The virtual calendar of learning activities as an educational tool

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Abstract

The teaching methodology being promoted via the creation of a common European Higher Education Area means taking the student's work into account. In this sense, and in order to support students' learning process, a procedure was developed that involved drawing up calendars of activities based on teaching guides for courses that are already expressed in ECTS, that is, in which information is provided on how much time students should spend on both classroom and independent learning tasks. This article presents this process of transformation and the first experiences in using the learning activities calendars as a tool to help students adapt to the new teaching methodologies, foster the development of transversal skills such as time management and taking responsibility, improving aspects of specific competences, and, in short, make students active agents in their learning.

General area of interest of this innovation

The method of drawing up activity calendars that is presented herein might be useful for any professor who has to overhaul syllabi in accordance with ECTS to ensure that it is comprehensive and universally understandable. It might also be of interest as an example of the use of calendars, in view of using them as a tool for developing certain student skills.

1. Objectives

The ultimate goal of the study presented in this article is an educational environment in which ICT is used to support students' learning, and in which professors are in charge of guiding students in this process. The project's mission is to offer whatever is needed to draw up learning guides for courses around which the educational environment described above is organised.

Given the fact that this environment is more difficult to create in large groups where the professor/student ratio is lower, the study has striven to resolve the problems of creating learning guides for large classes. For example, the course Fundamentals of Computers from the Technical Computer Management and Systems degree was taken as the course used in this study, which is taken in the first year of the degree programme and in recent years has had an average of 200 students per class.

This project is addressed to students in the first few years of their degree programmes, because they are the ones that are likely to have the most difficulties learning how to manage their own time and take responsibility for their learning process, as well as because they are the ones that receive the least personalised attention. The ultimate goal is to achieve as easier transition between a more guided and directed educational system and one that requires a higher level of maturity.

The main goal is thus to offer students in large classes a learning guide that facilitates this process, as mentioned by Ribas and Velasco (2007). This goal can be divided into two partial goals in two different realms: developing the guide and developing specific, transversal skills in students. All of this is ultimately aimed at attaining a higher teaching level, which in turn translates into more effective learning by students, as well as into a rise in academic performance.

In terms of developing the learning guide, the goal is to create a procedure for generating calendars of learning activities (learning guides) based on the teaching guides in ECTS, and designing the «views» that are presented to the professors and students.

With regard to the students' goals, the idea is to give them more personalised attention, to improve the development of specific abilities that are related to practical skills and to make it easier for them to develop transversal skills that involve time management and taking responsibility and that foster a proactive attitude towards the learning process.

Therefore, the overarching goal is for students to take a proactive role in their learning, that is, for them to take action when they notice that their development is not following the guidelines set in the guide or when they have not done the activities they should have. In the end, the goal is for them to be aware of how their learning is evolving and to take actions that help them to keep progressing properly. With this, they will also take responsibility for the learning process and develop a commitment to achieving the milestones set for them.

In order to get students to adopt this attitude, it is a good idea to turn teaching guides into learning guides. This transformation means adapting the contents of the teaching guides and, ultimately, synchronising the learning activities and the resources needed to perform them.

2. Description of the project

With the introduction of teaching methodologies based on student work, we have had to adapt the teaching guides to the courses. In the Computer Engineering and Technical Computer Engineering degree programmes, these guides must include the goals, skills, syllabus and evaluation systems. Plus, this information must be complemented by additional information, such as the workload of each activity, the calendar of classroom activities, the professors and references to materials that are available for students.

The study that has been conducted took advantage of the teaching guides to draw up calendars of activities that students must complete. The calendars should make it easier for students to follow a given course, and they should also help them to organise their time accordingly.

The contents of the teaching guides are classified into those related to teaching and learning and those related to resources (professors, places and times, materials, etc.). Therefore, a way of synchronising activities with resources is presented in order to yield a calendar of activities for the corresponding course.

During the first term of academic year 2007-08, the calendar of classroom activities was used in the course Fundamentals of Computers from the Technical Computer Management and Systems degree. Taking advantage of this experience, a computer programme was developed to synchronise the activities on the teaching guides with the resources that are available for students of a given course in a given year. The hope is that for the forthcoming terms, each student can have an individualised calendar of classroom activities for each course they are taking.

