

New Technologies in Classroom Design: Towards European Space for Higher Education

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In this paper, we present our experiences in the use of new technologies in classroom design. The University of Cadiz is involved in the process of convergence towards European Space for Higher Education. The Engineering School (ESI Escuela Superior de Ingeniería) is adapting its structures with this objective. In this line, we have designed a multimedia classroom. This classroom has different devices, such as a teacher computer, adjustable and mobile tables for students, an overhead projector capable of projecting visibly even in full classroom lighting, a whiteboard, five laptops for being used by students, internet access through wireless network and an electronic whiteboard used as an interactive projection screen. These devices are used as tools of exploration for each lesson, as well as for contents exposition by the teacher.

Keywords New Technologies in classroom; Classroom design; Electronic whiteboard; Learning environment design; European Space for Higher Education.

En este trabajo se presentan la experiencia de los autores en el uso de nuevas tecnologías en el diseño de un aula. La Universidad de Cádiz está implicada en el proceso de convergencia hacia el Espacio Europeo de Educación Superior. La Escuela Superior de Ingeniería está adaptando sus estructuras con este objetivo. En esta línea, se ha diseñado un aula multimedia. Esta aula está dotada de diferentes dispositivos, como un ordenador para el profesor, mesas móviles y adaptables para los alumnos, un proyector fijo en el techo capaz de proyectar incluso a plena luz, una pizarra, cinco ordenadores portátiles para ser usados por los alumnos, conexión a internet a través de una red inalámbrica y una pizarra electrónica que puede ser usada como pantalla de proyección interactiva. Estos dispositivos son usados tanto como herramientas de exploración de cada lección como para la exposición de contenidos.

Palabras clave Formación Continua; E-learning; B-learning; Formación en Administraciones Públicas; Colectivos de Renovación Pedagógica. Enseñanza Virtual.

1. Introduction

The University of Cadiz is involved in the process of convergence towards European Space for Higher Education. In this university, several actions had being financed by the Andalusian autonomous Government (Junta de Andalucía) in the project called "Proyecto Europa" [1].

The Engineering School (ESI Escuela Superior de Ingeniería e Cádiz) is adapting its structures with this objective. The Engineering School has almost 2000 students. The School's vision for the future is based on learning and research excellence, producing graduates who are well-equipped to play leading roles in society. A range of specialisations are available (Mechanics, Electrical and Electronics Industrial Engineering and Informatics Engineering). In all these specialisations there are running experiences oriented to change the learning activity in order to use European Credit Transfer and Accumulation System (ECTS).

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ECTS is a student-centred system based on the student workload required to achieve the objectives of a programme, objectives preferably specified in terms of the learning outcomes and competences to be acquired. ECTS is based on the principle that 60 credits measure the workload of a full-time student during one academic year. The student workload of a full-time study programme in Europe amounts in most cases to around 1500-1800 hours per year and in those cases one credit stands for around 25 to 30 working hours [2].

It is necessary to introduce alternative approaches focused on student active learning. Students who actively engage with the material are more likely to recall information later and be able to use that information in different contexts. Activities that encourage student involvement are incorporated into the teaching plan. Example activities include: class discussion, small group discussion, debate, posing questions to the class, short written exercises and polling the class. New conceptions of the classroom are being driven by the emergence of new methods of teaching and learning.

It is a fact the impact of classroom characteristics on learning process. Students learn better in a well-designed classroom and can be distracted by a poorly designed space. But the concept of classroom is changing. Classrooms receive technology installation and so acquire new functionalities and new learning activities become possible. But technology integration does not mean merely the placement of technology equipment in classrooms. Successful integration of multimedia technology depends on the teachers' competencies and understanding of the technology use for a variety of needs of learners.

2. Learning activities

The first step in designing an electronic classroom is to determine its purpose. Essentially, learning takes place when students interact with the teacher, each other, or materials in order to gain new knowledge, complete a task, or solve a problem. An ideal classroom is multifunctional, designed to be used by different teachers, using different learning paradigms. It is necessary to design a classroom that will accommodate a wide variety of learning activities: lectures, cooperative learning and group activities, learning by teaching or presentations or lectures by students, multimedia technology in classroom, etc.

2.1 Lectures

Though lectures are much criticized, universities have not yet found practical alternative teaching methods for the large majority of their courses. Lectures are used to convey critical information, history, background, theories and equations. Usually the lecturer will stand at the front of the room and recite information relevant to the lecture's content. Critics point out that lecturing is mainly a one-way method of communication that does not involve significant audience participation. But lectures delivered by talented speakers can be highly stimulating; at the very least, lectures have survived in academia as a quick, cheap and efficient way of introducing large numbers of students to a particular field of study. Lecture can also be used when students have questions they need an expert to answer.

2.2 Cooperative learning and group activities

Researchers report that, regardless of the subject matter, students working in small groups tend to learn more of what is taught and retain it longer than when the same content is presented in other instructional formats. Students who work in collaborative groups also appear more satisfied with their classes [3]. The activity is structured so that group members are interdependent (they must all participate to succeed) and individually accountable (all members are responsible for learning). In-class problem solving in small groups or turn-to-your-neighbour are examples of activities which requires special mobility in the classroom.

2.3 Learning by teaching or presentations or lectures by students

Learning by teaching designates a method which allows pupils and students to prepare and teach lessons or parts of lessons. They choose their own methodological and didactical approach in teaching their classmates a certain area of the respective subject.

