

NEO

IDEAS AND INNOVATION

5. INFORMATION TECHNOLOGY APPLIED TO LEARNING



INFORMATION TECHNOLOGY APPLIED TO LEARNING

Education was one of the first applications for Information and Communication Technology (ICT). The enormous potential of technology for managing knowledge and transforming the way people interact with one other offers significant benefits in terms of cost reduction, promotion of independent learning and student motivation. Today, IT has completely re-defined educational models, the roles of teachers and students, the generation and sharing of content, and the manner of gaining access to and working with knowledge. We have gone from speaking of "training" to speaking of "learning".

Companies have been particularly active in taking advantage of IT for learning, and they have spurred the development of a business that is undergoing a transformation thanks to the application to mobile devices, "social learning", and the emergence of technologies based on 3D immersive learning (virtual classrooms). Leading market analysis firms forecast annual growth rates in the e-Learning market of more than 10% in the coming years, driven by the demand of the education segment (primary, secondary and higher education), and by developing countries.

TRANSFORMATION OF THE EDUCATIONAL SYSTEM

Compared to the situation of e-Learning in companies, the educational system is the demand segment in which the degree of IT penetration is lower, also compared to other public administrations, both in terms of computer equipment as well as developed content, learning platforms and applications.

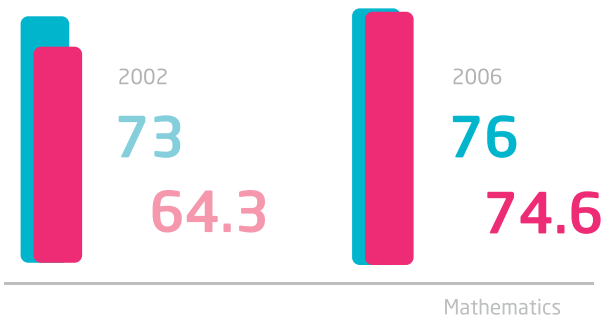
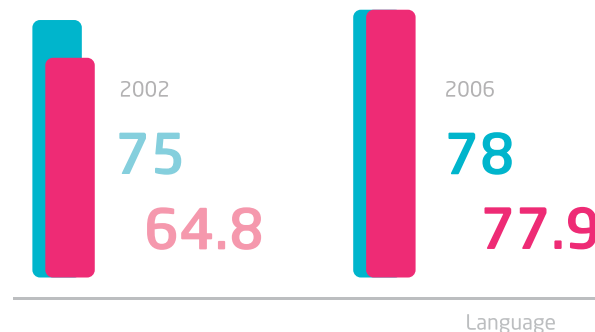
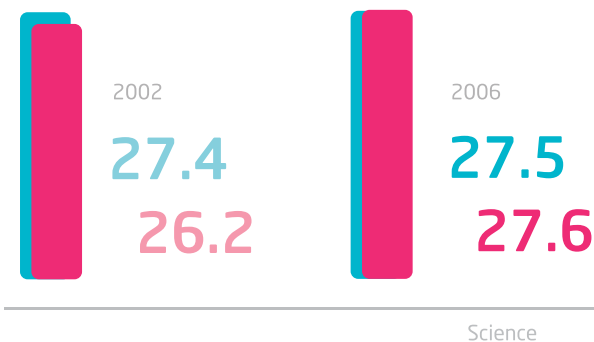
However, there are an increasing number of studies that demonstrate the positive correlation between using IT in education and positive academic results. This, along with the important role of education in the transformation of the productive and economic growth models of nations, should position IT investments for education as a priority for educational authorities, even more so in the current situation, where the global economic crisis has exposed the exhaustion of the growth model based excessively on natural resource depletion and the need to transform this model into one in which productivity growth is based on innovation, technology, and a more intelligent use of resources.

The "ICT Test Bed Project" study carried out by the Centre for ICT, Pedagogy and Learning Education and Social Research Institute at

Manchester Metropolitan University between 2002 and 2006¹ showed the progress of results in language, mathematics and science at 28 pilot centres in socio-economically depressed areas of the United Kingdom compared to the national average. The study showed that the centres that had implemented the use of ICT in education significantly improved their results by more than the national average, especially for students between the ages of 11 and 14.

Compared performance progress between 2002 and 2006 of students between the ages of 11 and 14.