2.1. Background

This study was based on a previous study conducted in academic year 2005-06 in which the model of a teaching guide for courses in the first few years of the Computer Engineering degree programme was analysed in order to determine whether it contained enough information for students to be able to draw up their own learning calendar. It is worth mentioning that, based on the fact that this degree was part of the pilot DURSI project on adapting the degree programmes to the EHEA, the teaching guides were already written in ECTS terms.

What is more, in certain courses with few students (fewer than 40), trials involving publishing the dates and times of all the classroom activities for the students had already been successfully run.

2.2. Implementation

With these experiences as the backdrop, a project aimed at improving teaching quality was launched with the goal of increasing the degree of individualised attention to students in the first year of the degree programme in order to get them to become more aware of their own learning process and make it easier for them to adapt to the new teaching methods.
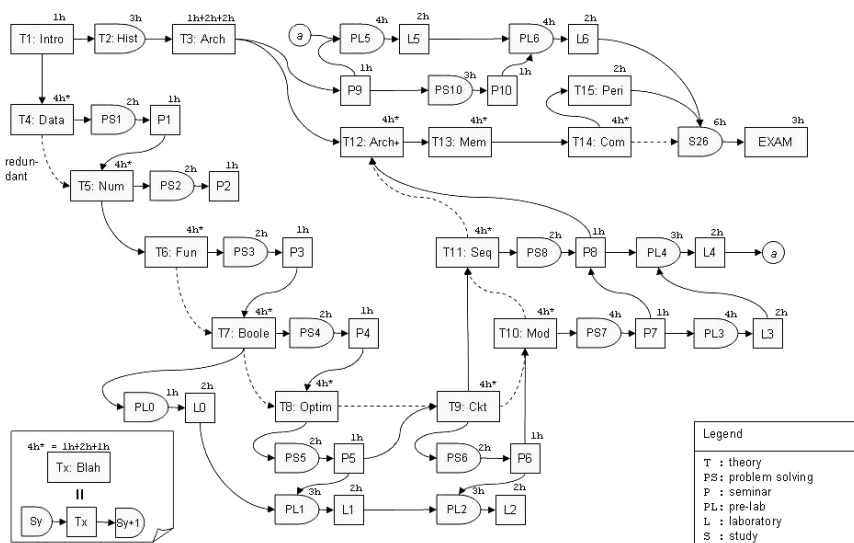
In the first year this project was applied, a series of tasks was begun, all of them aimed at offering students enough mechanisms for them to be able to easily track their own evolution during the course.

Therefore, efforts got underway to systematise the generation of learning calendars with views to future automation, as well as a preliminary trial as part of the course entitled Fundamentals of Computers.

Generating the learning calendars (Ribas *et al*. 2006) was organised so that first the information on the ECTS teaching guides would be studied and classified. Then, with the model extracted from this, a computer application would be developed that would try to synchronise activities and resources.

The division into learning activities and the resources needed to perform them resulted from the first stage. This separation enables professors to concentrate on designing a solid learning plan for students rather than on related details. This plan can be illustrated with a graph of activities in which the relationship (dependency) among the activities can be shown visually. Making the resources independent also means that it is a relatively constant element throughout the terms when the course is being taught.

Figure 1. Graph of learning activities in the Fundamentals of Computers course

Plus, all guides include «tables of resources» which indicate the resources available in a given term for a given course. These tables usually include a variety of resources of given lengths and times, such as the weekly timetables, which also shows the classroom and type of activity (theory, problems, lab practices, etc.). There are also tables showing a list of the professors with the type of classes they teach and their office hours, or others with links to the support material, such as Internet links and bibliographic references.

In the ECTS teaching guides, it is common to indicate a sort of «weekly learning cycle» which shows a timetable indicating not just the classroom activities but also independent learning activities. In this way, students have a clear reference to the work they are expected to accomplish.
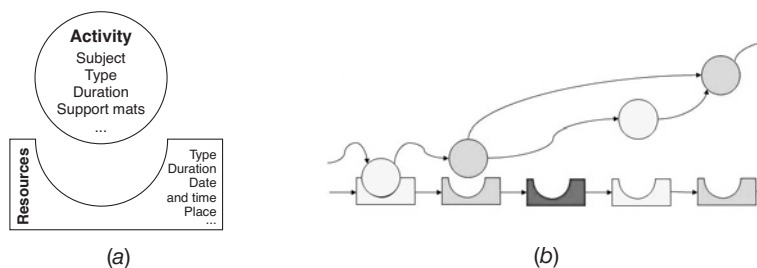
In short, the resources are grouped according to the type of activity. Unfortunately, the information is rarely presented in an integrated fashion, that is, in such a way that a single timetable includes the type of activity, the time it starts and finishes, the venue, the link to the support material and the professor in charge of it for each table entry. It should be said that this type of table could only be valid for a given set of students or, if independent learning activities are included, for each individual student.

