

Postgrad programme

SCIENCE TEACHING WITH ICT

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1 Background

In the recent years there has been, at European level, an increase in the implementation of Information and Communication Technologies in Education, due to different strategies and policies implemented in several projects since the 80s. In the literature much has been debated about the potential of Information and Communication Technologies (ICT) and its applications in education. It is now commonly accepted that ICT can help to extend or renew the traditional means of knowledge production allowing access to multiple opportunities for interaction, mediation and expression, facilitated by extended flows of information and communication.

However, the reality we see in primary and secondary schools leads us to realize that the ICT measures recommended by government in schools are not being fully implemented, at least effectively between students and teachers. If we were sensitive to the amount and diversity of resources that have been installed in European schools and to the results obtained by some studies of its use, we conclude that there are large discrepancies not yet explained.

Therefore it is necessary to intervene near the teachers. They must realize the possibilities and advantages of different new approaches to teaching science. They must be comfortable and motivated to use new ICT tools so that they can participate with their students in experiments. They must understand and be able to show the close relation between everyday life and science. Connecting research to primary and secondary school education can foster the development of new forms of teaching science and motivate students for a learning path into science and technology.

Having identified the gaps and needs level of ICT in schools, this postgrad programme answers the need to effectively train teachers to the use of ICT in such a way that they are confident and sure of their abilities.

2 Objectives

This post-graduation has, as main objective, to specialize teachers and educators in the areas related to information technology, fostering innovation in their teaching practices through the use of Information and Communication Technologies.

The programme is designed for people that want to use (or are using but want to improve their knowledge and skills) ICT in educational settings, such as teachers, trainers, user support staff, educational software developers, librarians and managerial staff. Therefore it provides an understanding of the theories, research and practical strategies for learning throughout life; it relates and examines how ICT can support learning across a range of educational settings but mostly on primary, secondary and vocational settings; it analyses the theoretical, professional and practical applications of ICT and evaluates research and development in ICT and education.

3 Target group

The main target groups are Teachers from Elementary, Secondary and Vocational Education who wish to become even more proficient and professional educators capable of operating in a range of new learning environments. But it is also designed for other stakeholders in education like user support staff, educational software developers, librarians and managerial staff.

4 Programme Structure

The programme is planned to last for one academic year, divided in 2 semesters with 15 weeks each, for a total of 600 classroom hours, corresponding to a total of 60 credits ECTS. In each semester students have 3 compulsory disciplines and 1 optional discipline, each with 7,5 ECTS, 75 contact hours plus 112,5h of autonomous work.

The programme includes guest lecturers and uses a variety of participative instructional approaches. Each discipline requires practical assignments to be done individually or collaboratively in an autonomous way.

Discipline	Time	Hours of work	
		Total	Theory/Lab/Tutorial
Educational Technologies	1st Semester	187,5	T:15; L:45; OT:15
ICT Supported Teaching / Learning Environments	1st Semester	187,5	T:15; PL:45; OT:15
Research Methodologies in Education	1st Semester	187,5	T:15; PL:45; OT:15
ICT in the Science and Mathematics Classroom	1st Semester (Optional)	187,5	T:15; PL:45; OT:15
Interactive Whiteboards in Collaborative Learning	1st Semester (Optional)	187,5	T:15; PL:45; OT:15
Educational Communities of Practice	1st Semester (Optional)	187,5	T:15; L:45; OT:15
Planning and Managing Learning Technologies in Schools	1st Semester (Optional)	187,5	T:15; L:45; OT:15
Multimedia Systems in Education	1st Semester (Optional)	187,5	T:15; PL:45; OT:15
Educational Resources Repositories	2nd Semester	187,5	T:15; PL:45; OT:15
Learning Management Systems	2nd Semester	187,5	T:15; PL:45; OT:15
Project Seminar	2nd Semester	187,5	T:0; PL:60; OT:15
Application of ICT in Primary School Education	2nd Semester (Optional)	187,5	T:15; PL:45; OT:15
Digital audio and video	2nd Semester (Optional)	187,5	T:15; PL:45; OT:15
Art of teaching	2nd Semester (Optional)	187,5	T:30; PL:30; OT:15
Digital Arts	2nd Semester (Optional)	187,5	T:30; PL:30; OT:15
Sign Language in Education	2nd Semester (Optional)	187,5	T:15; PL:45; OT:15