● Pilot schools ● National average



¹ Evaluation of the ICT Test Bed project, Final Report. Junio de 2007. Centre for ICT, Pedagogy and Learning Education and Social Research Institute de la Manchester Metropolitan University. <http://www.evaluation.icctestbed.org.uk/reports>

TRANSFORMATION OF THE EDUCATIONAL SYSTEM

The centres chosen to take part of the pilot project had significantly lower academic performance than the national average at the beginning of the project, and the introduction of ICT allowed them to converge with the national average.

The fact is, as pointed out by a UNESCO² study, ICT offers significant opportunities for facilitating the learning of students with different learning styles and abilities, including students that learn at a slow pace, and those who are socially disadvantaged, physically and intellectually disabled, gifted, or live in remote areas, for example.

Additionally, recent surveys performed in the United Kingdom³ and Nordic countries⁴ have shown that between 40% and 90% of teachers (depending on the country and the academic level) believe that the use of ICT has translated into a noticeable improvement in academic results.

However, it should be pointed out that the introduction of ICT does not automatically translate into improved results because, as is apparent, this also depends on many other

factors that range from the school's strategy, its leadership style, and parents' attitudes to ICT, the characteristics of the students (socio-economic factors, motivation, ability, prior knowledge, etc.), and the type of interaction that is established between the students and the technology.

In any case, the indicator that best illustrates the positive impact of ICT on academic results is that, overall, the best educational systems (according to the 2009 PISA report) are those with the most advanced policies for the implementation of ICT in education, starting with the development of a set of indicators for measuring the implementation and the impact of ICT. Thus, for example, almost all the European countries holding the top positions in the PISA ranking, such as Finland, Netherlands, Estonia, Germany and Iceland, have a national system for following and monitoring ICT in primary and secondary education that involves not only the existence of a battery of indicators of ICT use in the educational system⁵, but also that these indicators are taken into account in educational management.

**TECHNOLOGY OFFER
OPPORTUNITIES
IMPORTANT TO FACILITATE
STUDENTS WITH DIFFERENT
LEARNING STYLES OF
LEARNING AND SKILLS**

² "Information and Communication Technologies in schools: a handbook for teachers or how ICT can create new, open learning environments". UNESCO. 2005.

³ Harnessing Technology Review 2009. The role of technology in education and skills. Becta. Noviembre de 2009. <http://publications.becta.org.uk/display.cfm?resID=41329&page=1835>