The addition problem with the use of timetables is that they tend to be weekly. That is, they may vary throughout the academic year either because some activity may be held with a certain frequency (such as biweekly lab sessions) or because there are holidays, or indeed any other reason.

In this sense, when preparing the learning activities, it is a good idea to draw up a list of groupings of resources throughout the entire academic term in which a course is being offered.

Synchronising each of these groupings and the learning activities consists of associating each activity with the resources needed to perform it. This assignment can only be done if the group of resources is for an activity of the same kind, if the length of the activity is less than or equal to the amount of time available in the resources, and

Figure 2. The synchronisation between activities and resources (a) can leave some groups of resources idle (b)

(a)   (b)

finally if this assignment does not break the sequences between the activities shown on the corresponding graph. (There might be more restrictions, but these are the basic ones.)

Formalising the synchronisation procedure has enabled it to be partially automated, as explained in the article by Pérez and Ribas (2007). The computer application that was developed does not take into account the independent learning activities, because this would mean having to include individual information for each student. That is, in order to achieve full synchronisation, we must take into account the groupings of resources that affect independent learning activities and that therefore depend on, among other factors, the students' extracurricular schedule.

Still, the synchronisation of activities and groupings of resources was manually systematised for the course Fundamentals of Computers in the Technical Computer Engineering (Management and Systems) degree programme. Additionally, the students' visualisation of the calendar was examined, using both ad hoc systems and virtual learning environments, such as set forth in the article by Moncada and Ribas (2007). The following section describes the methodology used in further detail.

3. Methodology

The goal was to increase the degree of individualisation for students in Fundamentals of Computers as a way of getting them to become more aware of their own learning process and help them adapt to the new teaching methodologies

In academic year 2006-07, this course, which is taught at the School of Computer Studies of Sabadell, was adapted to the ECTS teaching methodology, as were all the first-year courses. In addition to changes in the teaching style and students' way of learning, this also meant the chance to seek mechanisms that would enable students to better adapt to this kind of learning.

Since there was no automatic synchronisation system among groups of resources and activities, and since it was not feasible to synchronise them manually because around 200 students take this course, the decision was taken to make a calendar of classroom activities.

To ensure that the students would follow this calendar, we decided to publish all the support material on the calendar. In this way, the students had to go look for the presentations from the teacher-led classes, the lists of problems and the scripts for the lab sessions on the calendar. The goal was to make students more aware of their learning process. The other factor that was developed was the gradual creation of links. With this, in addition to contributing to the first goal mentioned above, the second goal was for students to also have a guideline that would clearly describe the independent learning activities. For example, before a problems seminar they had to download the corresponding list of problems and solve them. (These lists included the solutions, which the students could use as a guide.)

Finally, the calendar would appear as a table in which each row corresponds to a week and each column to a type of activity. Unfortunately, this is not the best solution, but it is the most feasible given the fact that it must be drawn up manually. Additionally, it is simple to interpret and easy for students to understand.