5 Course Units

5.1 Educational Technologies

Learning outcomes

- To understand the meaning of technology under different theoretical perspectives;
- To analyze educational technology through specific case studies;
- To be familiar with the foundations of e-learning, educational technology, learning technologies, and new media;
- To design and plan curricular activities with integration of ICT;
- To foster the integration of ICT as a teaching-learning resource, in the scope of teaching and learning strategies;
- To analyze the different technological tools that are used in teaching context;
- To operate different types of digital tools that allow the creation of spaces for recording, archiving and presenting the productions of students and teachers;
- To develop a culture of collaboration, relationship, sharing and production of knowledge with colleagues through social learning networks;

Contents:

- (1) Foundations of Educational Technology: Historical, Cultural and Social Foundations
- (2) Information and Communication Technologies in Education (main concepts; Education in the Information and Knowledge Society, ICT in Education, ICT in Teacher profile.
- (3) The Design of Educational Technology: Curriculum and Instructional Design Foundations
- (4) Applications of Learning Theories to Instruction: major learning theories and how to apply them in specific instructional situations
- (5) Educational use of office software (word processing, presentations creation; Spreadsheet; Databases;)
- (6) Educational Multimedia
- (7) Web 2.0 and Education

5.2 ICT Supported Teaching / Learning Environments

Learning outcomes

- To provide students with the skills necessary to understand the concepts, technologies and tools that support the interactive educational ICT applications;
- To identify, characterize and use existing ICT tools on the market;
- To relate different theories of learning and instructional design models with ICT use in the classroom;
- To create and manage learning content from the technologist viewpoint in order to be able to develop interactive educational products;
- To examine the relationships between learning theories and digital technologies, and to explore subjects such as constructivism, collaborative learning, tutoring systems, modelling and role-play through the use of appropriate ICT applications;
- To think analytically and critically about pedagogical models and related designs;
- To be aware of a wide range of formal and informal learning environments, including games, e-learning, computer-supported collaborative learning, instructional software, and social networking sites.
- To analyze learning situations and identify associated technology-related design challenges.

Contents:

- (1) Multimedia, technologies and authoring tools
- (2) Concepts and methodologies that support the design and development of educational multimedia applications
- (3) Interactive Multimedia Applications
- (4) Potential communicative image in an educational context
- (5) Solutions that have the image as a mediator, using image processing tools
- (6) Build demonstrations or simulations of how to use a particular applications
- (7) Build, maintain and manage websites with dynamic content using Dreamweaver tool.
- (8) Development of educational content using authoring tools

5.3 Interactive Whiteboards in Collaborative Learning

Learning outcomes

- To promote the use of ICT in creating learning environments that foster the capacity to formulate and solve problems, to communicate, to develop critical thinking and creativity;
- To master strategies and methodologies of use of integrated educational software using the interactive whiteboard in formal educational context;
- To develop educational resources to integrate the learning process in the course units of learners and adopt practices that lead to the involvement of students in practical work with ICT.

Contents:

- (1) Pedagogy of collaborative work;
- (2) Work methodologies in the context of class;
- (3) Strategies for operation of the different models in educational software packages;
- (4) Relevant aspects in the development of an educational resource;
- (5) Operation of QIM as a resource for collaborative learning
- (6) Development of educational resources for use in interactive whiteboards.