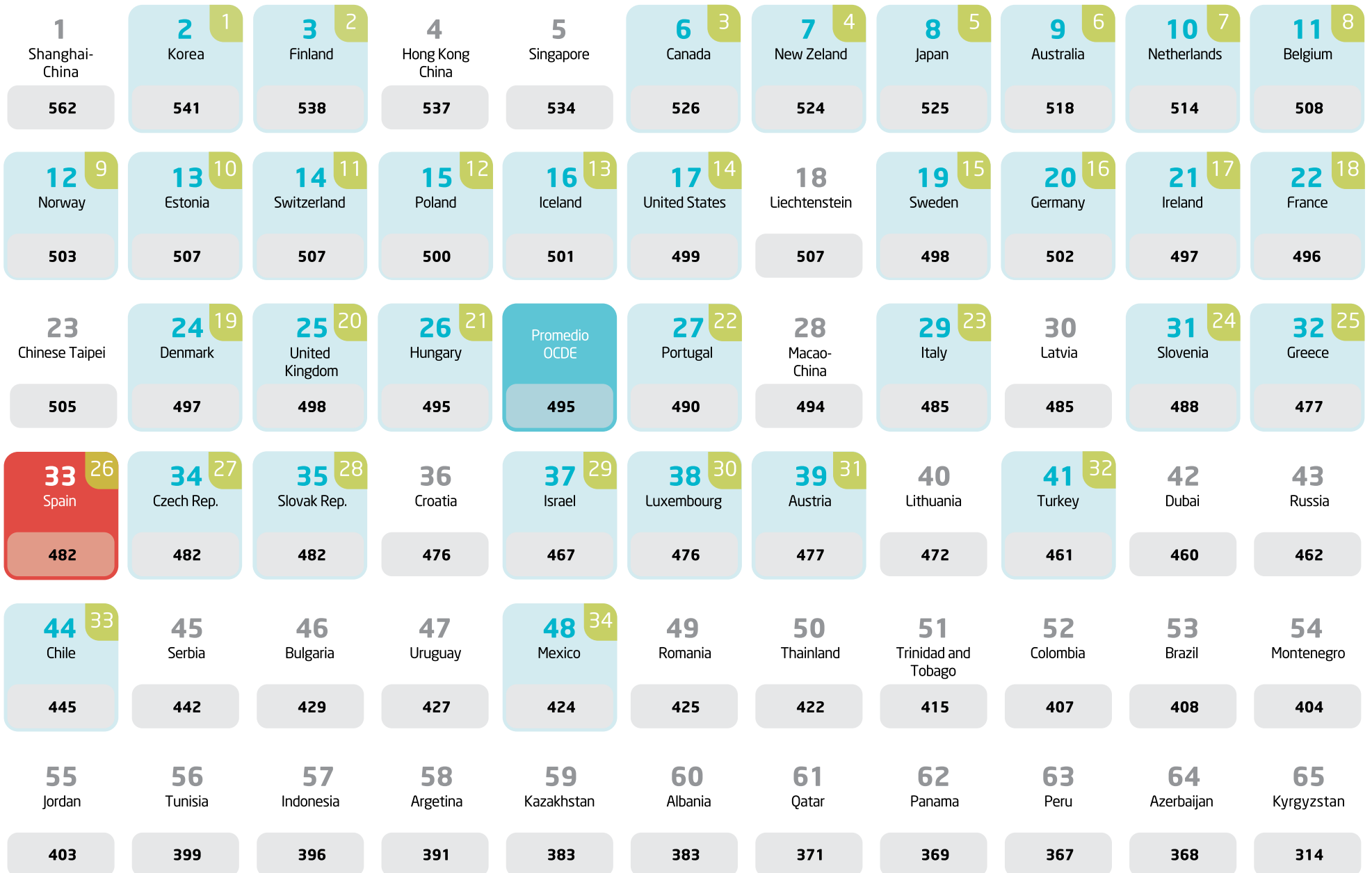
⁴ E-learning Nordic 2006: Impact of ICT on education. http://www.opf.fi/english/publications/2006/e-learning_nordic_2006

⁵ "Indicators on ICT in primary and secondary education". 2009. Comisión Europea. http://ec.europa.eu/education/more-information/moreinformation139_en.htm

Academic performance ranking by OECD countries.

● OCDE Countries
● OCDE Ranking

OCDE, Programme for International Student Assessment (PISA) 2009.
http://www.oecd.org/document/61/0,3746,en_32252351_32235731_46567613_1_1_1_1,00.html



In any case, beyond purely academic results, it has been demonstrated that the application of ICT in education has series of collateral benefits, starting with the fact that by introducing ICT in education, we will be preparing students for a labour market and a productive system that already demands the use of ICT as a standard and essential work tool. We can also highlight the following benefits⁶ :

For students: Students primarily require new teaching models that foster their participation in the training process and promote self-training.

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INDEPENDENT LEARNING

The change to the educational model described in the point above contributes to students assuming greater responsibility in their own learning when they use ICT. For example, in the framework of the "ICT Test Bed Project" described earlier, 47% of instructors stated that students participated in the processes of establishing objectives and tasks, organising their own schedules and monitoring their progress.



MOTIVATION

The use of ICT has been demonstrated to have very positive effects on motivation, behaviour, concentration, cognitive processing, reading comprehension, communication abilities and critical thought. For example, some students point out that the use of interactive contents and multimedia on interactive blackboards results in students being more attentive, especially in primary education. Additionally, we must consider that we are before a generation known as "digital natives", for whom technology is a fundamental part of how they interact with their surroundings.



TEAM WORK

ICT offers an enormous potential for collaborative work, and it has been observed that teamwork among students increases when ICT is used.

⁶ According to the studies: "Key findings for further education colleges based on evidence from the evaluation of the ICT Test Bed Project", BECTA, June 2007. http://www.evaluation.icctestbed.org.uk/files/Key_findings_FE.pdf; and "The ICT Impact Report - A review of studies of ICT impact on schools in Europe", European Schoolnet, European Commission, December 2006. http://ec.europa.eu/education/pdf/doc254_en.pdf

For teachers: Instructors demand more support in performing their work and a greater degree of participation in educational policy.



