently and which criteria determined choosing one or the other situation. Findings from the interviews indicate that usually the situation of working with a colleague happens when the same class is taught by two or more teachers, usually a Professor and one or more Lecturers. However, this instance of teamwork is basically aimed at the definition of the contents to be taught and only occasionally does include discussion of teaching techniques.

Our study sought to study the kind of teaching techniques used and if the legal difference between 'theoretical', 'theoretical-practical' and 'practical' classes had implications in the way classes are taught. Questions 8 aimed at answering these issues. Teachers were asked to select one of five hypotheses ('always', 'often', 'sometimes', 'never', 'I do not teach this type of class') in order to classify the frequency with which they used those techniques. 17,3% of teachers declared that they did not teach 'theoretical' classes, 24,5% that they did not teach 'practical' classes and 15,5% that they did not teach 'theoretical-practical' classes. The remainder teach at least two of the three types. Although not presented in Figures 14 and 15, these percentages are included in that data.

Findings from the interviews revealed that the circumstances which determine a clear difference between theoretical, practical and theoretical-practical classes are the following: when a class is taught by more than one teacher, usually a Professor and Lecturer, or when classes are scheduled according to that criteria, i.e., a theoretical class with all students and several practical classes with a small group of students in each. Although one interviewee said that under favourable circumstances, such as not having many students, the distinction between these types of classes was not clear, another interviewee referred that "having plenty of time for lesson preparation" was a condition for the differentiation.

Results reveal that oral presentation occupies a privileged position. When questioned on how often this teaching technique is used in the different types of classes, only 4,5% of teachers answered that they 'never' used it in their 'practical' classes and no teacher declared 'never' using it in 'theoretical' or 'theoretical-practical' classes. Although 39,1% of teachers 'always' employ oral presentation in their 'theoretical' classes and 36,4% do so 'often', the use of this technique in 'practical' classes is also relevant: 16,4% of teachers use it 'always' and 23,6% use it 'often' (Figure 14).

With regard to group and individual work, 22,7% of teachers declared 'never' employing these techniques in their 'theoretical' classes, while 33,6% declared that 'sometimes' they do, 11,8 did so 'often' and 4,5% 'always'. Although this distribution is more in accordance with the legal distinction between 'theoretical' and 'practical' classes, it still reveals that a small percentage 'never' use these techniques in 'practical' classes (2,7%) and 12,7% do so only 'sometimes'. Figure 15 shows this data.

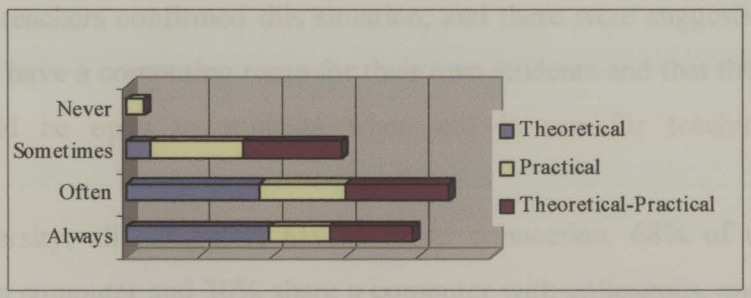

Figure 14 - Employment of "oral presentation" in classes

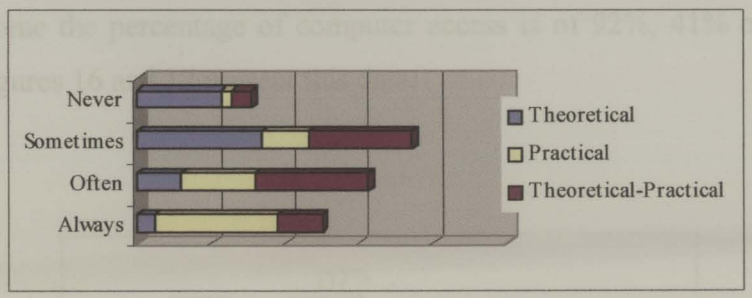

Figure 15 - Employment of "individual or group work" in classes

5.1.2 Teachers and ICT

The third section of our questionnaire, entitled "The new information and communication technologies", consisted of six close-ended questions, the aim of which was to gather information on teachers' computing skills, access and rate of use of ICT, what kind of teaching materials teachers use more frequently and how inclined are they to undergo technological training.

Questions 9 and 10 investigated the ratio of computer access. In what concerns students, although our study did not include any particular research of their rate of access to computing facilities, direct observation and interviews revealed that still more

investments are needed in order to increase this rate of access to a more acceptable one. Our interviews to teachers confirmed this situation, and there were suggestions that each department should have a computing room for their own students and that the "multimedia laboratories should be open to students when not in use for teaching purposes" (Interviewee 4).

At the university, all computers have Internet connection. 68% of teachers have access to their own computer and 30% share a computer with colleagues, and only 2% do not have access to a computer at the university. However, this last figure is certainly lower at present and is tending towards 0%, according to data from the interview to the Director of the CCS. At home the percentage of computer access is of 92%, 41% of which with Internet access. Figures 16 and 17 present this data:

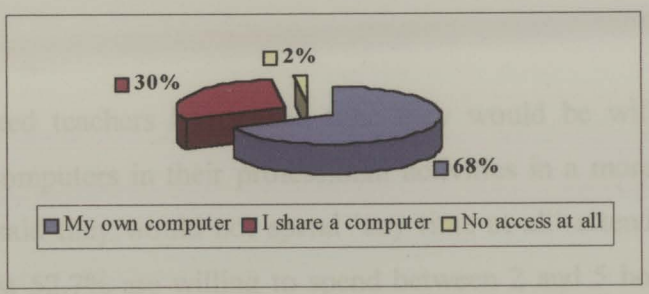

Figure 16 - Acess to a computer at the University

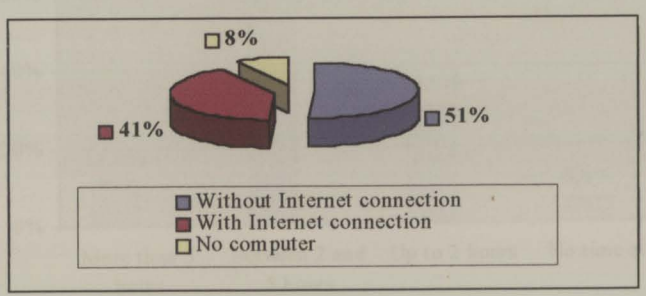

Figure 17 - Computer at home

When questioned on computing skills (Question 11), no teacher admitted knowing 'nothing at all' and only 15% said they knew 'very little'. This data was confirmed by later interviews. This same percentage of teachers rated their level of computer use as 'experienced user' and 70% declared knowing 'enough for their needs'. This data is presented in Figure 18:

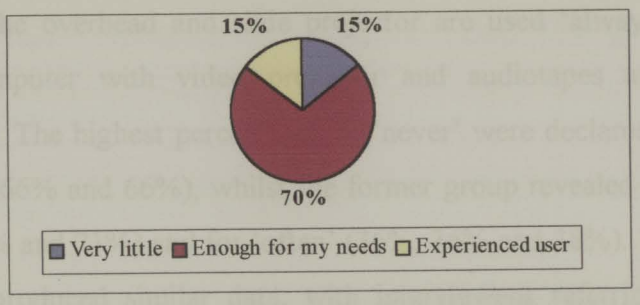

Figure 18 - Computing skills

Question 12 asked teachers how much time they would be willing to spend on learning how to use computers in their professional activities in a more productive way. 5,5% of respondents said they would not spend 'any time at all' attending technological training courses, whilst 52,7% are willing to spend between 2 and 5 hours, 30% up to 2 hours and 11,8% more than 5 five hours:

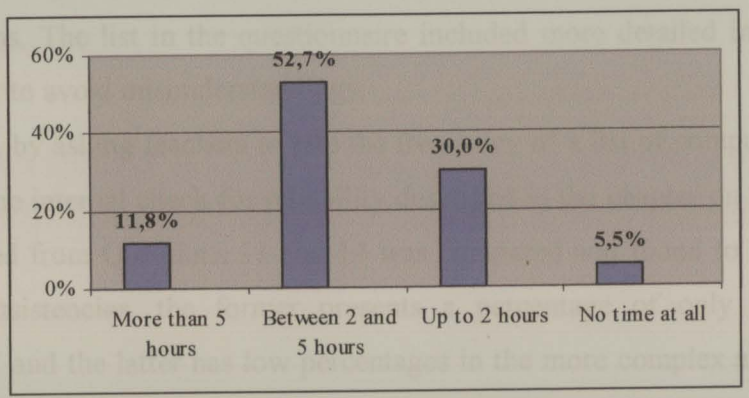

Figure 19 - Willingness to undergo technological training

It was important for our study to investigate which materials teachers made use of in their lessons and how often. In particular, we wished to compare the rate of use of the more traditional ones, such as the chalk / white board or handouts, against the more recent technological materials, as is the case of the computer with video projector.

Question 13 presented a list of six different lesson materials and requested teachers to rate their use of each item. The analysis of the data reveals that the chalk or white board, the handouts and the overhead and slide projector are used 'always' or 'often', whilst videocassettes, computer with video projector and audiotapes are 'never' or 'only occasionally' used. The highest percentages of 'never' were declared for the latter group of materials (52%, 66% and 66%), whilst the former group revealed high percentages for 'always' (36%, 16% and 21%) and for 'often' (36%, 36% and 38%). The interviews to the group of teaches produced similar data, with interviewees referring the handouts, the blackboard and the overhead projector as their main teaching materials. Only in one case was there a reference to the computer with video projector.

Besides learning about teachers' computing skills, by means of Question 11, it was important for our study to investigate what activities teachers develop on the computer and also the frequency of their development. Question 14 listed eight different computer activities and requested teachers to rate them according to the frequency with which they developed them. The activities were word processing, research on the Internet for professional reasons, spreadsheets, multimedia slides, electronic mail, mailing lists or electronic conferencing, use of educational CD-ROMs, and research on the Internet for recreational reasons. The list in the questionnaire included more detailed information on each item, in order to avoid misunderstandings.

Question 14, by asking teachers to rate the frequency of a list of computer activities, was used also as the internal check for reliability described in the chapter on methodology. Thus, data obtained from Questions 11 and 14 was compared and found to be consistent. Among other consistencies, the former presents a percentage of only 15% for the 'experienced user' and the latter has low percentages in the more complex activities, such as creating multimedia slides or participating in mailing lists or electronic conferencing. Table 4 presents the information on the frequency of development of computer activities:

Table 4 - Rate of utilisation and activities developed with the computer

	Always	Often	Sometimes	Never	No answer
a) written documents (i.e. Word document)	68,2%	23,6%	6,4%	0,9%	0,9%
b) connect to the Internet (for professional reasons)	15,5%	40,9%	31,8%	9,1%	2,7%
c) create or work on spreadsheets	22,7%	24,5%	32,7%	13,6%	6,4%
d) develop multimedia slides (i.e with PowerPoint)	10,9%	11,8%	28,2%	42,7%	6,4%
e) receive and/or send electronic mail	42,7%	27,3%	20,0%	5,5%	4,5%
f) receive and/or participate in discussion groups	3,6%	9,1%	23,6%	59,1%	4,5%
g) use educational CD-ROMs	0,9%	17,3%	40,0%	34,5%	7,3%
h) connect to the Internet (recreative motives)	0,9%	16,4%	48,2%	30,0%	4,5%

The most frequent activities developed on the computer by teachers are word-processing and electronic mail: when working on the computer, 68,2% of respondents 'always' use the word-processor and 42,7% 'always' use electronic mail. When using the computer, only 16,4% 'often' connect to the Internet for recreational reasons, whilst 40,9% do so 'often' for professional research reasons.

The highest percentages for 'never' developing an activity when working on the computer related to the production of multimedia slides (42,7%), to the participation in mailing lists or electronic conferencing (59,1%) and to the use of CD-ROMs (34,5%). However, respondents also declared percentages of 10,9% ('always') and 11,8% ('often') for the production of multimedia slides.

The interviews to the group of teachers, which took place at a later date, reveal a clear increase in the rate of production of multimedia slides, although in class these are usually presented with an overhead projector or by means of handouts. According to some interviewees, the rate of use in the classroom could be increased if classrooms were "equipped with the necessary technology or if special classrooms were set up for the effect" (Interviewee 2). These interviews also probed into how far ICT had influenced the professional activities of teachers. Lesson preparation and research were the activities referred as the ones that had undergone major change. Examples given were word

processing of learning resources, production of multimedia slides and research on the Internet. These interviews also revealed that certain graphic, simulation, statistical or mathematical programs are being learnt and used by teachers working in the scientific areas for which those programs were created. Data revealed that evaluation of students had been affected only in its administrative features (i.e., using spreadsheets for organising lists and grades of students). The contacts and tutoring of students has not been affected at all, according to the interviewees, whilst administrative activities had been so, although some teachers suggested that if there were an institutional strategy to the effect the changes would have been greater (Interviewee 5). Important innovations pointed out by teachers during these interviews were communication with peers and development of projects through collaboration and sharing of documents by means of electronic mail (Interviewee 4), and preparation of papers for conferences and interviews by mail for an electronic journal (Interviewee 2).

5.1.3 Teachers and professional change

The fourth section of our questionnaire, entitled "The future of teaching at the University of Madeira", included three close-ended questions, the aim of which was to gather information on teachers' attitude to change in their professional career: do they think it is necessary, what type of compensation do they consider important to adapt to these changes and what type of new teaching techniques would they prefer to develop. Question 15 consisted of three different statements of possible reactions by teachers to the changing of teaching methods, following the integration of ICT in teaching. Teachers were requested to indicate which of these statements was nearer to their probable reaction in a similar situation.

93% of respondents indicated that their probable reaction would be to say: "I like the idea and I think that changes to teaching should be introduced". Out of 110, only 2 teachers do not think it necessary to introduce changes in teaching methods and 5 teachers declare

that they do not worry about change and do not mind one way or another. The interviews to the group of teachers confirmed that there is a general acknowledgement that teaching has to change, towards a «stronger focus on the understanding of contents» (Interviewee 1) and a «decrease in the importance of mere memorisation» (Interviewee 2). Figure 21 presents the data from the questionnaire:

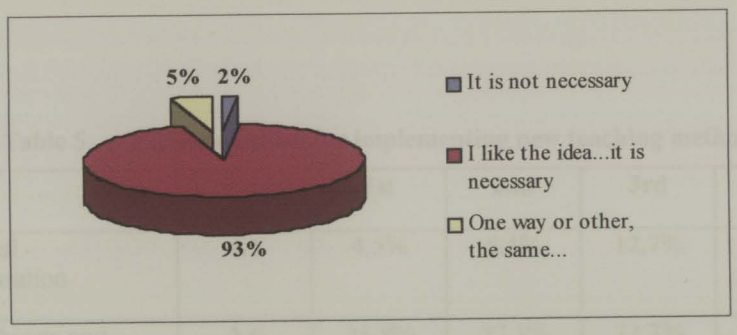

Figure 20 - Attitudes towards changing teaching methods

Although the majority of teachers consider that it is important to change teaching methods and integrate ICT, the process is not dependent solely on good will. Our next question in the study, by investigating what compensation teachers considered they should receive for the effort of adapting to those changes, was also aimed at discovering what obstacles might be raised to the introduction of the same changes. Question 16 concerned these issues and presented a list of five possible conditions that teachers might require as compensation for the implementation of new models of teaching: a financial compensation, less subjects and teaching hours, more decision-making by teachers in the change process, more computing facilities and training courses, and a lower number of students. Respondents were asked to categorise the five conditions, on a 1 to 5 scale, according to how important they considered them (1=most important).