Figure 3. Start of the table that contains the calendar of classroom activities

Set-mana	Dies: Activitat	Tema	Seminaris	Laboratoris + projecte
1	24 09 07	25: T1-T3 27: T4 (!) 25: T1 (!) 26: T3	**T1. Introducció.** Història dels computadors.	**T3. Arquitectura dels computadors.** Organització general d'un computador. Arquitectura de Von Neumann. Estructura d'un processador: Memòria i CPU.	(Organització grups.)
2	02 10 07	04: P1 03: T4	**T4. Representació de la informació.** Tipus de dades. Nombres naturals i nombres fraccionaris. Canvis de base.	Problemari P1.	Oferta dels grups.
3	08 10 07	09: T5 11: P2 09: P1 10: T5	**T5. Representació de nombres.** Nombres binaris enters.	Problemari P2.	
4	15 10 07	16: T6 18: P3 16: P2 17: T6	**T6. Funcions lògiques.** Portes bàsiques. Expressions lògiques.	Problemari P3.	Assignació d'alumnes a grups.
5	22 10 07	23: T7 25: P4 23: P3 24: T7	**T7. Àlgebra de Boole.** Definició, propietats i teoremes derivats. Lleis de DeMorgan.	Problemari P4.	1. Presentació del projecte i eines.
6	29 10 07	30: T8 30: P4 31: T8	**T8. Optimització de funcions.** Maxtermes i mintermes. Representacions canòniques. Mapes de Karnaugh.	Problemari P5.	

In order to make the calendar, first we had to design the graph of learning activities, without the assigned resources, and then we had to assign days and times to each one according to the weekly timetable of the course.

In parallel, small applications were developed to synchronise activities and resources and to show the calendar with a module integrated in Moodle (www.moodle.org). In any event, this development only aimed to be an initial step towards a feasibility study for the end product, which in fact remained outside the scope of the project to improve teaching quality.
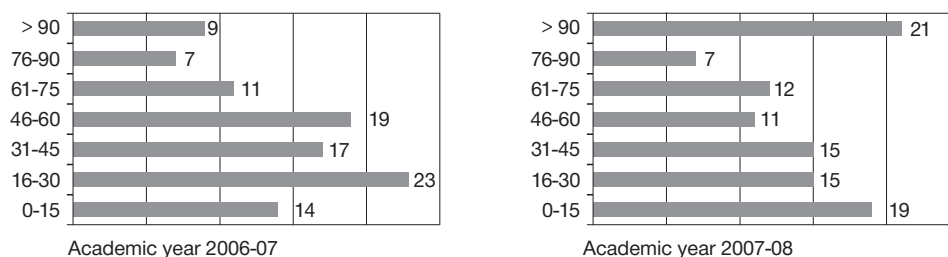
4. Results

Developing the synchronisation and visualisation tools for the learning calendars contributed a great deal towards organising the information that is provided in the ECTS teaching guides, and it has enable a set of XML files to be designed that can store all of the data involved in the learning process.

The calendar of classroom-based learning activities in the guise of a table was used in academic years 2006-07 and 2007-08. The students could check it via the area set aside for the course on the UAB's virtual campus. Students' tracking of the calendar was more than satisfactory. In both academic years, more than 60 % of the students checked the calendar three or more times per week on average. This means that they regularly downloaded the support material as it was activated. Unfortunately, no

figures were gathered that could serve as indicators of whether or not the independent learning activities were pursued. The professors' impression was that indeed the vast majority of students attended the classroom activities with the support material printed out, but that only a minority did the previous independent learning activities using the material provided.

Figure 4. Percentages of students according to number of hits on the calendar

Academic year 2006-07   Academic year 2007-08

However, the notable improvement in teaching was seen in the lower number of incidences and queries as to how the system works. Still, this was not due so much to the exhaustive planning as to the fact that it was in calendar format.

Finally, the positive news is the academic performance. In academic year 2006-07 5 % more students passed the course, and in academic year 2007-08 an additional 5 % passed, with one examination period still pending.

5. Conclusions

This study presents a systematic way of synchronising learning activities with the resources needed to perform them. To following this procedure properly, the information in the ECTS teaching guide should be suitably organised. In fact, what we achieved was to formalise both the structure of the information and the process of synchronising it, in an effort to present students with a learning calendar. Formalising the organisation of the teaching guide meant defining a series of XML files. However, even more importantly it meant being able to show the professors in charge of the teaching guides a coherent organisation which many of them already used intuitively.

Separating the learning activities from the resources needed to perform them also allows professors to focus on designing the learning instead of squandering time in details about the resources. Obviously, when preparing the learning guide for the students, professors must take into account the restrictions based on the groupings of resources they can make.

A small application to automatically synchronise activities and resources was developed, which obeys the principles of assigning resources to the activities that were

mentioned previously; that is, the association is made as long as the sequences among activities are not broken and the type and length are compatible. Unfortunately, the starting point of this application is XML files, which yield other XML files. Since this is a format designed to represent data and transfer them among applications, more than to interact with humans, one thing that must be done is to develop user interface programmes. With this purpose in mind, there is also a small application integrated with the virtual learning environment Moodle to show the calendar of activities.