GREATER EFFICIENCY AND FOCUS ON HIGHER-VALUE ACTIVITIES

the use of ICT allows for more efficient lesson planning, more effective management of each student's educational needs, increasingly streamlined mark reports and improved coordination between teachers, amongst other benefits. For example, according to a survey performed by BECTA⁷, between 41% and 46% of teachers (depending on the academic level) affirm that they have saved at least one hour per week thanks to ICT. Additional studies have shown that this time is re-invested in more critical activities. According to another analysis performed in Norway, teachers assume a more "advisory" role, and act as allies for critical dialogue with students and as leaders for certain specific domains.



GREATER SUPPORT FOR TEACHERS

Teachers find themselves better supported by the possibilities provided by ICT in terms of content access (including professional networks), training, the creation of consultation and communication channels, facilitation of administrative procedures, etc.

With the goal of highlighting the relationship between educational models and productive and educational models, it's worth noting how, overall and despite very complex factor correlations, countries with more advanced educational systems are also the ones with the most innovative, dynamic and competitive economies.

These conclusions, in terms of the benefits of applying ICT in the areas of early-childhood, primary, secondary and higher education can be easily extrapolated to other educational environments such as professional training. In other words, introducing e-Learning into companies and public administrations translates into, amongst other benefits, improved learning and increased knowledge assimilation, greater autonomy or more collaboration, and with important cost and time savings. But that's not all. Just as there appears to be a relationship between the quality of education and economic dynamism, we can deduce that that a good training model that makes proper use of ICT results in companies being more competitive and sustainable.

⁷ Harnessing Technology Review 2009. The role of technology in education and skills. Becta. November 2009. <http://publications.becta.org.uk/display.cfm?resID=41329&page=1835>

THE FUTURE OF APPLYING ICT TO LEARNING

Mobile technologies, augmented reality and collaborative content development, offer new opportunities to improve the educational experience.

The availability of more advanced mobile devices that are more affordable may allow us to witness the consolidation of this type of medium as a commonly used training channel in coming years. The use of mobile devices can help exploit the benefits of e-Learning even more in terms of independent

learning, autonomy, students the setting their own objectives and calendar, etc. But, in addition, mobile devices make it possible to introduce new teaching tools, such as augmented reality, which could radically change the pedagogy of teaching and the function of the teacher.

Specifically, the main advantages of applying mobile devices to learning refer to two areas:



FUNCTIONAL ADVANTAGES:

- **Learning anytime & anywhere :**
It is no longer necessary to be in a specific location at a specific time in order to learn. A mobile device can be used anywhere and anytime (at home, on a train, in a hotel, etc.), and so the learning process is personalised and adapted to each person's individual requirements and availability
- **Greater student teacher interaction :**
Mobile devices make it possible for the student and teacher to interact instantaneously, while offering an "anonymous" and automatic way to provide teacher feedback on the correct comprehension of the educational contents.
- **Greater penetration :**
Mobile telephony is accessible to almost everyone. Mobile devices currently have a penetration of more than 100%⁸, compared to 65% for Internet⁹.
- **Less expensive technology :**
The cost of purchasing a mobile device is significantly lower than that of a PC, which may also contribute to reducing the digital divide.
- **Greater accessibility :**
All of these mobile devices can be connected to networks and services accessed via the Internet.
- **Collaborative learning :**
Mobile technology favours the possibility of having students share certain activities with their classmates through the creation of groups, shared responses, etc.
- **Exploratory learning :**
Mobile devices facilitate exploratory learning, which means learning about a field through experimentation and applying the lesson learned.



PEDAGOGICAL ADVANTAGES:

- It helps students to improve their reading, writing and calculation abilities, and to recognise their skills.
- It can be used to provide incentives for independent and group learning experiences.
- It helps students identify the areas where they need help.
- It allows instructors to send reminders to students about activity deadlines or tasks, as well as messages of support or stimulus.
- It helps eliminate some of the formality in the learning experience and involves the students, who have been familiar with virtual environments and technology since a young age.
- It often provides inter-curricular activities, which is a key aspect in having instructors introduce m-Learning activities in the classroom.