The condition which, without a doubt, is considered of minor importance, when compared to the others, appears to be the one demanding 'financial compensation': 53,6% of respondents assigned it to the last place in the list. This information is all the more remarkable if we recall the fact that teachers do not earn high wages. The differences

amongst the other four conditions were small. Those, which were considered the most important as regards compensation for such requirements, as would derive from the change process, were 'more computing facilities and training courses', followed closely by 'more decision-making by teachers in the change process'. The interviews confirmed this data, with teachers repeatedly referring that "I will only change my teaching if training is available" (Interviewees 1, 2, 4 and 6). Table 5 shows the data from the questionnaire:

Table 5 - Compensations for implementing new teaching methods

	Average*	1st	2nd	3rd	4th	5th
Financial compensation	**4.1**	4,5%	6,4%	12,7%	21,8%	53,6%
Less subjects and teaching hours	**2.6**	21,8%	27,3%	22,7%	19,1%	8,2%
More decision-making by teachers in the change process	**2.4**	11,8%	23,6%	26,4%	28,2%	9,1%
More computing facilities and training courses	**2.3**	37,3%	22,7%	17,3%	12,7%	9,1%
Less students	**2.9**	22,7%	18,2%	20,0%	20,0%	18,2%

*** 1=More important; 5=Less important**

Question 17 concerned possible directions of change in teaching methods. It presented a list of five possibilities for new teaching roles and techniques: 'Production of multimedia teaching materials', 'Tutor students with the aid of CD-ROMs, videos, etc.', 'Assist students by means of electronic mail', 'Build and maintain a web page for your teaching' and 'Moderate electronic conferencing'. Teachers were requested to indicate their degree of interest, on a 1 (=not interested at all) to 4 (=very much interested) scale.

Although the results are not the same for all the five items of the list, the difference between them is not substantial. 'Production of multimedia teaching materials' is the

preferred teaching activity (3.3), whilst 'Moderate electronic conferencing' is the less preferred (2.6). The data is presented in the Table 6:

Table 6 - Interest in developing innovative pedagogical activities

	Average*	Not interested at all	Not much interested	Interested	Very much interested
Production of multimedia teaching materials	**3.3**	0,9%	11,8%	40,0%	46,4%
Tutor students with the aid of CD-ROMs, videos, etc.	**3.0**	2,7%	19,1%	45,5%	31,8%
Assist students by means of electronic mail	**2.9**	3,6%	25,5%	40,9%	27,3%
Build and maintain a web page for your teaching within UMa	**3.0**	7,3%	13,6%	46,4%	30,0%
Moderate electronic conferencing	**2.6**	5,5%	33,6%	43,6%	14,5%

*** 1=Not interested at all; 4=Very much interested**

There was considerable consensus among the teachers we interviewed regarding the factors which had led to using ICT. All of them cited the facilitating factor: "it makes things easier and quicker". The motivational factor was also pointed out as important: "classes are more interesting and motivating with a power point presentation" (Interviewees 1 and 2), although according to Interviewee 4 technology will not alter significantly students' motivation to learn. The same group of teachers referred to excess of information, scarcity of resources, time and training, and limited student access to computing facilities, as the main barriers to their using of ICT in their teaching. One teacher pointed out that an important barrier was that "almost all software is in English". Many teachers emphasised the fact that successful integration of ICT in teaching depends above all on how it is used: "one has to be sure it is leading to effective learning" (Interviewee 2) and "when used systematically, power point presentations may loose much of their advantages" (Interviewee 1). The importance of face-to-face contact, human relationship and psychological support to students were also emphasised by some teachers. Teachers who referred to these factors were those who were of opinion that each

department, and not the university, should play the major role in ICT integration. Thus, instead on large common institutional computer facilities, investments should be made on departmental computing rooms accessible only to their own students. The arguments were that it was better for students to work with colleagues from the same course, for it allowed for support and collaboration, than to "confront colleagues from other courses, in the common computer rooms, where the atmosphere is often very dissuading of learning, because other users frequently have good computer skills and want to use the computer for recreational reasons" (Interviewee 4).

A topic very much discussed during the interviews to the group of teachers was "what measures could be taken in order to increase the rate of integration of ICT at UMa." Technological training of teaching staff was repeatedly pointed out as the most important condition for any teacher to decide to use ICT in teaching activities, especially in the classroom: "if a teacher feels uneasy with a technology, he or she will never choose using it in front of students..." (Interviewee 1). Other suggestions were that "institutional support was very important" (Interviewee 2 and 5) and that "students should have easy access to computer facilities" (all Interviewees).

Our findings from the interviews to the group of teachers revealed that, although many teachers agree that their teaching methods are sure to change and their roles as transmitters will gradually give way to that of facilitators, there is great uncertainty on how this will actually take place. One teacher pointed out that "the facilitator role is much more demanding and many teachers are not prepared for that" (Interviewee 3). On supporting individual students, the same teacher commented "can teachers be forced to work extra hours answering all students' mail messages?"

Two different perspectives emerged throughout these interviews: either a firm belief that teaching will change in a radical way or the idea that the integration of ICT is only a supplement to the available educational resources. Those who held the latter view usually focused on the more particular aspects of technology, such as the need to learn how to create multimedia slides or use de computer with video projector in the classroom. Those who defended the former view focused on more global issues and posed questions such as

"if our role as transmitters is over and there is no longer a need to transmit certain contents, *what* are we going to teach them [the students] from now onwards?" (Interviewee 3).

One important finding of our study was that all departments within the university are at a similar stage in what regards the integration of ICT in teaching and learning, with the exception of Systems Engineering. A ratio of one computer for every three students, all teachers / disciplines with a Web page, mailing lists and e-mail for all teachers and students, were the indicators that this Systems Engineering is at a more advanced stage. By means of an informal interview to the teacher responsible for its computing facilities, we learnt that is has not been an easy task, but that strategies such as demonstrating the advantages of ICT to teachers and supporting their efforts to deal with technology, have been decisive in achieving success. Main obstacles have been the lack of institutional and technological support.

5.2 Teaching at the University of Madeira: services, resources and facilities

5.2.1 Communications, computer and documental services

Our research into the services offered by the Communications and Computer Sector (CCS) was developed by means of an interview with its Director, plus observation of the premises and consultation of various informative or institutional leaflets.

The Communications and Computer Sector is based on the ground floor of the university campus at Penteada, occupying five medium-sized rooms and five small ones. Many of the computer resources for which this Sector is responsible (personal computers, networks, etc.) are of course located in other areas, both in this building and in the central building of the Jesuit College.

The Director of the CCS pointed out that one of the responsibilities of the sector was to guarantee the maintenance and development of the university Web site and databases, namely those of the Students Registrar and of the Human Resources Sector, and all other tasks listed in the University statutes. According to these (UMa, 1998), the responsibilities of CCS are as follows:

- to guarantee the maintenance and operational excellence of the University's communications and computer resources;
- to give advice, enforceable as regards the sectors, non-enforceable as regards the departments or divisions, on the purchasing of computer resources;
- to guarantee technical support to the computer rooms available to students for academic or leisure pursuits;
- to give all the necessary technical support to the development of the overall information systems of the university, and guarantee its complete integration and integrity;
- to guarantee the sound management and operations of the communication networks of the university, and implement those measures determined by the qualified organisational boards.

As part of its daily tasks, the CCS establishes contact with the Board of Directors of the different academic departments or divisions and with the Directors of the different sectors within the university, in order to ensure the maintenance of the computer network, suggest or decide as to its best forms of development, and give the necessary technical support.

The number of people working for the CCS is still relatively small. According to the Director of CCS, the two main problems which affect this sector is the shortage of staff and the necessity of upgrading some of the network resources, namely the servers. The shortage of staff is especially felt in the areas of programming and databases, for which two more people are expected to work in the near future. At present, there are seven people in the sector, three of them holding a higher education degree.

Questioned on the contacts between the sector and the academic staff, the Director of CCS pointed out that the main reasons for teachers contacts with the sector were requests for very specific technical support, namely to help with problems concerning reading of e-mail, viruses in personal computers or other computer problems. Only very rarely do teachers suggest that CCS should organise training sessions. On the other hand, this type of

request is very frequent from the administrative sectors of the university, in particular from staff that has to work with the databases.

The professional links between CCS and the Documentation and Archive Sector (DAS) are exactly the same as those with all other sectors of the university, that is, the necessary contacts to guarantee the maintenance and technical support of the computer network and resources of DAS.

Our research into the services offered by DAS was developed by means of an informal interview with its Director, observation of the premises, consultation of various informative or institutional leaflets and semi-structured interviews to a group of teachers.

The DAS is located on the top floor of the university, occupying an approximate area of 1000 m^2. Its main room is the reading room, with one computer for searching the library database and a considerable number of tables and chairs. The majority of books are directly available from the shelves, where they can be freely consulted. The classification system used is UDC, developed by the Sector in collaboration with the Departments and Autonomous Sections, by means of its representatives to the library. The bibliographic stock has a total of about 70.500 references. Main users include academic staff and students, but the library is also open to external users. Apart from the main library materials, the following resources are available to all users in the reception room: a photocopying machine (flexicard service), two computers with CD-ROMs and network connection, and video equipment. Another ten computers will be available in the short term. For disabled users, a computer with a network connection and a phone line has been set up. All offices of staff working in the sector are equipped with computers, connected to the main network and to the Internet.

The most important mission of the DAS is to support all teaching and research activities of the university, as mentioned in its proposal of mission statement. This proposal also lists the main services offered by the sector, amongst others the assistance and referral services, local or inter-library loan services and acquisition of library materials. The Library is open daily between 9 am and 7 pm and Saturday morning.

According to the university statutes, the DAS is responsible for the following tasks:

- organisation, management and maintenance of the bibliographic and documental resources of the university (CDE - *(Current Archives)* Archives, Libraries *(Biblioteca Geral)* and European Documentation Centre *(CDE)*);
- establishing acquisition policies for the university libraries;
- to guarantee access to the bibliographic and documental resources of the university to all users;
- to ensure development of and access to the university catalogue.

The user's guide lists the DAS following collections: reference, monographs, periodicals, non-book materials, thesis, deposit materials, European Union collection and video and audio tapes. The main search and retrieval of information consists of free inspection of the library shelves and the library database. Since the creation of the University of Madeira, significant investments have been made in library materials and, more recently, in computing equipment. The library is part of the cooperative community PORBASE and a subscriber of the British Library services, through which photocopies of articles or part of books can be ordered. The library is also partner of IELA, BAD and RUBI. According to the Director of DAS, the main problems which affect this sector are shortage of staff and insufficient space to create specific areas within the library, such as individual reading rooms or a multimedia room.

In what regards contacts with academic staff, besides the group of teachers who represent the departments for library matters, a second group is expected to be created in the near future to deal with ICT matters concerning the library. Also planned for the near future, is the development of an integrated management software (Horizon or Aleph).

5.2.2 Teaching facilities and resources

Our investigation of the physical facilities and resources available for teaching activities at UMa was carried out by means of observation, informal interviews and consultation of various informative or institutional leaflets.

The campus of Penteada comprises a seven-storey building, which houses all the academic pursuits of the university (teaching, learning and research), the Documentation and Archive Sector, the Communications and Computer Sector, a few administrative services, the Students Union, the Photocopying Unit and the Cafeteria.

Its architectural design presents a very regular arrangement: each of its seven floors is divided lengthways, separating in three of them the area of classrooms from the teachers' offices, departments and other areas, as shown in Appendix A-3.

Teaching rooms and resources at UMa, depending on who acquired them or is responsible for them, may be available to the whole academic community or only to a specific department or division. As a rule, the normal classrooms, the lecture theatres, the computer rooms and the overhead projectors are shared by all, whilst each department or division has a few specific teaching rooms and resources for use by its teachers and students. Examples of these are physical education, drawing and science laboratories, laboratory materials and equipment, the multimedia laboratory, video and audio equipment, computer and associated video projectors and slide projectors. With regard to books, periodicals, CD-ROMs, video and audio tapes, although they are available to all library users, departments may borrow some of these resources on a designated "permanent" loan, where they will remain available to their own teachers and students during an extended period.

The majority of the teaching spaces at UMa consist of traditional classrooms and lecture theatres, equipped with chalk or whiteboards, overhead projectors and network connections. Although some teachers change the layout of the classrooms for their own lessons, in general classes are taught with all the students facing the teacher.

Apart from these traditional classrooms, teaching may also take place in designated 'computer classrooms' or in the 'multimedia laboratories'. These rooms are equipped with computers on all tables and the difference between them is that the latter allow for greater interaction between computers, in particular between the teacher's computer and those of the students. It also comprises a special interactive board. At present there is only one computer classroom and one multimedia laboratory, but four more of the latter are to be installed in the near future. Access to computers, for academic or leisure pursuits, is

available to students in the computer room, run by the Students Union. Apart from this possibility, some departments have recently made arrangements to allow students to work on computers within the departmental area.

As referred above, many departments or divisions have their own rooms and resources, as is the case of the Systems Engineering department which has four special computer laboratories for its classes and of many Science departments, which have their own teaching laboratories, for which they are accountable. Table 7 presents a description of the teaching rooms available to the whole of the university community.

Table 7 - Common teaching rooms at UMa

Number	Type	Number of students	Total
4	Large lecture theatre	120	480
6	Normal lecture theatre	56	336
32	Normal classroom	Between 20 and 76	1194
1	Computer classroom	20	20

Although the campus at Penteada has large common spaces, such as the corridors and patios, no space is assigned for students' individual study. As referred above, some departments have attempted to overcome this situation by admitting small groups of students for study in the departmental areas, which were initially restricted to teaching staff. Apart from these few spaces, students have to resort to the library or to the cafeteria if they wish to study individually or in groups. Although students are obliged to leave the classrooms at the end of lessons, many students go against the rules in order to find a place to study.