5.4 Research Methodologies in Education

Learning outcomes

- To be familiar with the variety of ways to frame and conduct research in education;
- To know which resources are available for the conduct of research (for example, libraries, online resources);
- To display skills in critical reading and scholarly writing;
- To describe the knowledge claims that the various research methodologies make;
- To determine the relationship between the research question or problem and the selection of a methodology;
- To locate and critically evaluate and/or build on previous research;
- To write clear and coherent essays that synthesize and critique educational research in their area of interest;
- To be able to develop assignments that reflect their personal education and research interests.

Contents:

- (1) Personal introductions and research interests. What constitutes good research? Criteria of Educational Research. Research paradigms, problems, and questions. Methodological assumptions. Elements of research design. Differences and similarities between quantitative methods and qualitative methods. Forms of writing and information presentation. Sources of information for research. Use of libraries and online resources. APA style manual.
- (2) Ethical issues, Ethnography, Field Research and Interview. History and document analysis.
- (3) Literature Review.
- (4) Survey, quasi-experimental, and action research.
- (5) Project and proposal design and writing.
- (6) Data analysis and transformation, qualitative and quantitative. Issues of representation, credibility, subjectivity, and reliability.

5.5 Educational Communities of Practice

Learning outcomes

- To acquire the necessary skills to create communities of educational practice supported by ICT;
- To know the concept of community of practice, identify their advantages and difficulties, and feel its impact in the educational field.

Contents:

- (1) Fundamentals of situated cognition and learning.
- (2) Collaborative learning.
- (3) Communities of practice
- (4) Participation, belonging and identity in a community of practice
- (5) Virtual Communities of Practice
- (6) Virtual Communities of Practice in teaching / learning
- (7) E-learning and communities of practice
- (8) Examples of communities of practice
- (9) Communities of practice and knowledge management

5.6 Multimedia Systems in Education

Learning outcomes

- To understand the concept of educational software and related concepts.
- To understand the concept of learning objects and related concepts.
- To understand concepts, models, techniques and tools for the design, specification and implementation of Multimedia Systems and evaluation of digital content in educational.
- To frame and contextualize the learning theories in relation to educational software.
- To identify educational software development tools.

Contents:

- (1) Theories of Teaching / Learning in the construction of digital content in educational
- Educational Software (SWE)
- (2) Educational Design.
- (3) The technology to support learning
- (4) Methodological approach to e-learning applied to the development of SWE.
- (5) Development models SWE

5.7 ICT in the Mathematics and Science Classroom

Learning outcomes

- To frame issues in contemporary educational technology research by synthesizing cases and international research;
- To demonstrate a situated understanding of technology in mathematics or science classrooms, drawing upon prior experiences as sources of insight;
- To create a pedagogical design of a learning environment that integrates technology within a mathematics or science context;
- To display a critical awareness of the implications technology has for students, teaching practice, curriculum development, and schools;

Contents:

- (1) Contemporary, international research on how people teach and learn mathematics and science with digital technologies. Video case studies, conduct field-based interviews, critique primary and secondary research papers in the field, examine historically substantive technology-enhanced science and math learning projects, dynamic information visualization tools, online networked communities, and multisensory immersive environments.
- (2) Contemporary issues related to technology in the mathematics and science classroom and create pedagogical designs for math or science technology-enhanced learning experiences.
- (6) Advancements in both social science, cognitive psychology and computing with an impact on our understanding of how people learn science and math.
- (7) Emergence of several genres in teaching and learning, including: knowledge representation, knowledge diffusion, learning-on-demand, and embodiment.
- (8) Technological advancements, such as dynamic visualization tools, computer simulations, collaboratories, networked databases, hand-held devices, and virtual reality, and evidence of their application to educational contexts are growing.

5.8 Planning and Managing Learning Technologies in Schools

Learning outcomes

- To understand the theoretical and organizational differences between knowledge-based and industrial-based organizations and how that might impact on planning and managing new technologies for teaching and learning;
- To develop strategies for planning and managing new technologies for teaching and learning at an institutional level so that they are funded, organized, and supported in ways that meet the educational, organizational and financial context in which they will be used.