⁸ 116,1% en economías avanzadas y 67,6% en economías en desarrollo, según la Unión Internacional de Telecomunicaciones <http://www.itu.int/ITU-D/ict/statistics/index.html>

⁹ 65,6% en economías avanzadas y 15,8% en economías en desarrollo, según la Unión Internacional de Telecomunicaciones <http://www.itu.int/ITU-D/ict/statistics/index.html>

THE FUTURE OF APPLYING ICT TO LEARNING

Mobile technologies facilitate the transformation of the role of the teacher towards activities with a higher added value, in which their training efforts focus more on student abilities (tool usage, critical analysis of the information, debate, etc.), instead of on knowledge. In the new learning process, the teacher would become a "guide", assuming the functions of a communicator, motivator and facilitator; creator of new learning environments; producer and user of new teaching materials in new environments and mediums; researcher and recipient of new contents and experiences (permanent self-learning), etc.

The use of "virtual worlds" can be found along this line. These are 3D immersive environments where students can interact with a virtual environment. These "virtual worlds" are already used in other types of applications, with resounding benefits. This is the case, for example, of aeronautical simulation for pilot training (with clear benefits in terms of costs and safety), or medical therapy for rehabilitation.

On another hand, e-Learning is also radically transforming how content is generated. In recent years, Internet tools such as blogs, "wikis" and social networks, where content is voluntarily generated by community members, have experienced extremely fast development and their power to influence continues to grow. These tools have an enormous potential for learning since they make it possible to offer a virtual campus to members of the learning community; in other words, a framework for information exchange that also turns into a communication medium. Collaboration between community members, which we refer to as social learning, becomes a key for success.

In practical terms, this means that, in parallel to the official course network, there will be additional networks developed by students where they will define their own concepts and it will be possible for new concepts to appear virally and undergo exponential growth, and whose final results could be an "encyclopaedia" focused on specific contents.

INDRA'S PROPOSAL

Indra has extensive experience in the field of solutions for improving educational systems, including e-Learning. Day by day, this offering grows from the skills we have developed in other sectors (such as simulation, healthcare, augmented reality) and with the knowledge we generate through our R&D projects and in our e-Learning excellence centre in León (Spain), which was established with the e-Cotec/21 Foundation.

Specifically, in the field of education, we offer a wide range of solutions and services that range from the design of the implementation indicator scorecard for ICT and its impact, to comprehensive academic management and the implementation of educational content platforms. An example of this is our participation in the "AGREGA" digital educational content project for Red.es in Spain, which contributes to building a new educational model that relies on digital content as an element on which to roll-out teaching-learning processes for students and which creates collaboration environments for the teaching community. The AGREGA website has had 2 million visits, benefits more than 7 million students, and maintains a network of 500,000 public centres. The success of this platform has led Red.es to provide the United Kingdom's Education and Research Network,

"Janet", with the source code and the documentation of the Agrega digital education content platform.

Our premise is that the proper implementation of IT in the education system will improve it. For this reason the goal must be to go beyond mere knowledge and the use of the new resources: it means the creation and implementation of new educational scenarios.