The departmental areas are equipped with photocopying machines, available free to all teaching staff. Also available to all teachers are the department's teaching resources referred to above. These have to be requested, usually in writing and with some days notice. The teachers' offices, small-sized rooms for 1 to 3 teachers, are located in the departmental areas and are usually equipped with computers, a printer and bookshelves.

In the following chapter, the results presented here will be discussed.

6. DISCUSSION OF RESULTS AND RECOMMENDATIONS

6.1 The working scenario of teachers at UMa

6.1.1 Managing the unfavourable circumstances

As expected, the structure and strategies of the University of Madeira, under pressure from external social, economic and technological development, have also been affected by the unprecedented changes underway in the majority of higher education institutions worldwide, namely the new funding systems, the shortage of teaching staff, the increased number of students, and others referred in Chapter Two (LAURILLARD, 1993; EVANS and ABBOTT, 1998; THOMPSON, 1997; BOWDEN and MARTON, 1998; DAVID, 1997). However, the fact that UMa is a young university, situated in a relatively poor insular region, and vulnerable to its political surroundings, allied to the rather turbulent period of its first years of existence (COSTA and BRANCO, 2000), has also contributed to this context of conflict and uncertainty. Our informal interviews revealed that in many sectors of the university there is awareness both of the changes in progress and that others are still required but that, in the words of one interviewee, "so many projects are made and so little happens... it is all words and projects and lots of paperwork and no action...". The data collected during our study, by means of the interviews, the questionnaire, the direct observation and the analysis of documentation, all concur in demonstrating that UMa is still at a stage of exploration whilst formulating its strategic policies. The title of one of the rare publications on the University of Madeira (COSTA and BRANCO, 2000) - *The Challenge of Deciding Its Own Future*- written by its previous rector and vice-rector, is a good illustration of this atmosphere of expectation and conjecture.

In discussing the results of our study we will endeavour to answer our research questions, which were listed in section 3.2.1. We shall use these questions as a frame to present our findings.

Our first research question had suggested the investigation of the main features that characterise the professional life of teachers and teaching at UMa. Data collection on these issues rendered the following information:

1. The teaching staff forms three **balanced groups in terms of work experience**: around one third of teachers with under five years experience; one third with more than twelve years of practice and one third with a number of years of teaching in between the first two groups;

2. The number of teachers in **the Sciences group is considerably higher**, representing 44% of the total number of teaching staff at UMa, whilst the group in the Humanities represent only 21%. The departments included in the remaining "miscellaneous" group (35%) are more akin to the Sciences than to the Arts;

3. The overload of teaching and lesson preparation is paramount: **teachers dedicate more time to teaching and lesson preparation than is expected** of them and only 22% of teachers declare having enough time for lesson preparation;

4. **Administrative tasks are also substantial** and a considerable percentage of **teachers have little time left for research activities**, although these are essential to their career advancement;

5. **Decision** making with regard to **lesson preparation** is usually undertaken **individually**; only one teacher declared to always working with colleagues;

6. Both oral presentation and group and individual work are used by teachers, in all the three types of classes established, and with **oral presentation occupying a privileged position**.

The fact that **teaching staff forms three balanced groups in terms of work experience** may represent an advantage for propitiating and favouring the integration of ICT in teaching and learning. As referred, teamwork is crucial in this process (LAURILLARD, 1993; HAMILTON, 1997). Furthermore, one trend in the adoption patterns of teaching staff is "that colleague supported training is a viable way to encourage diffusion of computer technologies" (JACOBSEN, 1998). Given that the decisions regarding the integration of ICT in teaching and learning should have as starting points pedagogical issues (GILLESPIE, 1998a; DONOVAN, 1999), which should then be discussed in the light of the available technologies, the different age groups which characterise teaching staff at UMa may contribute to the creation of successful collaborative teams. The fact that 'early adopters' of innovations are usually younger (ADAM and WILSON, 1996), the ideal team

would assemble the greater amount of pedagogical expertise accumulated by teachers in the 'older' group to the greater technological skills of the 'younger' group.

With regard to the relative importance of the different departments, **the Sciences group represents 44% of the total number of teaching staff at UMa**, thus placing it in a more privileged position of influence over the university's strategic decisions, as many of these are determined by the greater number of votes. For a successful integration of ICT, it is important that the choice of technology satisfies the needs of each scientific area, specially when considering the crucial concept of 'flexibility', as described by COLLIS (1998), as a means of matching up to the needs of the learner and the characteristics of the discipline. Identical technological solutions will not suit all groups. Different hardware and software solutions should be made possible, according to the requirements of very different disciplines, such as those pertaining to the Physical Education or Languages Department.

Our interviews revealed that this feeling is strong among teaching staff and that it would be important to ensure that each department is entitled to participate in the strategic decisions concerning the integration of technology at UMa. As an instance of this, one interviewee referred that the decision concerning the creation of a common computer laboratory for all students had not taken into account that "certain departments preferred to have their own computers for students in their quarters". Thus, when decisions are taken concerning the improvement of teaching and learning with technology, the different needs and preferences of the departments should be considered, as a means also of involving them in the integration of ICT in teaching. This attitude might also foster inter-departmental collaborative action, in order to reduce the competitive climate, which is inherent to the organisational and financial structuring of universities around its departments, and which was also referred to in our interviews as a barrier to the overall development of the university.

In terms of time available for teaching and lesson preparation, **teachers at UMa dedicate more time to teaching and lesson preparation than is expected of them and only 22% of teachers declare having enough time for lesson preparation**, thus confirming again that the changes taking place in higher education worldwide, in particular the shortage of staff and the increase in

the number of students, are a crucial issue at UMa. Our interviewees also confirmed that the most stressing aspect of any 'normal' week at work was that time was 'never enough'.

The fact that teachers at UMa work under the pressure of time and work overload should not be ignored or overlooked as being a normal feature of a teacher's professional life, indeed measures must be taken to tackle it, given that the 'time' factor is an important barrier to the integration of ICT by teachers (BALDWIN, 1998). Furthermore, although the requirements for teachers' career advancement in higher education are based on research development, **a considerable percentage of teachers have little time left for these activities, on account of the substantial load of administrative tasks, besides teaching and lesson preparation.** All interviewees referred to this most problematic issue. One of the dilemmas stated was that they had to choose between advancing in their career or working towards improving their teaching. In this context, it is clear that integration of ICT in teaching adds to the dilemma, making it more difficult to confront by imposing the further time-consuming activity of lesson preparation, with no consequences in career advancement for teachers.

Although teamwork is found to play a crucial role in the integration of ICT in teaching and one factor in the adoption of new technologies, as referred by BALDWIN (1998), is 'communication with other adopters', our study reveals that teachers at UMa do not usually discuss their teaching with colleagues and **decision making concerning lesson preparation is usually taken individually**[16]. Considering that many teachers teach the same or similar subjects within the same field of study, one can infer that a significant number of the 45% of teachers who answered that they worked 'always alone', develop very similar or exactly the same tasks, such as those which are part of lesson preparation (i.e., research and production of learning materials).

At a time of limited technological facilities and low number of students (which in the case of UMa was indeed a very short time), this did not represent a major problem: teaching ran smoothly with one teacher and a group of students, a few books and some class notes. With the rapid increase in the number of students, some of the teaching tasks and roles became more difficult to accomplish, namely tutoring and assessing large groups

[16] The only instance of teamwork found was the traditional teaching of the same class by a Professor and a Lecturer, but which usually comprises only decisions concerning the contents to be taught and not overall decisions as to how to teach or assess students.

of students. And with the rapid development of ICT, some of them became quite different, as ICT changes the way work is done (MORTON, 1996). Teachers not only have to learn how to use the new ICT, but are also confronted with a larger quantity of data or alternatives for their work. Although interviewees stated that the main reason for using technology was that "it made things easier and quicker", some of them referred that information and knowledge management required for lesson preparation became a completely different and more complex task following the availability of the Internet and digital database technology. One interviewee said sometimes "it is better to give up searching on the Internet and use what information you have", confirming the crucial importance of a greater individual awareness and analysis of information needs of professionals, pointed out by DRUCKER (1998).

Thus this data confirms that "new tools appear to both provide and require a new approach to teaching and learning" (JACOBSEN, 1998). More collaborative working habits might save a considerable amount of time, especially in lesson preparation, but also in the teaching of lessons, if teachers choose to extend collaboration to actual teaching. In a teamwork context, the different teaching roles and tasks referred in Chapter Two (GILLESPIE, 1998) could also be assigned to different teachers, according to their teaching preferences and to course aims. However, although many interviewees seemed to welcome the idea of teamwork, one of them was very sceptical as to the possibility of implementing such a radical change to the traditional organisation of teaching, due to factors such as power conflicts and rigid legislation. Administrative requirements, such as the criteria for assigning teaching duties, were also found as important barriers to implementing teamwork among teacher, according to some interviewees. As referred, the conservative nature of educational systems is often a barrier to change (FULLAN, 1993).

Legislation (ME, 1979) establishes different types of classes ('theoretical', 'practical' and theoretical-practical') as criteria for assigning teaching duties. At UMa, **both oral presentation and group and individual work are used in all the three types of classes, and oral presentation occupies a privileged position.** Teachers make use of group and individual work in their 'theoretical' classes and, although to a lesser degree, oral presentation is made use of in 'practical' classes. This situation of apparent disagreement with regulations may be

attributed in part to the educational reforms introduced during recent decades, namely to a trend towards learner centred approaches to teaching and learning (BOWDEN and MARTON (1998). Characteristics of what might constitute good teaching as referred in Chapter Two (CENTRA, 1993; COLLIS, 1998; RAMSDEN, 1996; LAURILLARD, 1993; BOWDEN and MARTON, 1998), namely that class interaction should be based on an intensive and targeted communication, and that students should be involved in a reflective, active and responsible manner, have also played a part in this tendency towards an unclear distinction between the different types of classes.

Teachers revealed throughout our interviews an awareness of these growing ambiguities as to what a 'theoretical' or a 'practical' class may consist of, and some of them referred that the circumstances, such as number of students and technological innovations, have forced them to rethink their teaching techniques, confirming that ICT increases the awareness of teaching staff concerning pedagogical issues (ELLIS, 1997). Bearing in mind that one of the implications of the growing use of technology is a greater diversity of teaching roles and activities (GILLESPIE, 1998; BALDWIN, 1998), we may naturally expect an increase in the blurring of the legal distinction between 'theoretical' and 'practical' classes and an increase in the frequency of individual and group work. Although the distinction between 'theory' and 'practice' might be preserved, a 'theoretical' class taught with ICT may resemble a traditional 'practical' class (i.e., if Internet search is develop in class, supervised by the teacher), while a 'practical' class may include significant parts of oral presentation (i.e., if a teacher is commenting on a computer simulation in a multimedia laboratory)[17], thus confirming that ICT alters the way work in done (MORTON, 1996). Although oral presentation is still the most frequent teaching technique at UMa, our study revealed that teachers there adjust their teaching techniques as a means of coping with the changing working context. Some of these adjustments are not in line with current regulations, evidencing the need to reformulate the rigid organisational structure of teaching activities.

[17] However, certain contexts of market-driven courses may prove an exception to this. when their main feature is the theoretical and orally presented lecture delivered via videoconference or Internet by well-known experts in the field.

6.1.2 Complementing classroom-based teaching with technology

Our first research question had further suggested investigation into the extent to which teachers at UMa are familiar with ICT and to what extent they integrate ICT in their teaching. Data collection for these issues rendered the following information:

1. In terms of computer access, **68% of teachers have access to their own computer at the university** and 30% share one with colleagues. **At home the percentage of computer access rises to 92%**, 41% of which with Internet access. At the university, all computers have Internet connection;

2. Although only 15% of teachers rated their computing skills as at "experienced user" level, **no teacher admitted knowing "nothing at all"** and only 15% said they knew "very little". **70% declared knowing "enough for their needs"**;

3. Our data revealed that teachers' interest in assigning time for learning how to use computers in their professional activities in a more productive way is considerable. **To attend technological training courses, 52,7% of teachers are willing to spend between 2 and 5 hours**, whilst 30% up to 2 hours and 11,8% more than 5 five hours;

4. Concerning teaching materials, data collection revealed **that the chalk or white board, the handouts and the overhead and slide projector** are used **"always" or "often"**, whilst **videocassettes, computer with video projector and audiotapes** are **"never" or "only occasionally"** used;

5. The **most frequent** activities developed on the computer by teachers are word processing and electronic mail: when working on the computer, **68,2% of respondents "always" use the word processor and 42,7% "always" use electronic mail**. The highest percentages for "never" developing an activity when working on the computer related to the production of multimedia slides (42,7%), to the participation in listserves or electronic conferencing (59,1%) and to the use of CD-ROMs (34,5%).

Teachers' access to computers and to the Internet at UMa was already considerably high at the time our questionnaire was developed, and is tending towards 100% at present, according to more recent data from the interview with the Director of the Computer Centre. Figures concerning access to computers at home were, at the time, already as high as 92%, although only 41% had Internet connection. These figures reveal that the ratio of computer access by teachers at UMa is satisfactory and that the 'available resources' factor in the integration of ICT in teaching and learning, as referred by BALDWIN (1998), is partially fulfilled at UMa.

With regard to computing skills, although **only 15% of teachers rated their computing skills as at "experienced user" level, no teacher admitted knowing "nothing at all" and only 15% said they knew "very little".** Considering that no significant training programmes for teachers have taken place, these figures are higher than would be expected and reveal the a considerable interest in technology displayed by the teachers at UMa. These percentages correspond roughly to the categories of the rate of adoption referred by ROGERS (1995), cited in JACOBSEN (1998): the 'early adopters', the 'laggards' and the 70% of teachers who declared knowing "enough for their needs" as including both the 'early' and 'late majority'. Under the circumstances of time pressure and work overload that our study has revealed, it is surprising to learn that a considerable percentage of teachers are ready to dedicate time to learning how to use computers in their teaching: **52,7% willing to spend between 2 and 5 hours, whilst 30% up to 2 hours and 11,8% more than 5 five hours.** This is a good indicator for the successful integration of ICT at UMa.

However, despite the high rate of access to computers, the considerable level of computing skills and the great interest and motivation to learn more revealed by teachers at UMa, their actual use of teaching materials in class seemingly contradicts these findings, suggesting a very low rate of integration of ICT in teaching: **the chalk or white board, the handouts and the overhead and slide projector are used "always" or "often", whilst videocassettes, computer with video projector and audiotapes are "never" or "only occasionally" used.** As HODAS (1996) refers, new technologies may be seen as threats to the competence and power in the professional routine of teachers, whilst traditional educational resources, such as the blackboard and the handouts, act as assistants to teachers' activities. Examples of this situation were revealed throughout the interviews: for instance, teachers who preferred to use downloaded material from the Internet in class by means of handouts than to have students look up the information themselves at the sites concerned; others openly admitted that they felt safer using traditional resources.

