

Training Modules

SCIENCE TEACHING WITH ICT

Background

This document presents the set of Training Modules prepared and developed in the scope of the ICTWays network. This set of Training Module results from the local workshops conducted by the partners (over 90) and the units integrated in the postgrad programme. From these workshops and units, 32 were selected for the topics involved and are presented here.

These modules follow the technological and pedagogical evolution of the use of Information and Communication Technologies in Education and really show the potential of these technologies and its applications in education. It is expected that these modules allow teachers 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.

Teachers will be more 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.

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Module	Hours	Methodology
Educational Technologies	187,5	Blended Learning

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 (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

Module	Hours	Methodology
ICT Supported Teaching / Learning Environments	187,5	Blended Learning

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;
- 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 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
- (8) Development of educational content using authoring tools

Module	Hours	Methodology
Interactive Whiteboards in Collaborative Learning	187,5	Blended 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.

Module	Hours	Methodology
Research Methodologies in Education	187,5	Blended Learning

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 personal education and research.

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.
- (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.

Module	Hours	Methodology
Educational Communities of Practice	187,5	Blended Learning

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

Module	Hours	Methodology
Multimedia Systems in Education	187,5	Blended Learning

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

Module	Hours	Methodology
ICT in the Mathematics and Science Classroom	187,5	Blended Learning

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, field-based interviews, primary and secondary research papers in the field, historically substantive technology-enhanced science and math learning projects, dynamic information visualization tools and online networked communities.
- (2) Contemporary issues related to technology in the mathematics and science classroom and create pedagogical designs for math or science 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, co-laboratories, networked databases, hand-held devices, and virtual reality, and evidence of their application to educational contexts.

Module	Hours	Methodology
Planning and Managing Learning Technologies in Schools	187,5	Blended Learning

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.

Contents:

- 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 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.

Module	Hours	Methodology
Educational Resources Repositories	187,5	Blended Learning

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.

Module	Hours	Methodology
Learning Management Systems	187,5	Blended Learning

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)

Module	Hours	Methodology
Project Seminar and Project	187,5	Blended Learning

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.

Module	Hours	Methodology
Application of ICT in Primary School Education	187,5	Blended Learning

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;
- 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 movie 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“

Module	Hours	Methodology
Image, Audio and Video	187,5	Blended Learning

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

Module	Hours	Methodology
Art of teaching	187,5	Blended Learning

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

Module	Hours	Methodology
Digital Arts	187,5	Blended Learning

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.

Module	Hours	Methodology
Sign Language in Education	187,5	Blended Learning

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.

Module	Hours	Methodology
Digital Games for Teaching Support	32	Blended Learning

Learning outcomes

- To understand the concepts behind video games;
- To be able to use games to enhance teaching;
- To design games for educational purposes;
- To develop games using specific tools that do not require advanced technical skills

Contents:

- (1) The concept of the video games as a support tool for learning;
- (2) How to use new technology to support teaching, amplifying student motivation and engagement;
- (3) How to build online didactic content;
- (4) How to direct games so specific themes and age groups;
- (5) How teachers can access this arsenal of tools.

Module	Hours	Methodology
Mobile Devices Integration in Educational Practices	32	Blended Learning

Learning outcomes

- To understand the concepts behind mobile devices;
- To be able to use mobile devices to enhance teaching;
- To select apps for educational purposes;
- To design pedagogical methodologies to integrate mobile devices.

Contents:

- (1) Integration of mobile devices in educational practice: some possibilities;
- (2) Tools optimized for the use in mobile devices.
- (3) Google Sites mobile - to create the mobile version of a website;
- (4) Mobile study - to create interactive exercises with automatic correction and the QR Code.

Module	Hours	Methodology
Digital Photography	32	Blended Learning

The main goal of this training module is to provide the participants with the knowledge and skills necessary to manipulate, create and process digital images, to use in educational resources.

Learning outcomes

- To understand the theoretical concepts behind digital photography;
- To be able to apply the concepts in practical applications;
- To be able to use digital photography processing tools.

Contents:

- (1) Semi-optics and framing concepts;
- (2) Working with layouts and images;
- (3) Shapes concepts and space;
- (4) The rule of thirds and image composition.
- (5) Tools and concepts for Photoshop: basic commands, manipulation of essential images elements;
- (6) Selection and crop tools, graphical techniques for editing, adjustment and manipulation; Filters and effects; Processing, composition and digital production.
- (7) Image applicability according to its use: print, web, powerpoint;
- (8) File types and their correct use, image resolution and their importance.

Module	Hours	Methodology
Basic Use of Smartboards	32	Blended Learning

Learning outcomes

- To understand the theoretical and practical concepts behind smartboards;
- To be able to use smartboards in teaching practice;

Contents:

- (1) What are smartboards? What types of smartboards are there?
- (2) What software is available to work with smartboards?
- (3) How to design a pedagogical methodology to integrate smartboards?

Module	Hours	Methodology
ICT best practices in secondary schools	32	Blended Learning

Learning outcomes

- To be able to search for best practice coming from other teachers;
- To be able to share one's own best-practice;
- To participate in community of practices related with teaching.