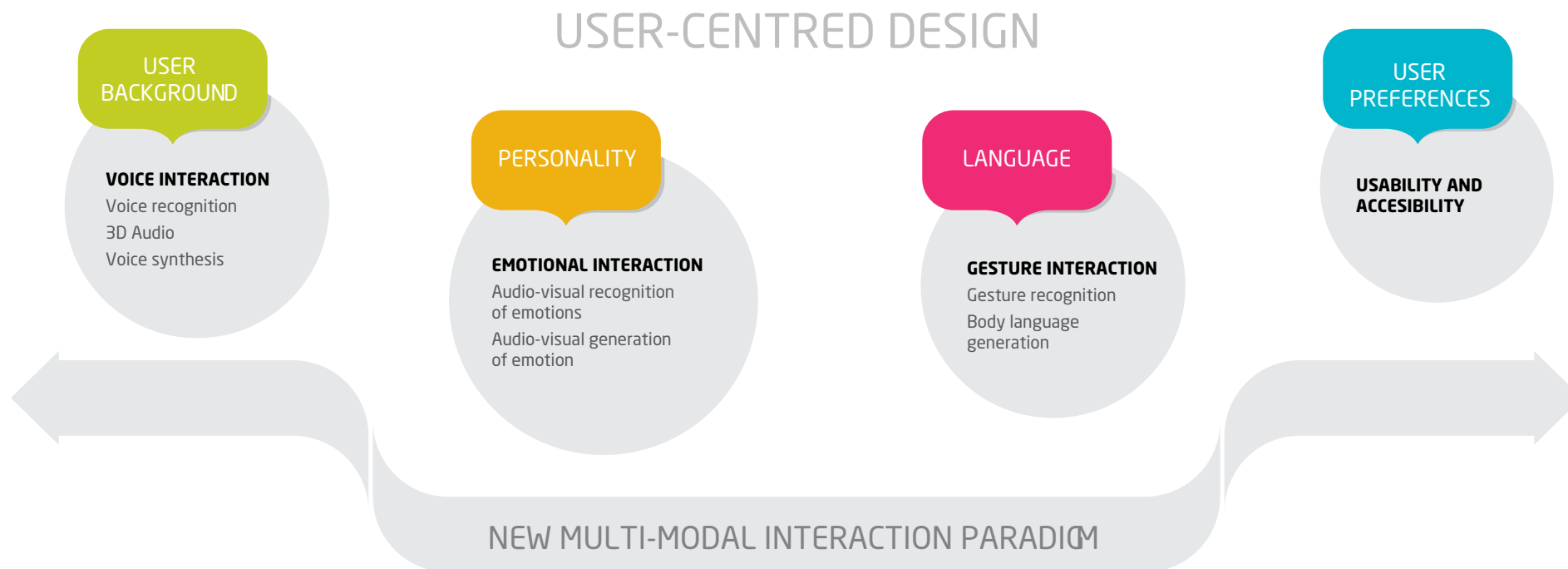
In this sense, to the degree that the success of ICT implementation in education depends in large part on the hardware tools being appropriately accompanied by software applications and computer services, as well as by programmes of transformation and training in the use of the technology that involve all agents active in the educational process, from students and teachers, to families; it must take into account that indicators and an implementation monitoring system for ICT based solely on measuring the degree of implantation of computer equipment (personal computers, digital blackboards, etc.) offer only a partial vision, and one that is slanted and not very realistic, and must also be accompanied by indicators that effectively measure the implementation of service software and the transformation of the educational model.

THE EVMIC PROJECT

Indra led and participated actively in the evMIC¹⁰ R&D project, within the framework of the R&D Project of Spain's Ministry of Industry and with the objective of developing a platform for the creation of learning environments that are virtual and immersive, interoperable, user-focused, accessible and operable through three channels (Internet, mobile and DTT). Collaborative virtual environments allow people to collaborate and interact in a way that is closer to real interaction between people thanks to aspects such as immersion, the feeling of presence, and the system's immediate response.

The underlying reason for this project is that we find ourselves in a situation in which, despite the progress made in recent years by virtual environments, the interaction between users and the virtual world continues to be unnatural and is not focused on the needs and profile of each user. Proof of this are the statistics that show that many users that connect to virtual worlds do not become frequent users¹¹.

New interaction interfaces are needed that are more natural, multi-modal, and focused on user needs. Therefore, in this project, not only was person-machine interaction researched, but the aim was to define a new user-focused interaction paradigm.