Following the classification of computers as tools, communication devices or learning resources (MAIER and WARREN, 2000), our study revealed that teachers at UMa make use of the computer mainly as a tool and only more rarely as a learning resource or communication device. Although our interviews revealed that at present more teachers produce multimedia slides, these are usually adapted to classroom by means of

handouts or traditional overhead projection. Connection to the Internet mostly affects the preparation of classes and does not directly involve students' learning. According to BALDWIN (1998), many teachers use technology as a mere 'supplement' to their classes, which does not affect significantly the core of teaching and learning activities.

The formal and informal interviews, the questionnaire and our direct observation confirmed that this is the situation at UMa. The questionnaire revealed that the **most frequent activities developed on the computer by teachers are word processing and electronic mail, whilst the highest percentages for "never" developing an activity when working on the computer related to the production of multimedia slides, to the participation in listserves or electronic conferencing and to the use of CD-ROMs.** The majority of the interviewees stated that ICT had affected many of their professional activities, including lesson preparation, but had not affected their teaching in the classroom or had so very slightly. For instance, electronic mail is also extensively used by teachers, but again without affecting their teaching. The interviewees referred that this means of communication is important for their professional activities but that, with the exception of one teacher, they never used it to contact students, because "students did not have regular access to computers".

A second important reason found for the low rate of integration of technology in teaching concerns the physical context at UMa, namely the bureaucracy involved when requesting these technological devices. Our interviewees acknowledged this situation, referring that "often it is easier and safer to take the necessary handouts to class than to request the video projector" or that "a teacher who wishes to use the computer with video projector or teach a class using the Internet has to spend too much time on bureaucracy..." One solution suggested by an interviewee was that all classrooms should be equipped with the necessary technology or that certain classrooms should be so. This same reason also explains why the less recent technology, such as video, television or audio equipment, is also rarely used in classes.

Since our questionnaire was distributed (July 1999), awareness of the importance of the Internet as a plentiful resource for information research has grown, as revealed in our formal and informal interviews. As a consequence of this awareness, teachers are increasingly using the Internet as part of lesson preparation and do so with little or no technical assistance or specific training. This situation confirms the second factor in the

adoption of new technologies pointed out by BALDWIN (1998): the 'perceived value the individual places on the innovation'. However, one teacher recognised the importance of the Internet but stated that 'it is a great problem that great part of it is in English...' and referred that the same happened with almost all software. Thus, in a Portuguese university, this issue has also to be taken into account notwithstanding the international status of the English language.

Besides the Internet for lesson preparation, the main technological innovations that have affected teaching at UMa are the word processing of documents and the creation of multimedia slides as learning materials. The following statements from interviewees are the reasons given for using these technologies: 'it makes things easier and quicker', 'it is more motivating to students', 'it helps a lot in the preparation of lessons', 'I use power point presentations because once at a conference I saw how effective it could be'. This data confirms the determinant factors in the diffusion of innovations as referred by ROGERS (1995), cited in DONOVAN (1999): 'advantage', 'compatibility', 'simplification', 'trialability' and 'observability', and which should be taken into account in ICT implementation plans.

GILLESPIE (1998a) and DONOVAN (1999) referred that pedagogical issues should be the starting points in the integration of ICT in teaching and learning. Interviewees revealed great awareness of this issue, repeatedly stating that technology should only be used if it improved learning. They also considered very important the interaction between teachers and students, as referred by LAURILLARD (1993) and RAMSDEN (1992). Some teachers stated that face-to-face contact must remain a fundamental part of teaching and learning. All these issues should be taken into consideration when demanding that teachers at UMa increase their level of use of technology in teaching. On the one hand, demanding extensive and immediate changes may drive teachers away from technology, for fear of failure of loss of control, as would be the case if they were required to transform their courses at once into digital ones. On the other hand, great attention must be paid to very specific and apparently unimportant situations, such as bureaucratic requirements or individual preferences, since disregard for these, as our study also shows, may drive teachers away from technological innovation.

6.1.3 Teacher's motivation at risk

Our first research question had further suggested the investigation into how teachers at UMa react to changes in their professional activities. Data collection on these issues rendered the following information:

1. **93%** of respondents indicated that their probable reaction would be to say: **"I like the idea and I think it is necessary to start changing teaching".** Out of 110, only 2 respondents do not think it necessary to introduce changes in teaching;

2. The condition which demanded **"financial compensation"** is unquestionably **of minor importance**, when compared to others: 53,6% of respondents assigned it to the last place in the list. Those considered **the most important** as compensation for the demands made upon them by the change process were **"more computing facilities and training courses",** followed closely by **"more decisional power in the change process"**, although the difference between the four alternatives was slight;

3. With regard to **teaching tasks**, only a **slight variation** was perceived between the proposed alternatives: "Production of multimedia teaching materials" had **the highest rating**, whilst "Moderate electronic conferencing" **the lowest**. In between were "Tutor students with the aid of CD-ROMs, videos, etc.", "Assist students by means of electronic mail" and "Build and maintain a web page for your teaching".

Data revealed that teachers at UMa are extremely motivated and enthusiastic towards the changes in teaching methodologies and organisation associated with ICT: **93% of respondents indicated that their probable reaction would be to say: "I like the idea and I think it is necessary to start changing teaching".** Such a high percentage is certainly a facilitator factor in the integration of ICT. Two reasons may explain this enthusiasm.

On one hand, it might be a consequence of the difficult working conditions of teachers, which have already been discussed in this study. Their interest and enthusiasm may be a sign of their expectations with regard to their career and of their awareness that only significant changes may better their professional circumstances. On the other hand, the high percentage may be explained by the fact that UMa is a very young university with a teaching staff that is also young. In this aspect, the situation is considerably different to many other universities, where an older and more graduated group of teachers governs university affairs and younger teachers know that they will have to wait some time before

ascending in their career. With UMa still in a stage of development, as referred in Chapter Four, the majority of teachers holding a PhD degree, and even some of those in the process of completing it, still have a chance to become more influential in the academic hierarchy.

Financial compensation for the effort which professional change demands is not considered very important: **53% of respondents assigned to it the last place.** Especially during the interviews, teachers pointed to 'training' as the important condition that had to be fulfilled before they dedicated efforts to changing their teaching. 'Computing facilities', 'power to decide', followed by 'less students, subjects and teaching hours', were also considered important compensations by respondents to the questionnaire. This data confirms the findings from the literature referred in Chapter Two (BALDWIN, 1998; GRANDGENETT et al., 1997; ELLIS, 1997), namely the importance of encouraging and training teaching staff and valuing teaching. This is the one important point to have in mind when devising a plan for ICT integration in teaching at UMa.

The interviews with the teachers were most elucidating on this issue. Apart from one rare case, teachers do not intend to invest their time and effort in learning to use ICT if there is no departmental or institutional support and training. On the other hand, teachers also considered 'decisional power' as an important compensation. Although this topic was not directly discussed during the interviews, the conversations revealed that teachers are used to making decisions on their own and that certain technological solutions may not appeal to all teachers. Thus, we inferred that the training teachers expect is not of the didactic type (how to teach with technology), but more of a 'useful' type (what can technology 'do' and how is it done), as DONOVAN and MACKLIN (1998) referred regarding the planning of a project for supporting teaching staff: "they wanted to know how to accomplish specific tasks using technologies and wanted to be able to easily repeat these tasks in subsequent academic quarters".

Although a high percentage of teachers seem to be interested in changing their teaching methods, neither the interviews nor the questionnaire nor the many informal conversations with teachers have revealed any clear direction of that change. The suggested tasks listed in the questionnaire received a very similar rating: **"Production of multimedia teaching materials" had the highest rating (3.3), whilst "Moderate electronic conferencing" the lowest (2.6). In between were "Tutor students with the aid of CD-ROMs, videos, etc.", "Assist**

students by means of electronic mail" and "Build and maintain a web page for your teaching". When the topic of the future of teaching was discussed at the interviews, the majority of teachers focused on partial and specific aspects of change, such as how certain activities could be improved by technology. Only a minority held a broader perspective of the issue, believing that radical changes would have to take place. Notwithstanding these diverse opinions, the general attitude of teachers at UMa towards the future of teaching and learning, as with the findings of the literature referred in Chapter Two, is that of expectation and uncertainty.

The literature has shown that teaching has to be valued and acknowledged at institutional level and that overall strategies have to be developed in order to sustain teacher's initial interest in technology (ELLIS, 1997). Furthermore, GREEN (2000) suggested the possibility of a temporary slowing down of the rate of technology integration in teaching, due to lack of institutional support. These issues will have to be born in mind if the University of Madeira really is committed to sustaining the willingness of teachers towards introducing changes in their teaching, as revealed by them during this study.

As referred in Chapter Two, the two crucial factors for a successful integration of ICT in teaching found in the literature were an unwavering support to teaching staff and an overall institutional strategy. The referred exceptional stage of ICT integration at which the Autonomous Sector of Systems Engineering at UMa was found to be, confirms the importance of these two factors. The reasons given for its more advanced stage of technological integration were, apart from its specific field of study, the support given to teaching staff and the department's overall strategy. As our study shows, both these factors are lacking at the remaining departments of UMa and may account for the low rate of integration of technology there.

In this section we have discussed the results of our study concerning the main features that characterise the professional life of teachers at UMa, the extent to which teachers at UMa are familiar with ICT, how they react to changes in their professional activities. In Section 6.2, we shall discuss the results of our study concerning the teaching services, resources and facilities available at the University, and how has the integration of ICT been promoted and developed at UMa.

6.2 The institutional environment

6.2.1 The network of services, resources and facilities

Our second research question enquired about the teaching services, resources and facilities available at the University and to what extent they contribute to the integration of ICT in teaching. Data collection for these issues rendered the following information:

1. **The Communications and Computer Sector (CCS)** is responsible for the technological infrastructure of UMa. Its functions include the development and maintenance of UMa's databases, web site, communication networks and computer equipment, as well as affording advice and technical support to all academic departments, Sectors and Computer Rooms. Teachers and students have access to all facilities, but e-mail accounts have not yet been assigned to students. Teachers' main requests involve help in solving common computer problems. Staff shortage and equipment upgrading are the main problems affecting CCS.

2. **The Documentation and Archive Sector (DAS)** supports the teaching and research activities of the university, and its functions include the organisation, management and maintenance of the bibliographic and documental resources of the university, and ensuring access to all users. Information retrieval is by free inspection of the library shelves and database. Library materials include a considerable bibliographic stock, a photocopying machine, two computers with CD-ROMs and network connection, and video equipment. Staff shortage and lack of adequate working areas are the main problems affecting DAS.

3. **The campus of Penteada** houses all the academic pursuits of the university. It is a seven-storey building in which the area of classrooms is separated from the teachers' offices, departments and other areas. Teachers and students share the common classrooms: 10 lecture theatres, 32 normal classrooms and 1 computer room, all equipped with chalk or whiteboards, overhead projectors and network connections. The laboratories, laboratory materials and equipment, video and audio equipment, computer and associated video projectors, slide projectors and the one existent multimedia laboratory are available on request exclusively to the teaching staff and students of the department to which they pertain. Teachers' offices are usually equipped with computers and a printer. No specific space has been assigned for students' individual study.

Analysis of the results of our study revealed that (1) professional communication between the Computer Centre (CCS) and the Library (DAS) is limited, as well as between these sectors and academic staff, (2) a shortage of staff affects CCS and DAS, (3) students have access to a limited number of computers, and there are no study areas or e-mail accounts available to them, and (4) the design of the Penteada campus is not adapted to the present teaching and learning requirements.

Support and adjustment, in collaborative scenarios, of the organisational structure of higher education institutions in relation to the new context of integration of ICT in teaching and learning is stated as being a critical factor for the success of this process (LAURILLARD, 1993). Libraries and Computing Centres are also said to play a fundamental role (HAMILTON, 1997). It would be expected that two fundamental sectors at UMa, the Computer Centre and the Library, would share their efforts and projects of development, working together towards the achievement of common goals. Our interviews confirmed that this is not the case. Both the Director of CCS and the Director of DAS acknowledged that, apart from the technical support the former gives to the latter, no other common projects have been developed and that both sectors work separately. In a later interview, the Director of DAS referred that, although very recently talks had taken place with a view to discussing strategies for improving the services of both sectors and facilitating the integration of ICT at UMa through the development of common projects, no effective action had as yet taken place.

Lack of time and money is indicated as a barrier to the integration of ICT (BALDWIN, 1998). According to both Directors, the most difficult problem encountered by the sectors on a daily basis and the one that is mainly responsible for the sectors having to limit their tasks to what is strictly required and expected of them is the shortage of staff. Our research found that two other reasons appear to be responsible for the situation referred above: firstly, the changes in the leadership of these sectors, which have taken place throughout the turbulent stages in the development of UMa, as referred in Chapter Four, and which have periodically led to reformulation of strategies; secondly, as stated in the university statutes, these sectors are not expected to develop any tasks other than the very specific and technically oriented ones relating to their field of action.

The work of these sectors will never be effectively fulfilled, according to one of the Directors, beyond merely offering technical support and advice, unless joint efforts are made towards discussion of their common mission of supporting teaching and learning. For instance, the sectors should hold regular meetings to exchange information on their endeavours and difficulties: CCS would gain a better understanding of the purposes of its technical support to the library and DAS would assess the information requirements of

CCS. With regard to communication between CCS and DAS and academic staff, the interviews with the teachers revealed that it should be increased, suggesting that teachers expect these sectors to develop other different tasks and to play a crucial role in the integration of ICT at UMa. Regarding DAS, one interviewee stated that the Library should undergo significant changes in order to improve its services, particularly by taking advantage of technology namely through subscription to online databases and by improving its own database. According to the Director of DAS, in the near future a team consisting of teachers and library staff will be assembled to deal with technological innovations to the library services.

In the case of CCS, whilst some teachers recognise that training is not the role of the Computing Centre, others complained that it was the most natural place to approach for help. The Director of CCS pointed out that the technical services alone, supplied to all computing equipment at UMa including support to teaching staff, took up almost all the time available and there was very little opportunity for other important services. According to its Director, CCS technicians spend a considerable time in solving very common and specific technical problems on teachers' computers. Some of our interviewees confirmed this, saying that they turned to CCS for help, often when something important for them was at risk, be it a professional e-mail or a handout for the next class. In an informal interview, a technician complained that some years ago, when teachers received their first personal computers, some would actually simply press the "power" button when wishing to shut down the computer.

This data reveals that the rate of communication and particularly the quality of information transfer between the two sectors and academic staff must be improved. In an information-based organisation, as is the case of UMa, information responsibility of staff and sectors plays a crucial role (DRUCKER, 1998). Although both CCS and DAS are not responsible for training academic staff, and both of them have shortage of staff and time, periodical newsletters, e-mails or a web page offering very specific and detailed items of information, along the lines of FAQs, would certainly avoid teachers contacting CCS with time-consuming queries as often as they do. This simple measure would not take up much time and might even save time, lessening the number of teacher visits to CCS, generally

with often-repeated questions. In the case of DAS, regular information on library issues, also by means of e-mail, web site or newsletter, might improve the services of the sector.