Contents:

- Main themes of the course, and the meaning of distributed learning and why it is becoming increasingly important in education and the importance of adopting an analytical and critical approach to planning and managing new technologies in a rapidly changing technological environment;
- How technology is changing teaching, and the forces that are leading to changes;
- Elements necessary for the development and delivery of high quality technology-based distributed learning;
- Processes or mechanisms for planning and managing technology-based distributed learning so as to achieve cost-effective use of resources;
- Key players and roles in planning and managing technology-based learning;
- The nature of information-based organizations, and how they differ from industrial and craft-based organizations;
- Strategic planning at an institutional level and the institutional vision;
- Various strategies for funding technology-based teaching and learning;
- How to implement strategies to support student access and use of technologies;
- Appropriate organizational structures to support technology-based learning.
- The importance of institutional cultures in facilitating or resisting change, and developing strategies for successfully implementing institutional change that will support the appropriate use of technology for teaching.

5.9 Educational Resources Repositories

Learning outcomes

- To describe the importance of metadata and to know the most used standards;
- To know the SCORM specification and its uses;
- To know various types of digital repositories, distinguishing them and knowing characterize them;
- To be able to describe the common features from search engines and exploitation of digital repositories;
- To understand the initiative Open Archive Initiative (OAI);
- To develop and implement a use methodology for a digital repository of educational resources.

Contents:

- (1) Learning objects metadata and related standards (Dublin Core, SCORM, LOM).
- (2) The reuse of learning objects.
- (3) Characterization of repositories of educational resources: objectives, features and target audience.
- (4) Platforms of educational resources repositories (DSpace, Fedora, Eprints, others).
Open Archive Initiative.
- (5) Exploration of educational resources repositories (OAI-PMH).
- (6) Evaluation of educational resources repositories.

5.10 Learning Management Systems

Learning outcomes

- To explore e-learning platforms (like Moodle), utilizing and developing e-learning courses and integrating technologies associated as a trainer or breeder courses;
- To create, organize and structure e-Learning courses (e-courses) in Moodle;
- To evaluate the functionality, usability, accessibility and quality of service platforms for specific learning/training contexts;
- To reflect on the scenarios and methods of use of e-learning technologies in particular and of learning technologies in general.

Contents:

- (1) Distance Learning and e-Learning (LMS and LCMS technologies and platforms; Learning and Metadata objects; ADL SCORM, Instructional Design and Learning Design.
- (2) A Learning Management System: Moodle
- (3) Installing and configuring an e-learning platform (Web server, Database ...). Exploring and evaluating it.
- (4) Best practices in the development and operation of e-courses (webquests, Portfolios and Web 2.0)

5.11 Project Seminar

Learning outcomes

- To critically examine the practice, research and development in the area of ICT in Education, and to investigate the impact of computer based technologies on education.
- To explore and / or experiment technologies in the field of the Education supported by technology.

Contents:

- (1) Analysis and application of multidisciplinary project management methodologies;
- (2) Design and implementation of a project;
- (3) Demonstration and documentation of the project results.

5.12 Application of ICT in Primary School Education

Learning outcomes

- To gain knowledge about the use of ICT in primary school education
- To be aware of practical examples of the application possibilities of ICT in the educational process;
- To acquire ICT skills and apply it in the initial teacher education;
- To acquire positive attitudes on ICT application in initial teacher education like self-learning;
- To be able to proceed with communication in a public space and to collaborate with the use of modern ICT means.