¹⁰ www.evmic.es

¹¹ http://secondlife.com/whatis/economy_stats.php

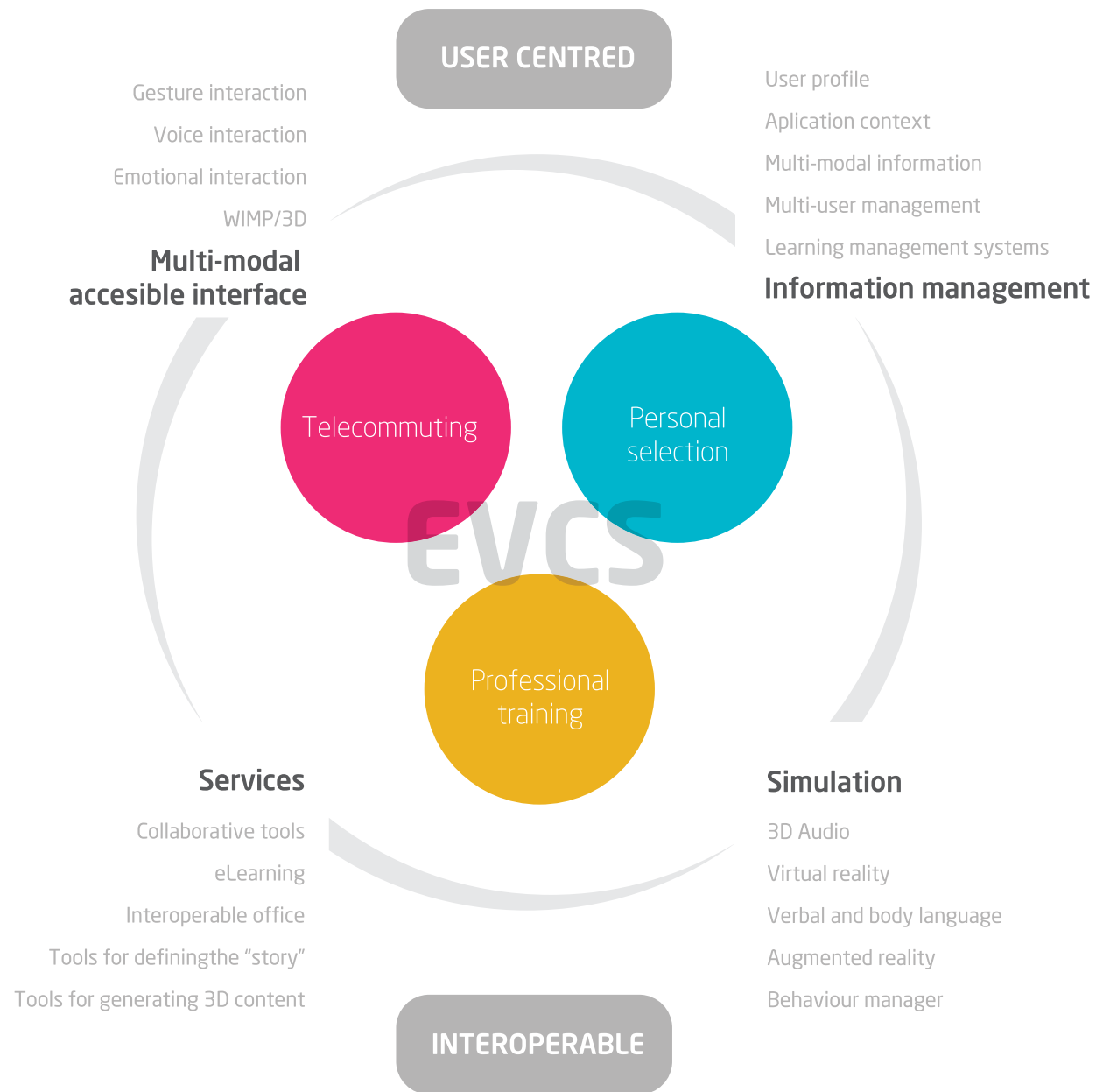


THE EVMIC PROJECT

The main axis of the project was the creation of a generic, interoperable platform centred on the user, overcoming the current limitations through four strong pillars: a new accessible interaction paradigm, information management, simulation and the services offered by the virtual world.