Our field visits to the Penteada Campus and the interviews with teachers confirmed the third feature referred above: a lack of computers and study rooms for students. The literature refers the importance of adequate infrastructure and support to students for a successful integration of ICT in teaching and learning (BALDWIN, 1998; GRANDGENETT et al., 1997). One of the most important requirements at present for the integration of ICT at UMa is a more reasonable rate of student access to computers and e-mail accounts. This issue was pointed out in almost all formal and informal interviews. The more advanced stage reached in integration of ICT in the teaching of Systems Engineering is partly due to the fact that its laboratories allow access to one computer for every three students, as was stated by one of our interviewees.

Several visits to Penteada in the morning and afternoon confirmed that important measures have to be taken to improve the necessary adjustments: both the cafeteria and the library were often overcrowded because a high number of students were using these facilities as study areas. Our interviews confirmed that teachers are aware of this problem and the Director of DAS also referred that it affected the normal running of the library, but "there was no way out". One possible solution was dependent on a hypothetical building of a new library and the adaptation of the present one to a study room. One of the interviewees suggested that some of the regular classrooms should be allocated to students for individual or group study.

Greater flexibility in teaching methods and the trend towards learner centred approaches to teaching and learning in higher education (BALDWIN, 1998; BOWDEN and MARTIN, 1998) point to necessary changes in the time and space features of educational facilities. Although the campus at Penteada is a recent building with a modern architectural design, its premises follow a traditional pattern (Appendix A-3) of many large and regular classrooms and many small sized offices for teaching staff, consistent with the model of classroom and lecture based teaching. Besides the traditional classroom and lecture theatre, campuses have to make way for the specific requirements of new modes of learning and new technologies, namely computer rooms and multimedia laboratories, more

rooms equipped for tutorials and individual viewing or listening to audio visual materials, group work, individual study, etc. Up to date, UMa has undergone only slight adjustments: the transformation of two normal classrooms into a computer room and a multimedia laboratory, network distribution to classrooms and installation of computers in teaching staff offices.

Pedagogical issues should be the starting points in the integration of ICT in teaching and learning (GILLESPIE, 1998a; DONOVAN, 1999). However, as referred by JACOBSEN (1998), using new educational tools also requires new approaches to teaching. If we add to these arguments the fact that recent technologies are permanently being replaced by even more recent ones, it is easy to understand why the most critical ICT challenge facing higher education teachers is how to integrate ICT in their teaching (GREEN, 1999), and especially how the educational environment should be structured to support the type of learning expected in the future.

As referred in Chapter Two, a greater flexibility is required in the organisation and management of pedagogical activities, namely flexibility in location and in study materials (COLLIS, 1998). Although insufficient, some measures towards these types of flexibility have been taken at UMa. For instance, some departments referred that they have created study rooms, equipped with computers and other resources, within their departmental areas. Although this measure is contrary to the established separation of teachers' and students' areas within the campus, it is consistent with the recent pedagogical trends and with the 'University of Learning' referred by BOWDEN and MARTON (1998), and may foster a positive interaction between teachers and students in the same field of study. Other measures could include equipping some of the smaller classrooms with multimedia materials (CD-ROMs, video and audiocassettes, etc.), for borrowing or working there, to be made available to students and teachers, individually or in small groups. Other classrooms should be equipped with materials, such as a computer with videoprojector, so that these are easily available for teaching in class. Allowances should be made towards greater flexibility in teaching schedules in order to support teachers in their attempts to deal with ICT. Although no direction is yet clear regarding future learning environments, adjustments such as these are crucial to the improvement of teaching at UMa.

6.2.2 The integration of ICT in teaching at UMa

Our third research question enquired as to how the integration of ICT in teaching at UMa has been promoted and developed and how successful that process has been and what, if any, problems have arisen.

No standard successful pattern has been suggested for the strategic style of universities; it is the understanding of the *configuration* of the individual university which allows the pinpointing of the crucial and necessary features which must undergo change or, when this is impossible, ways of accommodating them (HARDY, 1990). As revealed by our informal interviews and analysis of documentation, the creation and development of UMa has been characterized, particularly up to 1998, by an atmosphere of conflicting interests and policies, with frequent changes in leadership. Although successive plans for its development have been devised, it has not been easy to implement them thoroughly within such a context of instability. Furthermore, notwithstanding the many consultancy studies suggesting UMa should follow an innovative university model, its development has actually followed very traditional paths (COSTA and BRANCO, 2000).

Changes take place at universities at different levels (political, cultural, financial, pedagogical and organisational), in accordance with the individual context of the institution, as referred by (GORDON, 1999). In the case of UMa, only slight or insufficient adjustments have been made at the pedagogical and organisational levels. As confirmed by our formal and informal interviews and documentation analysis, the structural rigidity of the department based organisation and the lack of training for teaching staff are instances of the type of adjustments needed for UMa. According to the university statutes, departments and sectors are expected to share the responsibility for the running of courses. This situation should foster a partnership atmosphere. However, it often leads to conflict over disciplines, students and, ultimately, funding for the departments, as some of our informal interviews and analysis of the Senate minutes confirmed.

Consensual strategies, and academic focus and ideology, manifested through a shared commitment to research and teaching, have been found to be associated to

successful universities (HARDY, 1990). Although changes at the referred levels are very much conditioned by external factors, measures should be devised so as to reduce the competitive and conflicting climate, increase communication and foster a common vision among sectors and departments throughout the university.

With regard to the integration of information and communication technologies at UMa, in particular within its teaching and learning activities, policies have focused on investments in the computer hardware and technological infrastructure, evidence of which is in the high rate of computer access for teaching staff and the creation and development of the Computer Centre, but hardly any measures have been taken concerning the training of teaching staff in these matters, as both the questionnaire and the interviews confirmed. Investment in technology is ineffective if not closely accompanied by investment in human resources (BECKER, 1996; MORTON, 1996; GREEN, 2000), as referred in Chapter Two.

The most frequent measure taken by universities to tackle this problem has been in-house solutions, by means of the creation of teams or central units, assembling both subject and technology experts, responsible for disseminating information and best practices, conducting research, organising workshops and offering support (BADLEY, 1999; HAMILTON, 1997). Lack of time, money and space are conditions characteristic of UMa, and the particular trait of teachers with regard to their individual work habits, as confirmed by our study, may not propitiate a solution of this type at this stage of the integration of technology at UMa. Furthermore, the temporary and uncertain features that characterise technological issues and require continuous updating, as well as the need to support a diversity of teachers in a lifelong learning context, also point to a different solution. Bearing in mind these specific features in the context of UMa, a more global and immediate solution is needed at this stage of its development.

DONOVAN and MACKLIN (1998) considered the creation of an online portal to support the integration of ICT in teaching and learning as more effective than the central unit model, as referred in Chapter Two. At present, this type of solution might prove to be more adequate for UMa. By means of an online portal, important information concerning the integration of ICT in teaching could be easily accessed by all teachers and sectors at UMa, and might contribute more effectively to the needed increase in communication at

the University and, in particular, to a widespread discussion of the critical issue of ICT. The development of this portal, which should be hosted at UMa's web site, would have to involve both teachers and staff all sectors and not be the sole responsibility of technicians at the Computer Centre.

As revealed by our study, ICT integration within the context of UMa calls for vital measures to be taken, if UMa wishes to achieve its aims as stated in its statutes. The solution of an online portal is but one possible first and immediate measure, which together with others, should be part of an overall strategy to confront the critical issue of ICT integration at UMa. In the following section a list of recommendations based on discussion of the results of our study, which are summarised in Fig. 21, will attempt to answer the last research question of our study namely, how can the process of integration of ICT at UMa be improved.

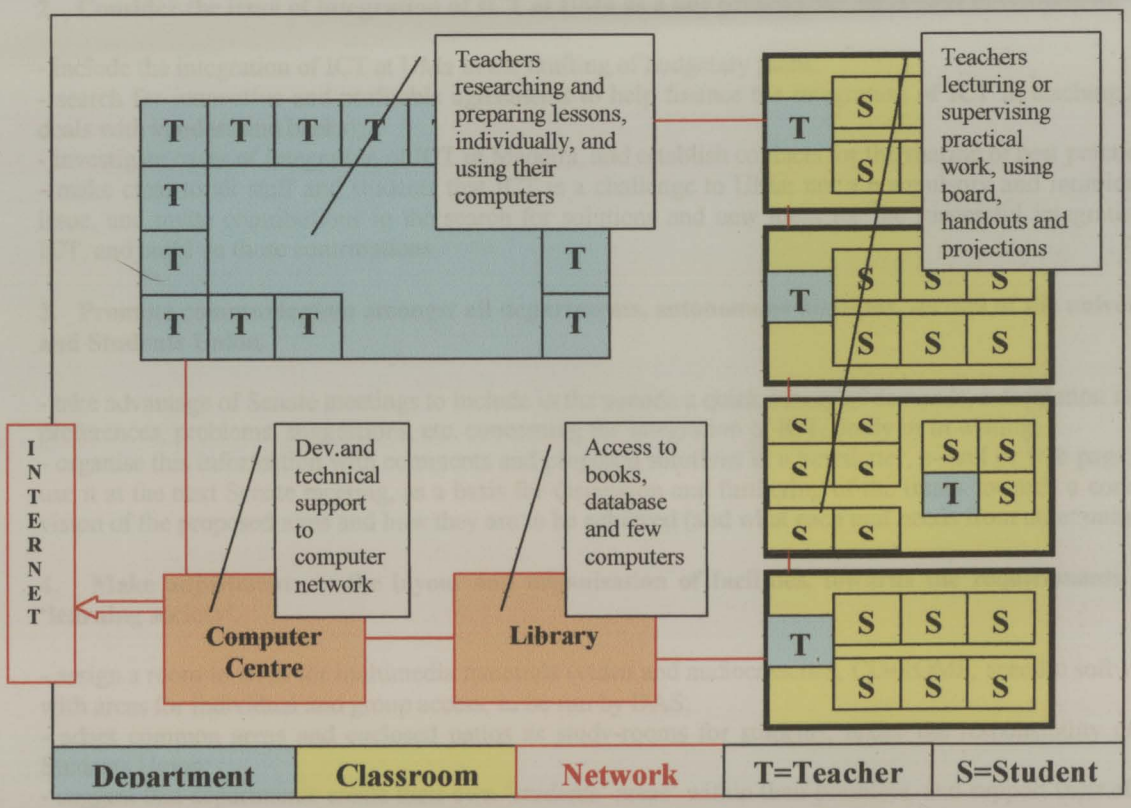

Figure 21 - The working scenario of teachers at UMa

6.3 List of recommendations

The following list of recommendations and suggestions of actions was compiled based on the background information to our study, presented in Chapter Two, and on the findings of our research into the context of teaching at the University of Madeira. Its overall aim is to assist UMa during the first stage of the essential adjustments required for integration of ICT in teaching, enabling it to fulfil its mission as defined by the statutes and develop into a "centre for the creation, transmission, review and diffusion of culture, science and technology in the service of humankind".

1. Make the issue of the integration of ICT at UMa visible to the whole academic community and a pervasive topic of its public and private discussions.

- communicate to all teachers, administrative staff and students the assumptions and progress of ICT policies, by means of regular newsletters and e-mail or web page;
- investigate best practices worldwide and divulge them by means of temporary exhibitions installed in common areas at UMa;
- acknowledge the importance of feedback on the issue of ICT, including it in the agenda of organisational meetings, in particular those held by the University Council, Senate, Pedagogic Board and Course Committees, and using instant surveys or other means to collect suggestions from all staff and students.

2. Consider the issue of integration of ICT at UMa as a key priority for successful development.

- include the integration of ICT at UMa in the drafting of budgetary plans;
- search for innovative and profitable agreements to help finance the integration of ICT in teaching (i.e., deals with vendors and banks);
- investigate cases of integration of ICT in Madeira, and establish contacts for the sharing of best practices;
- make clear to all staff and students that ICT is a challenge to UMa, not a compulsory and intimidating issue, and invite contributions in the search for solutions and new ideas for the successful integration of ICT, and build on these contributions.

3. Promote communication amongst all departments, autonomous divisions, sectors of the university and Students Union.

- take advantage of Senate meetings to include in the agenda a quick survey of demands, information needs, preferences, problems, suggestions, etc. concerning the integration of ICT, orally or in writing;
- organise this information with comments and proposed solutions in a newsletter, e-mail or web page, and use it at the next Senate meeting, as a basis for discussion and furthering of the issues towards a common vision of the proposed aims and how they are to be achieved (and what each unit needs from other units).

4. Make adjustments in the layout and organisation of facilities, towards the requirements of a 'learning society'.

- assign a room to DAS for multimedia materials (video and audiocassettes, CD-ROMS, specific software), with areas for individual and group access, to be run by DAS;
- adapt common areas and enclosed patios as study-rooms for students, under the responsibility of the Students Union;
- suggest that departments create their own 'students' areas' within their premises, and support their efforts by granting them resources (i.e., computers);
- assign a classroom to be equipped with special resources (computer and video projector, television and video equipment, radio and tape recorder).

5. Ensure the development of an adequate technological infrastructure.

- organise joint meetings with CCS and DAS to discuss their role in promoting learning, what is expected from them and support their needs (staff, training, resource upgrade);
- increase students' access to computers, either through acquisition or other means (helping students buy their own laptops, contracts with vendors, etc)
- furnish the library with more computers and designated areas for individual or group work, or for computer use.

6. Demonstrate commitment to academic research and teaching.

- form a team with representatives (preferably technology and pedagogy enthusiasts) of departments, library (DAS), computer centre (CCS) and students, to whom training and some form of compensation should be agreed, and charge it with the task of supporting teachers through an online portal, such as a presentation depicting the potential of technology in teaching, learning and research;
- value the emergence of initiatives towards the enhancement of learning with or without technology, by rewarding and publicising descriptions of best practices on the online portal, after selection of proposals by teachers or students;
- foster the creation of teams among teachers and students to share technological skills and support colleagues (i.e., creation of 'help-desk' teams, available online, by phone or in person);
- encourage teachers to lead the process of integration of ICT in their professional activities, by fostering teamwork and colleague supported training among teachers, and allowing different organisational forms of pedagogical activities: team teaching, flexibility in location and time, distribution of different roles, etc.

7. Gradually build a consensual vision for 'learning' at Uma (which involves teaching, learning and research by teachers and students).