2.4 Multimedia technology in classroom

Teachers realized the needs to find effective presentation resources related to teaching content. The advantages of interactive multimedia in learning include visualizing abstract and concrete ideas by creating images, diagrams, or animations, reducing cognitive load in learning, facilitating mental representation of external objects, and improving cognitive learning for low spatial ability learners.

The use of projectors and computers in the classroom has come a long way in recent years. The introduction of this new technology revitalises whole class teaching with the traditional blackboard replaced by a new focal point. Through the use of projectors, screens, videos and a graphics computer helps students have a more active role in the learning process.

On the other hand, the use of the internet in education is growing. The Internet provides up-to-date information on a variety of classroom-related topics unavailable from other sources. A classroom with internet access must be used to show this information.

3. Classroom devices

With these considerations in mind, the classroom was equipped with different devices, such as a teacher computer, adjustable and mobile tables for students, an overhead projector, a whiteboard, five laptops for being used by students, internet access through wireless network and an electronic whiteboard used as an interactive projection screen.

3.1 Teacher computer hooked up to a projector

The teacher computer hooked up to a projector allows teachers to display computer or VCR output onto a large screen format. The overhead projector is capable of projecting visibly even in full classroom lighting. The projector is permanently mounted on a ceiling and it has one IR port on the front and one on the rear for receiving remote control signals.

3.2 Adjustable and mobile tables

The use of adjustable and mobile tables for students allows cooperative learning and group activities. In-class problem solving in small groups or turn-to-your-neighbour are activities which can be hardly programmed if the classroom has fixed tables. Classroom can be reconfigured to suit different activities if we use movable tables and chairs.

3.3 Laptops for being used by students

Classroom is equipped with five laptops for being used by students in group activities. Portable computers allow comprehensive, dynamic and easily modifiable classroom demonstrations. Nowadays, almost all computer science or engineering textbooks include a companion CD-ROM. Students of informatics engineering must be oriented towards the design of applications using programming languages and this design can be trained in classroom using laptops.

3.4 Wireless network

The advent of wireless networks across campuses fits hand-in-hand with laptop use. During a class, all the students can be simultaneously visiting specific website related to the current topic under teacher's supervision. The Internet is full of interactive and interesting sites, and hundreds of books are available online. In this line, the University of Cadiz has an electronic library [4] that allows the access to database and electronic journals and books. Access to virtual campus is also possible. In our university, we use moodle as virtual learning environment [5].

3.5 Interactive whiteboard

The most advanced device used in this classroom is the interactive whiteboard. It is an electronic whiteboard writing surface connected to teachers' computer and projector. Interactive whiteboard is used to capture notes written on the whiteboard surface. It must be used like a traditional whiteboard, using the electronic pen to write in different colours, as shown in fig. 1.

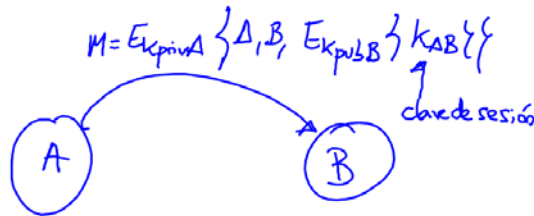


Fig. 1: Interactive whiteboard used like a traditional whiteboard.

The whiteboard pen too allows doing annotations over the screen. It can be used to add annotations to any computer-generated image displayed. These annotations can be moved using click and drag and can be saved as a file. Figure 2 shows annotations over an image.

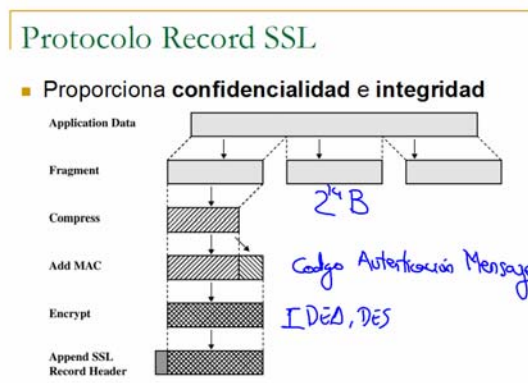


Fig. 2: Annotations over a image.

Finally, the pen also can be used as computer mouse. The interactive whiteboard can be used to operate any software that is loaded onto the connected PC, including access to the internet via a web browser. So, it is possible to emulate the operation of software on a PC. The computer can be controlled via the board; when the pointer is detected by the sensors of the board, the cursor points to that location.

Our whiteboard has the video projector in front it, if the presenter must stand in front of the screen their body will cast a shadow, but this is the only disadvantage.

5. Conclusions

It is a fact the impact of classroom characteristics on learning process. Students learn better in a well-designed classroom and can be distracted by a poorly designed space. In any design of a classroom, a high number of variables may affect the outcome. We have adapted an existing classroom equipping it with different devices, such as a teacher computer, adjustable and mobile tables for students, an overhead, laptops, wireless network and an interactive whiteboard and so acquire new functionalities.

But technology integration does not mean merely the placement of technology equipment in classrooms. In this process, the first step was to determine its purpose. We ever have in mind that classroom may be used by different teachers, using different learning paradigms, so it may accommodate a wide variety of learning activities.

A more detailed analysis of this experience can be found in [6].

Acknowledgements The authors thank to Juan José Domínguez Jiménez, Rafael Bienvenido Bárcena, Juan Manuel Barrientos Villar, Jose Luis Isla Montes, Manuel Laguía Bonillo, Félix Reyes Fernández and Miguel Rodríguez Rodríguez, members of the Technical Support Workgroup.

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