Contents:

- (1) Examples of best-practice available;
- (2) How to organize and describe a good teaching practice as a best-practice;
- (3) What are communities of practice? How to be involved and participate;
- (4) Potential of social networks in the learning field. These virtual platforms allow users to discuss, share news and contents and collaborate in new creations, promoting a continuous participation.
- (5) The relevance of social network integration in teaching and experimenting with the implementation of virtual communities of practice;
- (6) The ICTWays community of practice.

Module	Hours	Methodology
Webquests and Interactives exercises	32	Blended Learning

Learning outcomes

- To understand the theoretical concepts behind webquests;
- To be able to structure and publish a web quest;
- To integrate a web quest into the pedagogical methodology.

Contents:

- (1) Webquests as a teaching-learning process based on online resources, which enhances its pedagogical use and presents the opportunity to work individual and in collaboration with other students.
- (2) Explore the Hot Potatoes software to create interactive exercises, with automatic correction, as a support for autonomous learning.

Module	Hours	Methodology
Virtual worlds in the classroom	32	Blended Learning

Learning outcomes

- To understand the idea of virtual worlds;
- To be able to use common tools for virtual worlds;
- To be able to create our own virtual world;
- To understand how to use virtual worlds in learning contexts;
- To integrate a web quest into the pedagogical methodology.

Contents:

- (1) Virtual worlds as virtual classrooms or simulations;
- (2) Explore and interact in 3D worlds, such as Second Life, Active Worlds and similar;
- (3) Tools used for an easy creation of 3D content;
- (4) Creating virtual educational spaces. Creation of 3D objects using simple modeling tools, from modular elements.

Module	Hours	Methodology
Concepts and practices for web programming	32	Blended Learning

Learning outcomes

- To understand the main concepts about the web;
- To understand and be able to use the most important web-related tools;
- To be able to create static and dynamic web pages;
- To be able to use those pages in learning contexts.

Contents:

- (1) Concepts about web pages, browsers, web clients and web servers;
- (2) The HTML language structures and CSS styling;
- (3) Interactive and dynamic web pages;
- (4) Embedded scripting languages in a HTML document, as well as javascript language structures and W3C DOM;
- (5) Server-side programming using PHP;
- (6) Concepts and tools for Web 2.0 (web as a work platform) and Web 3.0 (semantic web).

Module	Hours	Methodology
Interactive response systems in the student teaching-learning process	32	Blended Learning

Learning outcomes

- To understand the main concepts about interactive response systems;
- To be familiar with the more common tools for interactive response systems;
- To be able to use those systems in learning contexts.

Contents:

- (1) Interactive response systems as a tool to promote a greater participation and consequently a better and faster content acquisition;
- (2) The collaborative and cooperative attitudes among student-student, student-teacher and student-class when using interactive response systems in the context of the classroom;
- (3) The use of interactive response systems in the classroom and its implications in the teaching-learning process as some of the challenges facing teachers as movers' agents in implementing this technology in school.

Module	Hours	Methodology
How to make your school more international	32	Blended Learning

Learning outcomes

- To understand the main concepts about internationalization;
- To be aware of internationalization possibilities;
- To be able to implement internationalization in your own organization.

Contents:

- (1) Developing a policy plan of internationalization, project work, European dimension in curriculum and other topics.
- (2) What are the organization's needs in terms of quality development and internationalization?
- (3) European mobility and cooperation activities, and how these activities contribute to meeting the organization's needs.
- (4) How can an organization integrate the competences and experiences acquired by staff participating in the project, into its strategic development in the future?

Module	Hours	Methodology
Educational Robotics with Lego and Scratch	32	Blended Learning

Learning outcomes

- To understand the main concepts about robotics;
- To be aware of possibilities of the use of robotics for pedagogical purposes;
- To be able to implement examples of the use of robotics.

Contents:

- (1) Scientific-Technical Areas in Physics applied to robotics, electrical and electronics;
- (2) Creatively encouraging thinking, deduction;
- (3) Project-based learning projects.

Module	Hours	Methodology
Tablets course 'Tap-Swipe-Pinch'	32	Blended Learning

Learning outcomes

- To understand the basic concepts of tablets;
- To create their own multimedia learning lessons;
- To design specific activities with tablets related to specific disciplines and levels.

Contents:

- (1) iPad, Android, and Windows tablets changing the way to learn and teach;
- (2) Trial use and evaluate tablets and different apps according to the subject;
- (3) Build and present good examples of use.

Module	Hours	Methodology
Problem Based Learning	32	Blended Learning

Learning outcomes

- To understand the basic concepts of problem-based learning;
- To understand the skills related to PBL like improvements in critical, lateral and creative thinking, problem solving skills, team collaboration and communication skills;
- To be able to design and implement a PBL experiment.

Contents:

- (1) Problem-based learning (PBL) as a learner-centered educational pedagogy;
- (2) How to establish a PBL experiment;
- (3) How to guide students in a PBL methodology.