The following figure summarises these recommendations:

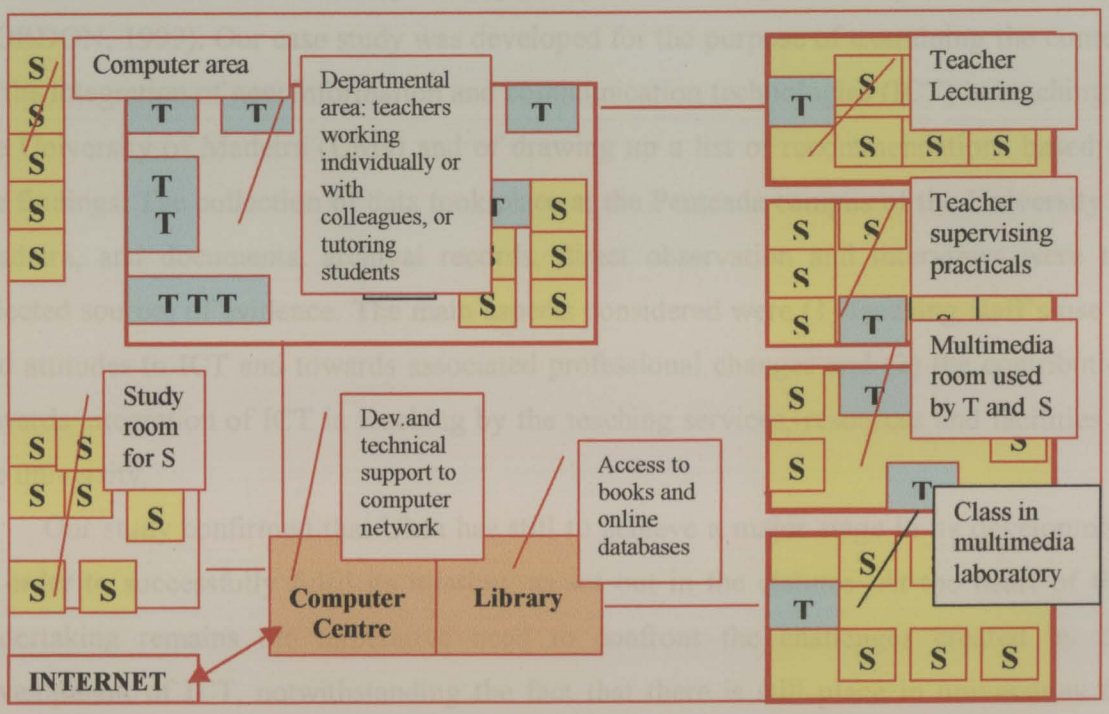

Figure 22 - Alternative learning scenarios at UMa

7. CONCLUSION

The working scenarios of teachers at UMa, characterised by an overload of teaching and administrative tasks, confirm that the unprecedented changes underway in the majority of higher education institutions throughout the world (DAVID, 1997; LAURILLARD, 1993) have also affected the University of Madeira, which is being required to play a major role in a very competitive market-driven social setting. Besides external pressures, the rather turbulent period of UMa's first years of existence and the conflicting interests and policies of each of the three institutions from which it emerged, have further contributed to this scenario of conflict and uncertainty (COSTA and BRANCO, 2000). Contrary to that suggested by previous consultative studies, UMa has followed a very traditional model for its development which allied to the context referred above, has not facilitated the integration of ICT in its teaching activities.

Findings from the literature reveal that the answer to the present challenges has not been nor needs to be necessarily a unique model for all higher education organisations GORDON, 1999). Our case study was developed for the purpose of examining the context of the integration of new information and communication technologies (ICT) in teaching at the University of Madeira (UMa) and of drawing up a list of recommendations based on the findings. The collection of data took place at the Penteada campus of the University of Madeira, and documents, archival records, direct observation and interviews were the selected sources of evidence. The main aspects considered were (1) teaching staff's use of and attitudes to ICT and towards associated professional changes and (2) the contribution towards integration of ICT in teaching by the teaching services, resources and facilities of the university.

Our study confirmed that UMa has still to achieve a major stage in its development in order to successfully fulfil its mission, as set out in the statutes. At the heart of this undertaking remains the imperative need to confront the challenges created by the development of ICT, notwithstanding the fact that there is still place in universities for

teachers who use little or no technology (BALDWIN, 1998; DONOVAN, 1999), and that neither would it be feasible for UMa, a young and small-scale publicly funded university, to be transformed immediately into a digital university. The two crucial factors for a successful integration of ICT in teaching found in the literature were an unwavering support to teaching staff and an overall academic strategy (ELLIS, 1997; HAMILTON, 1997; LAURILLARD, 1993). With the exception of the Autonomous Section of Systems Engineering, both these factors are lacking at the remaining departments of UMa.

Under the adverse circumstances described above, it has been difficult to establish common goals for all those involved in the development of UMa, and the integration of ICT has remained a matter of chance and individual preference. Policies have focused on investment in computer hardware and technological infrastructure, evidence of which is in the high rate of computer access for teaching staff and the creation and development of the Computer Centre. However, hardly any measures have been taken concerning the training of teaching staff in these matters, contrary to the findings of the literature which are unequivocal in stating that ICT integration requires support and training of users. Teachers at UMa confirm this and, more important than financial compensation for the efforts expended on the changes, they do suggest as compensation conditions such as computer facilities, their own decision-making and, above all, training.

Our findings from the investigation concerning the two above referred aspects support our conclusion that important measures urgently demanded for ICT integration at UMa include (1) fostering the involvement of the whole academic community, in particular the teachers, (2) encouraging greater flexibility in the organisation of pedagogical activities, and (3) introducing adjustments in the campus layout, consistent with current approaches to learning.

Our study found that teachers at UMa make significant use of their computers, are greatly motivated to learn how they can use them in their teaching and are interested in changing their teaching methods and that considerable investments have been made in technology. However, the majority of features concerning the two referred aspects were found to be in disagreement with the present tendencies concerning teaching and the integration of ICT.

No standard model of development of university teaching has been described, but some trends may be taken for granted: the focus on learning and on the learners, the shift from the traditional passive student to the individual and active learner, a modular design for courses and, under the umbrella concept of "independent learning", many more flexible and varied approaches to learning. Findings from recent studies on teaching and learning in higher education underline the importance of interaction, dialogue and teamwork amongst teachers and between teachers and students (LAURILLARD, 1993; RAMSDEN, 1992). At UMa, the majority of teachers work on their own and the only instance of teamwork is that in which a Professor and a Lecturer teach the same class. Oral presentation is the most frequently used technique, although our study revealed that teachers at UMa adjust their teaching methods as a means of coping with the changing work context and use techniques of a more collaborative type. Teachers' involvement in the integration of ICT at UMa was found to be still mainly restricted to the use of the computer as a tool for the production of traditional materials, such as handouts or assessment sheets, or content research on the Internet.

Besides the lack of more collaborative environments, teamwork habits, involvement of teachers, an overall strategy and support and training of teaching staff, other very important factors were also found to account for the low rate of ICT integration and for the teaching scenarios described in the previous paragraph, which are in conflict with the current tendencies concerning teaching and learning. Our study revealed that (1) professional communication between the Computer Centre (CCS) and the Library (DAS) is limited, as well as between these sectors and academic staff, (2) a shortage of staff affects CCS and DAS, (3) students have access to a limited number of computers, and there are no study areas or e-mail accounts available to them, and (4) the design of the Penteada campus is not adapted to the present teaching and learning requirements.

Thus, even if the working scenario of teachers at UMa were ideal, with collaborative environments and plenty of training available, the integration of ICT would be hindered and held back by the structural rigidity of their teaching environments: the inflexible teaching schedules, the single type of classroom, the bureaucracy entailed in requests for a computer classroom or for a video projector, the lack of computers and e-mail accounts for

students, of facilities for working with CD-ROMs or videos and of access to online databases, amongst others.

A plan should be drafted to deal with the adjustments to be made at the Penteada campus, with the participation of teachers and students, guided by an overall strategy and by the combined efforts of staff directly responsible for the services, resources and facilities at UMa. These adjustments would encourage teachers and lead UMa through a process of change towards greater flexibility in the organisation of its teaching and learning activities, in accordance with the current context of a lifelong learning society. Demand for extensive and immediate changes may drive teachers away from technology, for fear of failure or loss of control, as referred. Creating an adequate environment suggestive of useful changes may gradually open the way for a radical improvement of teaching scenarios: flexible teaching schedules, such as a whole day for a certain subject or tutoring students by means of e-mail; flexible choice of classrooms, such as computer rooms, video projector room, multimedia room for assisting group work, lecture theatre for oral presentation or no classroom at all; flexibility in teaching roles, namely sharing classes with colleagues and each being assigned different roles, such as: content researcher or web page organiser, student tutor, evaluator or any other required by ICT.

The recommendations presented attempt to offer some solutions to the current situation of limited ICT integration in teaching at UMa. They are not a complete or final answer to the current problems of the university, but aim at assisting in the process of its essential adaptation, as required by ICT integration. The suggested actions also represent but a few of the many measures that can be taken. Therefore, our study forms no more than a basis for the gradual process that will require a continuous evaluation and reassessment of its outcome. We trust that our search for solutions to the challenges faced by teachers at Uma may, to some extent, contribute towards the development of a university supportive of its most important activities, those of teaching and learning, and that confronting the challenge of ICT integration may help build a consensual vision of all teachers, students and staff, as the Learners of the University of Madeira.

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9. APPENDICES

APPENDIX A - Information on the University of Madeira

APPENDIX B - Copy of letter sent to the Administration

APPENDIX C - Schedules of interviews and questionnaire

APPENDIX D - Legislation

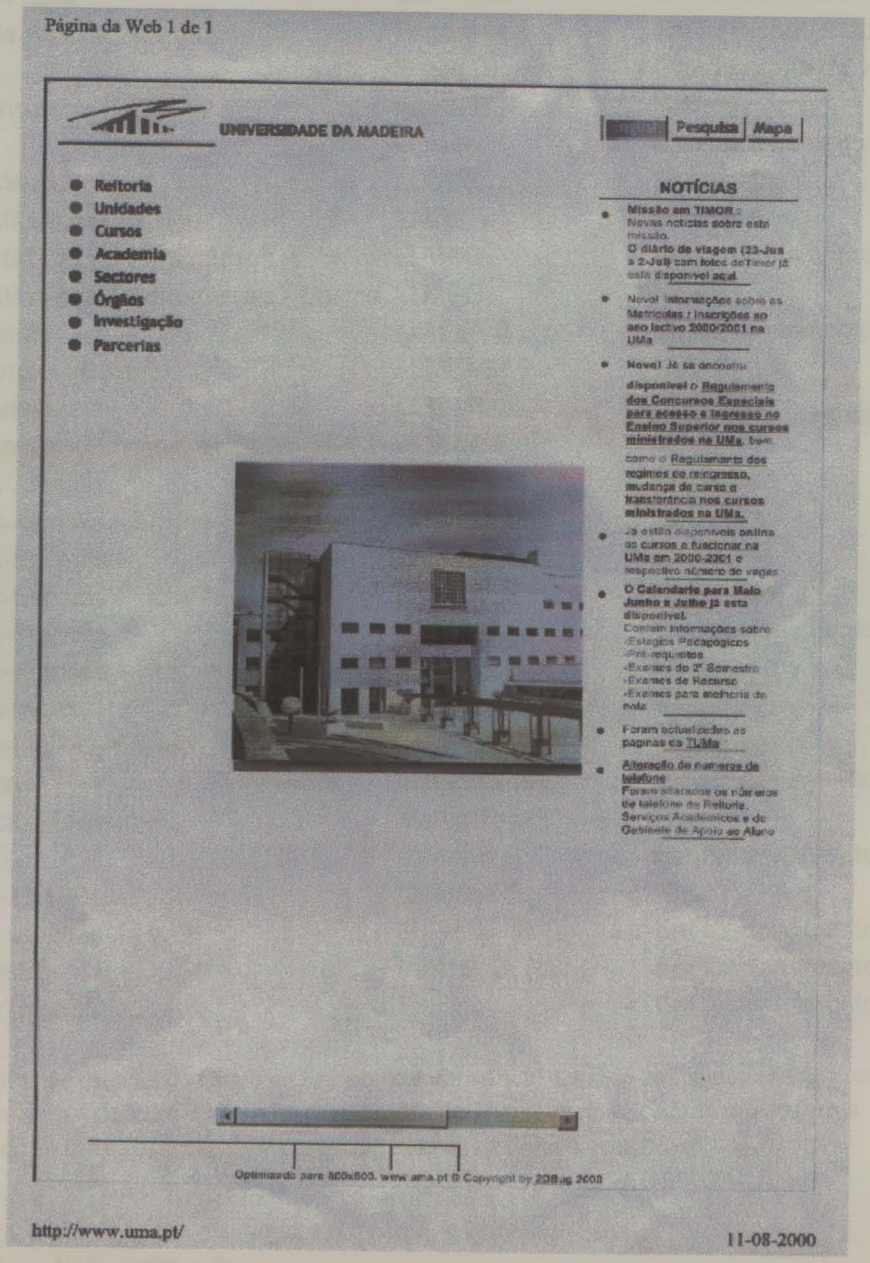
APPENDIX A - The University of Madeira: web site and courses

APPENDIX A-1 - WEB SITE OF THE UNIVERSITY OF MADEIRA

APPENDIX A-2 - LIST OF COURSES RUN AT THE UNIVERSITY OF MADEIRA

APPENDIX A-3 - ARCHITECTURAL PLAN OF FLOOR 2 AT PENTEADA CAMPUS

Appendix A-1 - Web Site of the University of Madeira



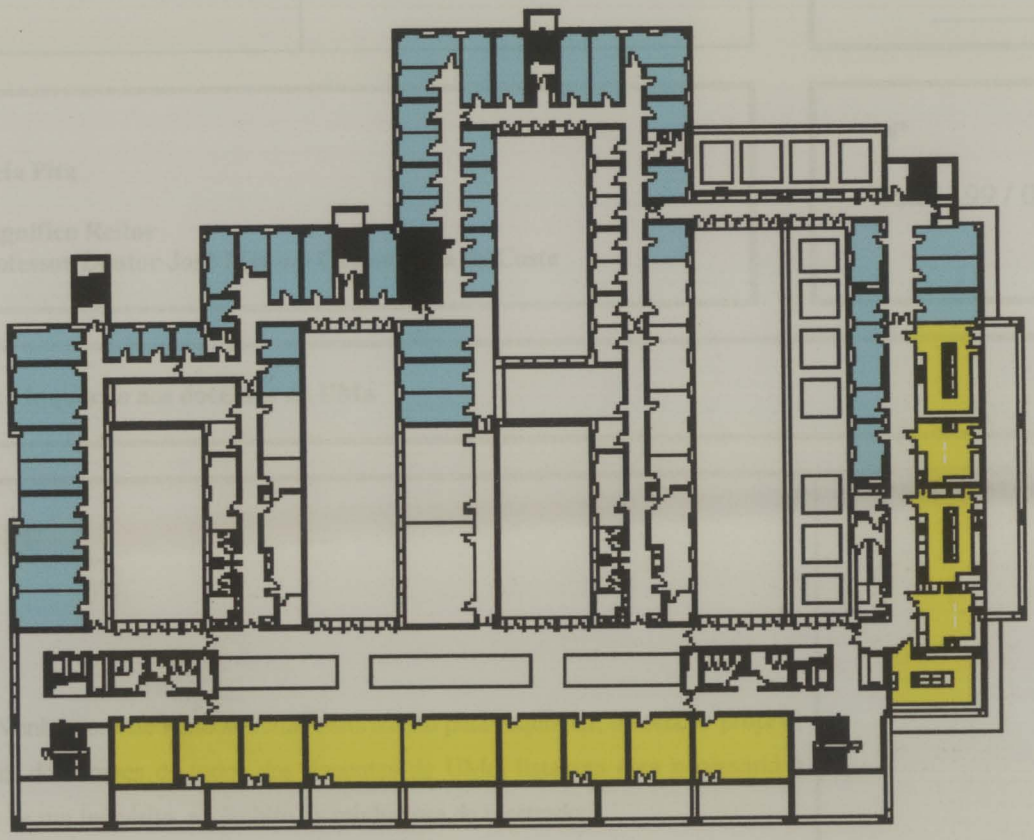
Appendix A-2 - List of courses run at the University of Madeira