Contents:

- (1) Information and communication technologies in initial teacher education
- (2) Using of Google drive opportunities in primary education
- (3) Creation and management of a new Website
- (4) Communication with other teachers and parents using ICT
- (5) Ethical communication using ICT
- (6) Edition of graphical objects
- (7) Creating videos using computer desktop and saving it as an educational activity
- (8) Creation, edition and publication of videos using Window film maker
- (9) Text preparation tools
- (10) Using of PC calculators in Primary education
- (11) Preparing of Power Point presentations
- (12) Using of programme „Prezi“ for interactive tools creation
- (13) Creation interactive cards using ICT tool „Quizlet“
- (14) Creating interactive tasks using „Hot Patatoes“
- (15) Drawing, modelling and programming using „Imagine Logo“

5.13 Image, Audio and Video

Learning outcomes

- To be able to use processing tools tailored to the content needs (image, audio or video) and enforce codecs or change formats when appropriate.
- To be aware of the fundamental role that the addressed content (image, audio and video) plays in the production of multimedia content in various professional aspects.

Contents:

- (1) Digital representation of the visual information.
- (2) Static and dynamic digital image.
- (3) Acquisition; Editing and formats; Image and sign
- (4) Image use contexts
- (5) Fundamentals of digital photography
- (6) Capture systems, storage and playback of audio and video.
- (7) Processing systems for audio and video.
- (8) Digital Audio: (sampling, conversion, compression, and transmission formats)
- (9) Post-production audio.
- (10) Synopsis and Script; Capture, plans, processing, editing and post production

5.14 Art of teaching

Learning outcomes

- To discuss and practice the vocal conditioning and posture in the classroom.
- To know and understand the three fundamental aspects of Personal Productivity;
- To understand the importance of implementing best communication practices;
- To be able to implement and maintain the management of working group;
- To be able to effectively promote the use of electronic communication channels;
- To be able to apply various driving techniques to achieve productive sessions;
- To identify the psychological aspects involved in decision-making and operation and how they can condition the capacity to deliver.

Contents:

- (1) Artistic aspects of human communication.
- (2) Major verbal and physical barriers in the communication process.
- (3) How to prepare to perform in public: posture and etiquette.
- (4) Voice expected: Specific demands and needs.
- (5) Effectiveness: the speaking voice
- (6) Risk factors for the development of voice disorders according to the profession.
- (7) Improvement: breathing, sound, intensity, vocal projection and articulation of speech sounds.
- (8) Basic vocal conditioning.
- (9) Interpersonal Productivity
- (10) Protocol email and other communication channels
- (11) Driving productive sessions
- (12) System of personal organization

5.15 Digital Arts

Learning outcomes

- To make trainees aware of the digital arts concepts in its various valences, through an interdisciplinary and comprehensive approach;
- To present and explore the potential of different media for the development of creative projects.

Contents:

- (1) Digital arts roots: culture and history underlying it;
- (2) Net art;
- (3) Software as an artistic concept (art software);
- (4) Art in the virtual platforms;
- (5) Interactivity / gameplay;
- (6) Digital Art in Education;
- (7) Nomenclature and tools for building projects.

5.16 Sign Language in Education

Learning outcomes

- To foresee deafness as biopsychosocial reality and sign languages as a cultural manifestation of an inherently human capacity;
- To situate historically and socially as well as scientifically the support, pedagogical recognition, relevance and the importance of sign languages;
- To contextualize Sign Languages, while communication model of a minority language community, and enhance its presence in different policy contexts, in particular the socio-educational;
- To provide direct contact with Sign Languages, to sensitize students and to provide them with some practical knowledge and for the performance of duties as professionals, either to their training as citizens.

Contents:

- (1) Background and context of the binomial deafness / sign language, viewing deafness and hearing problems as biopsychosocial reality and sign languages as a cultural manifestation of an inherently human capacity.
- (2) Background in the historical-social and scientific and pedagogical support recognition, the relevance and importance of sign languages, especially the LGP in different policy contexts, in particular the socio-educational. Deafness pre-linguistic and post-linguistic deafness. Natural language, mother tongue, learning language.
- (3) Principles of bilingual education for the deaf. The role of listeners in building a non-exclusive society for the deaf.
- (4) Interaction in the context of a sign language environment in order to provide direct contact with it and its structure. Learning a few words, expressions and structural knowledge. Conversation and practical exercises.