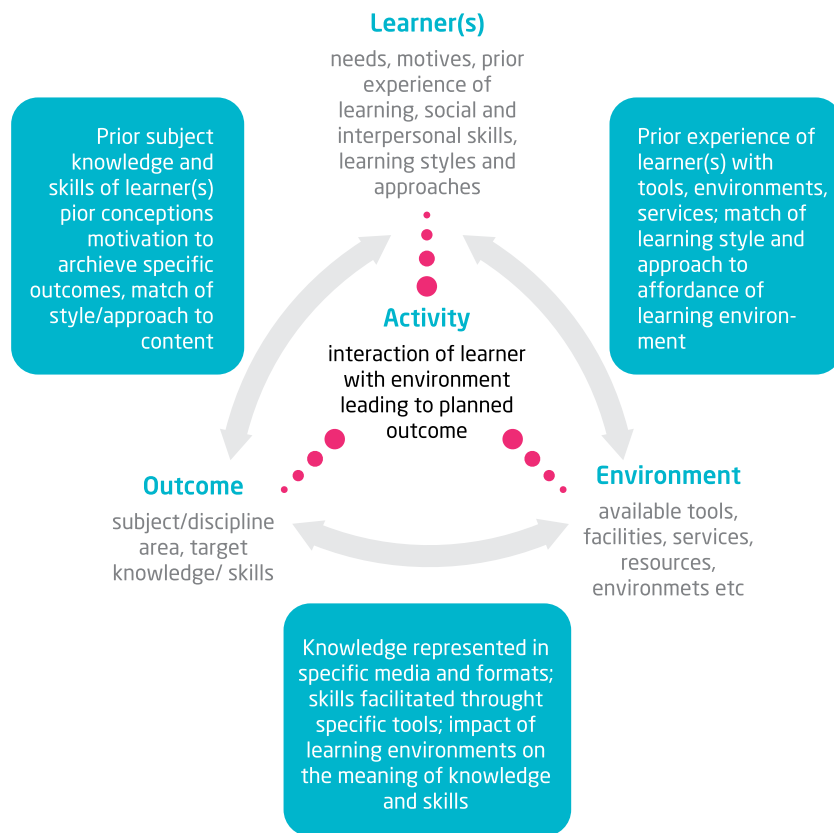
This platform will be validated in three key settings of the labour market (telecommuting, personnel selection, and professional training) but, obviously there is an enormous potential for it to be applied in all training environments (companies, public administrations and education) and in all business sectors.

The integration of new technologies such as simulation, 3D audio, photo-realism and augmented reality techniques will enrich user experiences (another aspect not currently addressed). The project will also make it possible to create new specialised and contextualised social networks that are able to provide more and better support to social activities.



THE SIMAULA PROJECT

In line with our belief that the role of a teacher in education needs to change, Indra also is also participating in the R&D SimAULA¹² project, focused on developing a new training methodology for primary education instructors (teacher training) based on exercises in 3D online environments where the teacher-trainees interact with student-avatars and plan and teach lessons in a virtual classroom. The student-avatar behaviour will be built thanks to contributions from teachers and experts in psychology and pedagogy with the aim of creating solid and constructive behaviour models for education. SimAULA is funded by the Education, Audiovisual and Culture Executive Agency (EACEA) of the European Union as part of the Lifelong Learning Programme (LLP).



The project will be particularly centred on the pedagogical aspect, and thanks to the simulations, teachers will be able to practice their teaching and management skills.

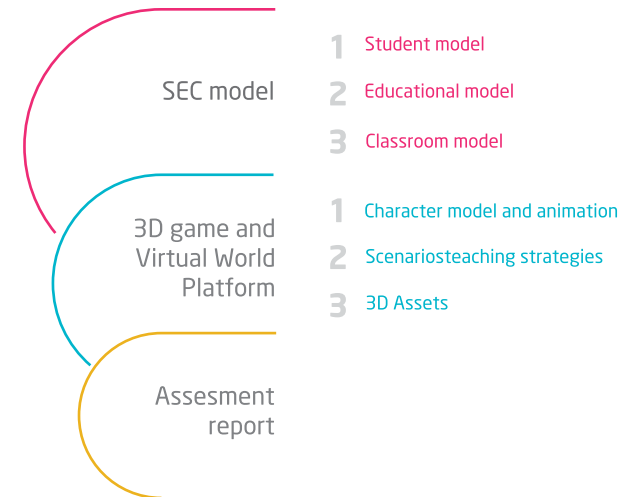


The pilot project will be carried out in Spain, the United Kingdom, Italy, Bulgaria and Greece with 200 students and 60 teachers in five languages.



Therefore, the result of SimAULA will be a training platform for trainers that will provide universities and educational centres with an innovative system for improving the skills of their teaching staffs through results-oriented exercises. SimAULA will also allow teachers to test out teaching ideas in order to see which combination of strategies best contributes to student learning. This will help to improve teaching skills through improved critical thought, creativity and "learning by doing".

"This Project has been funded by the European Commission. This publication (communication) is the sole responsibility of its author. The Commission is not responsible for any use made of the information contained therein"



¹² www.simaulaproject.eu