CURSOS	ABREVIATURA	ESTADO ACTUAL
Biologia	Biologia C	Em funcionamento
Biologia – Ensino	Biologia E	Ver Nota 1)
Design	Design	Em funcionamento
Educação Física	Ed. Física	Em funcionamento
Engenharia	Engenharia	Em funcionamento
Física	Física C	Sem abertura de vagas
Física – Ensino	Física E	Nota 1)
Gestão	Gestão	Em funcionamento
Estudos Clássicos	LLCC	Encerrado
Estudos Clássicos –Ensino	LLCE	Encerrado
Estudos Clássicos e Portugueses	LLMPC	Em funcionamento
Estudos Clássicos e Portugueses - Ensino	LLMPE	Nota 1)
Inglês-Alemão	LLM I/A C	Em funcionamento
Inglês-Alemão – Ensino	LLMI/AE	Nota 1)
Inglês-Francês	LLM I/F C	Encerrado
Inglês-Francês – Ensino	LLM I/F E	Encerrado
Português-Alemão	LLM P/A C	Encerrado
Português-Alemão – Ensino	LLM P/A E	Encerrado
Português-Espanhol	LLM P/E C	Encerrado.
Português-Espanhol - Ensino	LLM P/E E	Encerrado.
Português-Francês	LLM P/F C	Em funcionamento
Português-Francês – Ensino	LLM P/F E	Nota 1)
Português-Inglês	LLM P/I C	Encerrado.
Portugués-Inglês – Ensino	LLMP/IE	Encerrado.
Matemática	Matemática C	Em funcionamento
Matemática – Ensino	Matemática E	Nota 1)
Química	Química C	Em funcionamento
Química – Ensino	Química E	Nota 1)
Educação de Infância	Ed. Infância (L)	Em funcionamento
Ensino Básico	Prof. E. B. (L)	Em funcionamento
Ensino de Informática	Ensinfb	Em funcionamento

Nota 1) Com a excepção do Curso de Ensino de Informática, o acesso aos ramos ensino passou, desde o ano lectivo de 1998/1999, a fazer-se no fim do 3° ano do ramo científico e de forma condicionada ao número de vagas de estágio existentes na Região no ano seguinte.

Adapted from UMa (1999, p.9).

Appendix A-3 - Architectural plan of Floor 2 at Penteada Campus



Source: Architectural Plans of Penteada Campus (Archives).

APPENDIX B - Copy of letter sent to the Administration (request for authorisation)

UNIVERSIDADE DA MADEIRA	COMUNICAÇÃO INTERNA	PROPOSTA _____ INFORMAÇÃO _____

DE: Doroteia Pita

PARA: Magnífico Reitor
Professor Doutor José Manuel Castanheira da Costa

Nº

Data: 99 / 05 / 12

ASSUNTO: Inquérito aos docentes da UMa

INFORMAÇÃO

Venho por este meio solicitar autorização para requisitar, na secção própria, uma listagem dos nomes de todos dos docentes da UMa, listagem essa necessária à organização de um inquérito, no âmbito da minha tese de mestrado.

Junto envio, em anexo, cópia do inquérito, ainda sujeito a algumas alterações.

Pede Deferimento

Doroteia Pita

DESPACHO

APPENDIX C - Schedules of interviews and questionnaire

APPENDIX C-1 - SCHEDULE OF INTERVIEW TO THE DIRECTOR OF THE COMMUNICATIONS AND COMPUTER SECTOR (CCS)

APPENDIX C-2 - SCHEDULE OF INTERVIEW TO THE DIRECTOR OF THE DOCUMENTATION AND ARCHIVE SECTOR (DAS)

APPENDIX C-3 - SCHEDULE OF INTERVIEW TO THE TEACHERS AT UMA

APPENDIX C-4 - QUESTIONNAIRE TO TEACHERS AT UMa

Appendix C-1 - Schedule of interview to the Director of the Communications and Computer Sector (CCS)

Tempo (aprox.)	Tópicos / Questões	Observações
5 m	(Apresentação informal e objectivos da entrevista). 1. Quais os objectivos do Centro de Informática: - principais funções e serviços desenvolvidos... - o dia-a-dia do CI...	Tentar que sejam dados exemplos concretos dos serviços prestados, através da descrição do quotidiano do CI.
10 m	2. De que recursos físicos dispõe o CI: qual a infra-estrutura tecnológica, quantas salas de informática ou laboratórios multimédia, ...	Solicitar eventual documentação escrita sobre a infra-estrutura tecnológica, nomeadamente mapa de rede ou inventários.
5 m	3. Quais os recursos humanos com que conta: quantas pessoas, a sua formação, áreas de especialização, ...	
5 m	4. Como é que os professores da UMa tomam conhecimento das actividades do CI? Pelo sítio da UMa na Internet ou há contactos pessoais directos da parte do CI? Quais os motivos desses contactos?	
5 m	5. E os professores, tomam a iniciativa de contactar o CI? Em geral, quais as razões desses contactos? Pedidos de apoio técnico ou outras razões?	
10 m	6. Quais os problemas mais comuns do CI? Há mudanças que gostaria de introduzir? Projectos futuros ou em curso?... (Solicitação de documentação relativa a algumas questões e agradecimentos).	

Appendix C-2 - Schedule of interview to the Director of the Documentation and Archive Sector (DAS)

Tempo (aprox.)	Tópicos / Questões	Observações
5 m	(Apresentação informal e objectivos da entrevista). 1. Quais os serviços prioritários oferecidos pela Biblioteca? - principais funções e serviços desenvolvidos... - o dia-a-dia da Biblioteca	Exemplos de serviços prestados, através da descrição do quotidiano da Biblioteca
10 m	2. De que recursos físicos dispõe a Biblioteca: que infra-estruturas, como é feito o acesso ao acervo bibliográfico, quem são os utilizadores, quais os recursos tecnológicos, como funciona a sala de leitura, qual o ambiente de trabalho, etc.	Solicitar eventual documentação escrita sobre a Biblioteca, nomeadamente folhetos informativos.
5 m	3. Quais os recursos humanos com que conta: quantas pessoas, a sua formação, áreas de especialização, ... que problemas se levantam nesta área?	
5 m	4. Como é a estabelecida a relação Biblioteca/Docentes da UMa? Que contactos são estabelecidos habitualmente? E os professores, tomam a iniciativa de contactar o CI? Em geral, quais as razões desses contactos...	
5 m	5. Como é estabelecida a relação Biblioteca / Centro de Informática? Existem contactos regulares e quais as razões desses contactos...	
10 m	6. Quais os problemas mais comuns da Biblioteca? Há mudanças que gostaria de introduzir? Projectos futuros ou em curso?... (Solicitação de documentação relativa a algumas questões e agradecimentos).	

Appendix C-3 - Schedule of interview to Teachers at UMa

Tempo (aprox.)	Tópicos	Questões fechadas
	(Apresentação informal e objectivos da entrevista)	
+- 10 m	1. As novas tecnologias de comunicação e informação (TIC) têm ou não alterado a sua vida profissional ... - na preparação das aulas... - na leccionação das aulas... - na avaliação dos alunos... - no apoio aos alunos... - nas funções administrativas... - na sua investigação... - noutras actividades profissionais... por exemplo...	Tempo de serviço docente: ____ anos ----------
+- 10 m	2. Que factores têm influenciado a utilização das novas tecnologias de comunicação e informação (TIC) nas suas actividades docentes: - favorecendo a utilização... - dificultando ou impedindo a utilização...	Pertence ao grupo de Dep/Sec.Aut.: - grupo A (Educação Física, Ciências da Educação, Arte e Design, Engenharia de Sistemas ou Gestão)
+- 10 m	3. Relativamente à integração das novas tecnologias de informação e comunicação (TIC) nò ensino na Uma, qual a sua opinião sobre: - as vantagens e/ou desvantagens - «o que fazer»... - a hipótese de mudar a sua maneira de ensinar	- grupo B (Estudos Romanísticos, Estudos Anglísticos e Germanísticos ou Estudos Clássicos) - grupo C (Biologia, Matemática, Química e Física)

	4. Ao longo de uma semana «normal» de trabalho, que actividades desenvolve relacionadas com:	
	- o ensino	Tem computador em casa? _____
	- a investigação científica	Com acesso à Internet? _____
	- a gestão e/ou administração	
+- **10 m**		----------
	5. Quando prepara as suas aulas, costuma:	
	- trabalhar com colegas ou sozinho/a...	
	- distinguir claramente aula teórica, prática ou teórico-prática, em termos das actividades a desenvolver...	Os seus conhecimentos de informática são:
	- considerar certos materiais imprescindíveis (se sim, quais...)	
		Muito Bons
	6. Gostaria de acrescentar mais alguma coisa sobre este assunto?	Bons
+- **5 m**		Suficientes
		Insuficientes
		Nulos
	(Agradecimentos)	

Appendix C-4 - Questionnaire to Teachers at UMa

INQUÉRITO

A integração das novas tecnologias de informação e comunicação nos modelos de ensino universitário

Inquérito realizado no âmbito de uma tese de mestrado em Gestão de Informação - FEUP, 97/99
Doroteia Pita - Assistente Convidada no Departamento de Ciências da Educação
Universidade da Madeira, Junho de 1999
Tel.(091)705209
teia@dragoeiro.uma.pt

Objectivos do inquérito

A realização deste inquérito insere-se no âmbito de uma tese de mestrado sobre a introdução das novas tecnologias de informação e comunicação nos modelos de ensino universitário. Pretende obter dados que permitam, relativamente aos docentes da Universidade da Madeira, descrever:

1. as actividades desenvolvidas no âmbito da sua profissão;
2. o conhecimento que têm das novas tecnologias de informação e comunicação;
3. as suas atitudes face a hipotéticas mudanças nos actuais modelos de ensino.

Garantia de anonimato

Todos os cuidados foram tomados, tanto na formulação das questões, como na organização da fase de recolha, para assegurar o anonimato da participação neste inquérito. O inquérito preenchido, dentro do envelope fechado, poderá ser entregue em qualquer uma das secretarias de Departamento ou Secção, independentemente daquele a que pertence o docente.

Agradecimentos

Estando consciente das limitações de tempo e do muito trabalho que, particularmente nesta fase do ano lectivo, caracteriza a nossa vida profissional, agradeço antecipadamente a todos os docentes a sua participação neste trabalho. Caso tenha interesse em conhecer os resultados do inquérito, queira acrescentar algo ou discutir estes assuntos, faça o favor de deixar o seu contacto ou contactar-me na UMa, através da extensão 5209 ou duma mensagem para teia@dragoeiro.uma.pt

PRIMEIRA PARTE - ***Situação profissional***

1. Trace um círculo à volta da alínea que corresponde ao **número de anos de serviço docente**, prestado em **qualquer nível ou instituição de ensino:**

a) entre **1 e 5** anos
b) entre **6 e 11** anos
c) **mais de 12** anos

2. Trace um círculo à volta da alínea **a) ou b ou c)** que inclua o **seu Departamento ou Secção Autónoma**:

a)	**b)**	**c)**
Arte e Design	Estudos Anglísticos e Germanísticos	Biologia
Ciências da Educação	Estudos Clássicos e Humanisticos	Física
Educação Física e Desporto	Estudos Romanisticos	Matemática
Engenharia de Sist. e Computadores	História e Cultura	Química
Gestão e Economia		

SEGUNDA PARTE - ***Ensinar actualmente na Universidade***
(Caso não esteja a leccionar este ano, considere o **último ano lectivo** em que tenha leccionado)

Trace por favor um círculo à volta **da alínea** que, em **cada uma** das questões, **mais se aproxima da sua situação.**

3. Durante uma semana de aulas típica, o número de horas que dedica a **actividades relacionadas com o ensino** (preparação e leccionação das aulas) situa-se habitualmente:

a) Entre **1 e 10** horas **b)** Entre **11 e 20** **c)** Entre **21 e 29** **d)** Entre **30 e 35** **e) Mais de 35** horas

4. Para preparar as suas aulas, considera que o tempo que habitualmente tem disponível é:

a) suficiente **b) o estritamente necessário** **c) insuficiente**

5. Ao longo de um ano lectivo típico, o tempo dedicado a actividades de investigação científica (tese, comunicações, artigos, etc.) é, em média:

a) sensivelmente igual ao que dedica, durante o mesmo período, ao **ensino** (prep. e leccionação de aulas)
b) inferior ao que dedica, durante o mesmo período, ao **ensino** (preparação e leccionação de aulas)
c) superior ao que dedica, durante o mesmo período, ao **ensino** (preparação e leccionação de aulas)
d) não desenvolve actividades de investigação científica

6. Ao longo de um ano lectivo típico, o tempo dedicado a actividades de participação em órgãos da Universidade (Senado, Conselhos ou Comissões, etc.) e/ou actividades administrativas (horários, calendários de exames, etc.) é, em média:

a) sensivelmente igual ao que dedica, durante o mesmo período, ao **ensino** (prep. e leccionação de aulas)
b) inferior ao que dedica, durante o mesmo período, ao **ensino** (preparação e leccionação de aulas)
c) superior ao que dedica, durante o mesmo período, ao **ensino** (preparação e leccionação de aulas)
d) não desenvolve actividades administrativas ou de participação em órgãos da Uma

7. As decisões relativas às **actividades e estratégias** das aulas (isto é, como «dá» as suas aulas: com exposição oral ou trabalhos de grupo ou escrita no quadro, etc.) são tomadas:

a) Sempre **sozinho/a** **b)** Sempre **com colegas** **c) Sozinho/a** e/ou **com colegas**, consoante a disciplina ou as aulas (teóricas, teórico-práticas ou práticas)