Parallel to these efforts, a case study in the use of the learning calendars was also prepared and applied in the course entitled Fundamentals of Computers in the Technical Computer Engineering degree programme during academic years 2006-07 and 2007-08. Drawing up these calendars served to set the basic mechanisms for systematising them, which was then used to develop the applications mentioned above.
The overall goal of the project to improve teaching quality is to make it easier for students to adapt to the first few years of their university degree by offering them individualised attention. Especially in the case of courses with many students, such as Fundamentals of Computers, the mechanism that we tried to use is the learning calendar.

In academic year 2006-07, dovetailing with the first experience using a teaching guide, the result was positive in terms of students' academic achievement, as well as because the calendars contributed to lowering the number of questions on how it works. However, there was a great deal of inertia among the students who were repeating the course. In the following academic year, however, this did not take place and there were practically no incidents in terms of following the learning guide. What is more, academic performance improved a little more, and compared to previous years this improvement is significant.

In the forthcoming academic year, we hope to consolidate the good results of this experience. Efforts will also be made to improve the "visualisation" of students' learning process, most likely using a system of files containing activities with further detail that are as personalised as possible. We are confident that this new action will further strengthen this teaching tool, which, judging from the results to date, significantly helps students to achieve the goals of the course.

Full individualisation, with resources that will depend on each student, requires the synchronisation to be automatic. Even though this goes beyond the scope of the project aimed at improving teaching, it would highly desirable to be able to fully individualise these calendars in the near future.

References

DEPARTAMENT OF EDUCATION AND UNIVERSITIES (2006). *Pla pilot d'adaptació de titulacions l'espai europeu d'educació superior*. Barcelona: Autor. 14th of January. [website: http://www10.gencat.net/dursi/ca/un/eees_pla_pilot.htm]

MONCADA, J. L. and RIBAS, Ll. (director). (2007). *Adaptació d'un gestor de continguts per a agendes d'aprenentatge*. End-of-degree project in Computer Engineering. Bellaterra: UAB.

PÉREZ, M. I. and RIBAS, Ll. (director). (2007). *Agendas de actividades de aprendizaje*. End-of-degree project in Computer Engineering. Bellaterra: UAB.

RIBAS, Ll.; OLIVER, J.; TOLEDO, R.; VELASCO, A. J.; FERRER, C. and VALDERRAMA, E. (2006) *Del calendari de la planificació docent a l'agenda d'aprenentatge*. 4th International Congress on University Teaching and Innovation (Abstracts of papers). Vol. 2, pp. 632. Barcelona, 5th–7th of July.

RIBAS, Ll. and VELASCO, A. J. (2007). *La agenda de aprendizaje como herramienta de adaptación a la metodología educativa en ECTS del EEES*, XIII Jornadas de Enseñanza Universitaria de la Informática (JENUI). Teruel, 16th-18th of July.

Currently, learning calendars have been used for the courses Fundamentals of Computers in the Technical Computer Management and Systems degree, and students have access to the calendars via the UAB's virtual campus. On the website http://microlec.uab.es/ribas/edu/fc_euis, you can find the teaching guide for the course, with the calendar of classroom activities and the schema of a graph showing the learning activities that the students in this course must complete.

Interesting links
· http://microelec.uab.es/ribas/edu/fc_euis/ [2008]

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Teaching scheduling, student guides, time management, learning calendars.

Financing

Supplementary materials on the CD-ROM
Demonstration of activity files for Basic Computing subject.

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Presentation of the project leader

Lluís Ribas has been involved in issued related to organising teaching since 1997, especially on the issue of the use of ICT to facilitate students' learning. Based on the experience of the UOC (Open University of Catalonia), he worked on the concept of the calendar of learning activities, which for now has culminated in this article. He has also participated along with other professors on the working groups of the two teaching innovation projects mentioned above, on the first courses that were developed following ECTS criteria for the degree programme in Computer Engineering, as part of the DURSI pilot plan to adapt the degree programmes to the EHEA. Additionally, the author is the teaching coordinator of the first year in the Computer Engineering (2005-) and Technical Computer Management and Systems (2007) degree programmes.

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