8. Trace um círculo à volta de **uma das palavras ou expressões** «Sempre» OU «Muitas vezes» OU «Ás vezes» OU «Nunca» OU «A minha disciplina não tem...», consoante a frequência com que utiliza cada uma das actividades e estratégias descritas.
(Caso leccione várias disciplinas, responda tendo em conta apenas **uma da sua preferência).**

a) nas minhas aulas **teóricas**, exponho oralmente a matéria a leccionar
sempre muitas vezes às vezes nunca A minha disciplina não tem aulas teóricas
b) nas minhas aulas **práticas**, exponho oralmente a matéria a leccionar
sempre muitas vezes às vezes nunca A minha disciplina não tem aulas práticas
c) nas minhas aulas **teórico-práticas**, exponho oralmente a matéria a leccionar
sempre muitas vezes às vezes nunca A minha disciplina não tem aulas teórico-práticas
d) nas minhas aulas **teóricas**, oriento trabalhos de grupo e/ou individuais
sempre muitas vezes às vezes nunca A minha disciplina não tem aulas teóricas
e) nas minhas aulas **práticas**, oriento trabalhos de grupo e/ou individuais
sempre muitas vezes às vezes nunca A minha disciplina não tem aulas práticas
f) nas minhas aulas **teórico-práticas**, oriento trabalhos de grupo e/ou individuais
sempre muitas vezes às vezes nunca A minha disciplina não tem aulas teórico-práticas

TERCEIRA PARTE - *As novas tecnologias de informação e comunicação*

Trace por favor um círculo à volta **da alínea** que, em **cada uma** das questões, **mais se aproxima da sua situação**

9. Na Universidade da Madeira:

a) tem um computador **só para si**
b) tem um computador **para partilhar com colegas**
c) **não** tem acesso a um computador

10. Em sua casa:

a) tem um computador **sem ligação** à Internet
b) tem um computador **com ligação** à Internet
c) **não** tem computador

11. Sobre computadores, considera que:

a) não sabe **mesmo nada**
b) sabe **muito pouco**
c) sabe **o suficiente** para as suas necessidades
d) já sabe **bastante**

12. Quantas **horas, por semana,** estaria disposto/a a dedicar à sua **formação tecnológica,** a fim de utilizar melhor o computador na sua vida profissional:

a) **mais de 5** horas
b) de **2 a 5** horas
c) o **máximo de 2** horas
d) **nenhuma**

13. Trace um círculo à volta **da palavra** que, em **cada uma das alíneas**, melhor caracteriza a **frequência** com que utiliza nas suas aulas os materiais seguintes:

a) quadro preto / branco	sempre	muitas vezes	às vezes	nunca
b) cassetes vídeo	sempre	muitas vezes	às vezes	nunca
c) fotocópias	sempre	muitas vezes	às vezes	nunca
d) cassetes audio	sempre	muitas vezes	às vezes	nunca
e) retroprojector para acetatos	sempre	muitas vezes	às vezes	nunca
f) comput. e projector vídeo associado	sempre	muitas vezes	às vezes	nunca

14. Trace um círculo à volta **da palavra** que, em **cada uma das alíneas,** melhor caracteriza a **frequência** com que, quando utiliza o computador, desenvolve as actividades seguintes:

a) elaborar documentos escritos
(textos de apoio, exames, etc. Por exemplo: no Word ---------- sempre muitas vezes às vezes nunca
b) ligar à Internet para recolha de informação
(pesquisa para investigação ou ensino) ---------- sempre muitas vezes às vezes nunca
c) elaborar listas ou folhas de cálculo
(pautas, estatísticas, etc. Por exemplo: no Excel) ---------- sempre muitas vezes às vezes nunca
d) desenhar slides multimédia com dados e vídeo
(construir «apresentações», etc. Por exemplo: no PowerPoint---- sempre muitas vezes às vezes nunca
e) receber e/ou enviar correio electrónico
(por razões profissionais e/ou pessoais) ---------- sempre muitas vezes às vezes nunca
f) receber e/ou participar em grupos de discussão
(listas de distribuição e/ou conferências electrónicas) ---------- sempre muitas vezes às vezes nunca
g) utilizar CD-ROMs educativos
(pesquisa de enciclopédias, programas educativos, etc.) --------- sempre muitas vezes às vezes nunca
h) ligar à Internet para navegação recreativa ---------- sempre muitas vezes às vezes nunca

QUARTA PARTE - *Ensinar futuramente na Universidade da Madeira*

Trace por favor um circulo à volta **da alínea** que, em **cada uma** das questões, **mais se aproxima da sua situação**

15. Face à hipótese de poder começar a aplicar **novos modelos de ensino, com novas tecnologias,** a sua **reacção** seria a de dizer:

a) «**Não me parece necessário** mudar os actuais modelos de ensino...»
b) «A ideia agrada-me e **acho necessário começar a mudar o ensino...**»
c) Tanto me faz, **é-me indiferente** duma maneira ou doutra...»

16. Ordene as alíneas seguintes, distribuindo os algarismos 1, 2, 3,4 e 5 pelos espaços em branco, consoante a **importância** que atribui às **condições** para implementar **novos modelos de ensino:**

a) __ ° **lugar - uma compensação económica**
b) __ ° **lugar - menos horas lectivas e menos disciplinas**
c) __ ° **lugar - maior poder de decisão acerca dos novos modelos**
d) __ **a lugar - mais recursos informáticos e cursos de formação**
e) __ ° **lugar - menos alunos**

17. Trace um círculo à volta de **um** dos algarismos **1, 2, 3 ou 4,** consoante o seu **interesse** em desenvolver, individualmente ou com colegas, e reunidas as condições necessárias de tempo e formação, as **actividades pedagógicas** descritas em cada uma das alíneas. Utilize a escala seguinte:

1 = nada interessado/a **2 = pouco interessado/a** **3 = interessado/a** **4 = muito interessado/a**

a) Construir materiais pedagógicos multimédia
(por exemplo, «passar» conteúdos para o computador, para fazer apresentações
nas aulas e/ou para utilização fora das aulas pelos estudantes) ---------- 1 2 3 4
b) Orientar o estudo de estudantes, em pequenos grupos ou individualmente,
utilizando **CD-ROMs, Vídeos, Internet, etc.** ---------- 1 2 3 4
c) Ser responsável por orientar e tirar dúvidas a alunos, em matérias da sua área
científica, **através de mensagens de correio electrónico** ---------- 1 2 3 4
d) Construir e manter uma página Web (com informação, conteúdos, programas de
discussão, etc.), **para apoio às aulas ou ensino à distância, dentro da UMa** ---------- 1 2 3 4
e) Moderar conferências electrónicas de discussão (destinadas a colegas e/ou
estudantes da UMa, numa área científica e/ou pedagógica do seu interesse) ---------- 1 2 3 4

Muito obrigada por ter preenchido o inquérito. Agradeço que o coloque, dentro do envelope fechado, numa das caixas para o efeito, em qualquer uma das Secretarias de Departamento ou Secção Autónoma. Caso tenha interesse em conhecer os resultados deste trabalho, queira acrescentar algo ou discutir estes assuntos, faça o favor de deixar o seu contacto ou contactar-me na Uma, através da extensão 5209 ou duma mensagem para *teia@dragoeiro.uma.pt*

APPENDIX D - Legislation

APPENDIX D-1 - Excerpt from the *Estatuto da Carreira Docente Universitária* (Art. 4th, 5th and 7th of the Decree-Law nº 448/79 of 13 November)

APPENDIX D-2 - Excerpt from the *Lei da Autonomia das Universidades* (Art. 1st, 2nd, 3rd and 7th of the Decree-Law nº 108/88 of 24 September)

Appendix D-1 - Excerpt from the *Estatuto da Carreira Docente Universitária* (Art. 4th, 5th and 7th of the Decree-Law nº 448/79 of 13 November)

ARTIGO 4.º
(Funções dos docentes universitários)

Cumpre, em geral, aos docentes universitários:

a) Prestar o serviço docente que lhes for atribuído;
b) Desenvolver, individualmente ou em grupo, a investigação científica;
c) Contribuir para a gestão democrática da escola e participar nas tarefas de extensão universitária.

ARTIGO 5.º
(Funções dos professores)

1 - Ao professor catedrático são atribuídas funções de coordenação da orientação pedagógica e científica de uma disciplina, de um grupo de disciplinas ou de um departamento, consoante a estrutura orgânica da respectiva escola, competindo-lhe ainda, designadamente:

a) Reger disciplinas dos cursos de licenciatura, disciplinas em cursos de pós-graduação ou dirigir seminários;
b) Dirigir as respectivas aulas práticas ou teórico-práticas, bem como trabalhos de laboratório ou de campo, não lhe sendo, no entanto, normalmente exigido serviço docente em aulas ou trabalhos dessa natureza;
c) Coordenar, com os restantes professores do seu grupo ou departamento, os programas, o estudo e aplicação de métodos de ensino e investigação relativos às disciplinas desse grupo ou departamento;
d) Dirigir e realizar trabalhos de investigação;
e) Substituir, nas suas faltas ou impedimentos, os restantes professores catedráticos do seu grupo.

2 - Ao professor associado é atribuída a função de coadjuvar os professores catedráticos, competindo-lhe, além disso, nomeadamente:

a) Reger disciplinas dos cursos de licenciatura, disciplinas em cursos de pós-graduação, ou dirigir seminários;
b) Dirigir as respectivas aulas práticas ou teórico-práticas, bem como trabalhos de laboratório ou de campo, e, quando as necessidades de serviço o imponham, reger e acompanhar essas actividades;
c) Orientar e realizar trabalhos de investigação, segundo as linhas gerais previamente estabelecidas ao nível da respectiva disciplina, grupo de disciplinas ou departamento;
d) Colaborar com os professores catedráticos do seu grupo na coordenação prevista na alínea d) do número anterior.

3 - Ao professor auxiliar cabe, para além do exercício das atribuições constantes do n.º 1 do artigo 7.º, reger disciplinas dos cursos de licenciatura e dos cursos de pós-graduação, podendo igualmente ser-lhe distribuído serviço idêntico ao dos professores associados, caso conte cinco anos de efectivo serviço como docente universitário e as condições de serviço o permitam.

ARTIGO 7.º
(Funções dos assistentes e assistentes estagiários)

1 - São atribuições dos assistentes a leccionação de aulas práticas ou teórico-práticas e a prestação de serviço em trabalhos de laboratório ou de campo, em disciplinas dos cursos de licenciatura ou de pós-graduação, sob a direcção dos respectivos professores.
2 - Os assistentes só podem ser incumbidos pelos conselhos científicos da regência de disciplinas dos cursos de licenciatura quando as necessidades de serviço manifesta e justificadamente o imponham.
3 - Aos assistentes estagiários apenas podem ser cometidas a leccionação de aulas práticas ou teórico-práticas e a prestação de serviço em trabalhos de laboratório ou de campo em disciplinas dos cursos de licenciatura.
4 - Os assistentes e assistentes estagiários não podem, sem o seu acordo, ser incumbidos da prestação de serviço docente em mais de uma disciplina simultaneamente nem, salvo a seu requerimento, em disciplina diversa ou não pertencente ao grupo de disciplinas para que foram contratados.

Appendix D-2 - Excerpt from the *Lei da Autonomia das Universidades* (Art. 1st, 2nd, 3rd and 7th of the Decree-Law nº 108/88 of 24 September)

Artigo 1.º

Missão da universidade

1. As universidades são centros de criação, transmissão e difusão da cultura, da ciência e da tecnologia, que, através da articulação do estudo, da docência e da investigação, se integram na vida da sociedade.
2. São fins das universidades:
   a) A formação humana, cultural, científica e técnica;
   b) A realização de investigação fundamental e aplicada;
   c) A prestação de serviços à comunidade, numa perspectiva de valorização recíproca;
   d) O intercâmbio cultural, científico e técnico com instituições congéneres nacionais e estrangeiras;
   e) A contribuição, no seu âmbito de actividade, para a cooperação internacional e para a aproximação entre os povos, com especial destaque para os países de expressão oficial portuguesa e os países europeus.
3. Às universidades compete a concessão de graus e títulos académicos e honoríficos, de outros certificados e diplomas, bem como a concessão de equivalência e o reconhecimento de graus e habilitações académicos.

Artigo 2.º

Democraticidade e participação

As universidades devem garantir a liberdade de criação científica, cultural e tecnológica, assegurar a pluralidade e livre expressão de orientações e opiniões, promover a participação de todos os corpos universitários na vida académica comum e assegurar métodos de gestão democrática.

Artigo 3.º

Natureza jurídica da universidade

1. As universidades são pessoas colectivas de direito público e gozam de autonomia estatutária, científica, pedagógica, administrativa, financeira e disciplinar.
2. A cada universidade é reconhecido o direito de elaborar os seus estatutos, com observância do disposto na presente lei e demais legislação aplicável.
3. Os estatutos referidos no número anterior são homologados, no prazo de 60 dias, por despacho do membro do Governo com tutela sobre o sector da educação e publicados no Diário da República.
4. A recusa da homologação dos estatutos só pode fundar-se na inobservância da Constituição ou das leis, ou na inconformidade do processo da sua elaboração com o disposto na presente lei.
5. Decorrido o prazo previsto no n.º 3, o reitor, ouvido o senado universitário, manda publicar os estatutos no Diário da República.
6. As unidades orgânicas gozam também de autonomia científica, pedagógica, administrativa e financeira, nos termos dos estatutos da respectiva universidade.
7. Aos estabelecimentos de ensino superior universitário não integrados em universidades aplicam-se os princípios e as regras de autonomia consagrados na presente lei e relativos às faculdades e estabelecimentos equivalentes.
8. Os estatutos dos estabelecimentos referidos no número anterior carecem de aprovação ministerial, devendo adaptar às suas condições específicas as normas gerais definidas na presente lei, nomeadamente as relativas aos órgãos de governo da universidade e as que dizem respeito à concessão de títulos e graus.

Artigo 7.º

Autonomia pedagógica

1. No exercício da autonomia pedagógica, e em harmonia com o planeamento das políticas nacionais de educação, ciência e cultura, as universidades gozam da faculdade de criação, suspensão e extinção de cursos.
2. As universidades têm autonomia na elaboração dos planos de estudo e programas das disciplinas, definição dos métodos de ensino, escolha dos processos de avaliação de conhecimentos e ensaio de novas experiências pedagógicas.
3. No uso da autonomia pedagógica, devem as universidades assegurar a pluralidade de doutrinas e métodos que garanta a liberdade de ensinar e aprender.
4. Os problemas específicos do ensino médico e dos estabelecimentos que o ministram são objecto de legislação especial.