TIMED MIND MAPS USING MINDMANAGER & MSPROJECT FOR EDUCATIONAL INNOVATION

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Abstract

The adaptation to the European Higher Education Area (EHEA) is becoming a great challenge for the University Community, especially for its teaching and research staff, which is involved actively in the teaching-learning process. It is also inducing a paradigm change for lecturers and students. Among the methodologies used for processes of teaching innovation, system thinking plays an important role when working mainly with mind maps, and is focused to highlighting the essence of the knowledge, allowing its visual representation. In this paper, a method for using these mind maps for organizing a particular subject is explained. This organization is completed with the definition of duration, precedence relationships and resources for each of these activities, as well as with their corresponding monitoring. Mind maps are generated by means of the MINDMANAGER package whilst Ms-PROJECT is used for establishing tasks relationships, durations, resources, and monitoring. Summarizing, a procedure and the necessary set of applications for self organizing and managing (timed) scheduled teaching tasks has been described in this paper.

Keywords: system thinking, temporal mind maps, precedent systems, MindManager, Ms-Project.

1 INTRODUCTION

The efforts made in educational innovation for implementing the European Higher Education Area (EHEA) are the reason for the innovative initiative presented in this paper. The need for coordinating different teaching activities present in long duration subjects dealing with a high number of exercises, practical work, supervised work, and where several lecturers are involved suggests that computer tools can help in carrying out such coordination tasks. Since the authors have a significant previous experience in the practical implementation of systemic thinking (mind maps [4]) and project management in different areas of teaching and technology transfer, the use of computer applications from those areas appear as good candidates for these coordination tasks. For this purpose, MindManager [11] and Ms-Project [10] software packages have been used in order to provide a scheme and the work breakdown structure of a scheduled process, so that lecturers, tutors and students participate jointly and synergistically in order to develop organized and scheduled subjects. Mind maps can significant add to the quality of university teaching as they promote meaningful learning. This technique is preferred to concept maps which are used for similar purposes in reference [6].

Authors are convinced that the transition to the EHEA should be inspired on the theoretical foundations of systemic thinking and on the energy transmitted by radiant thinking, among others. Therefore this change should be based on project management expertise and on mind maps operational and motivating capacity, so that the different agents of change are efficiently implied.

2 METHODOLOGY AND RESULTS

L. von Bertalanffy [2] states that in systemic thinking the whole is greater than the sum of its parts. This is the opposite of reductionism, i.e. 'a philosophical position that a complex system is nothing but the sum of its parts, and that an account of it can be reduced to accounts of individual constituents' (INTERS, 2007 -Interdisciplinary Encyclopedia of Religion and Science). Systemic vertical thinking, horizontal, in depth and circular (so that connections between parts are feedback loops) that defy,

examine and clarify the common forms of analytical thinking; it is most similar to our own minds. Additionally, systemic thinking deals primarily with so-called "mental models" which means that usually our ideas, strategies and primitive perspectives participate in the different aspects of our usual life. These models are referred to as "mental" since they reside in our mind fed by our expertise and directing our actions [16].

Therefore, systemic thinking can be considered as a theoretical-practical reference which confers consistency and perspective to the radiant thinking, highlighting the essence of our knowledge, and organizing it visually by means of mind maps [3]. When these maps are completed with the time involved in each activity, it results in a new concept called "timed mind maps".

Nowadays, it is well known that with some given software tools, it is possible to plan a specific subject without huge efforts, achieving significant improvements in programming and effectiveness during its execution. The markets offer an amount of methodologies, tools and techniques helping organizations in the task of requirements specifications, as well as in project analysis, design, monitoring and control. In turn, methods, tools and techniques for educational projects management are not so common. It is understood that planning a particular subject requires the ability to design the development of educational intervention, ordering tasks within a given time limit, in order to achieve objectives through the development of proposed activities within the subject.

In our university degrees, MindManager and Ms-Project software tools have been applied to the Mathematics subject (Maths I) taught during the first course of the B.Sc. in Landsurveying at the Engineer's School for Landsurveying, Geodesy and Cartography of the Technical University of Madrid (UPM). This subject has a face to face dedication of 210 hours during two consecutive semesters. Six lecturers are involved teaching 4 groups of students, and are constantly concerned about teaching improvement and innovation. In fact, all these groups are assessed continuously.

As it has been already mentioned, two general purpose software tools for project management and innovation have been used. Although in literature, the most usual references dealing with Mind maps are related to creativity strengthening [8,13], in the current work, they are linked to the timed management of activities, so that mind maps generated with MindManager attain mainly an organizational value previous to scheduling and monitoring. Research has also been done on concept mapping as an assessment tool [5,7,15] and as a way to assist academics in course design [1]. Several empirical studies have ascertained the validity of the use of concept maps [9,14].

These tools have been used to implement the following procedure. First, similarly to [1], a scheme has been generated with the breakdown of all activities needed for teaching this subject: teaching objectives, presence sessions, exercises, tutelage, exams, etc. Second, all these activities are registered with the required execution time. Therefore, a timed process has been designed for teaching all activities of the given subject.

Figs. 1 and 2 depict two examples of the breakdown diagram using MindManager and MS-Project tools for matrices and spherical trigonometry themes, respectively. Fig.1. shows a Timed mind map for topic 'Matrix Algebra' using MindManager, whereas in Fig. 2. a timed breakdown diagram for 'Spherical Trigonometry' topic   using MS-Project can be appreciated.

Furthermore, with Ms-Project a precedence system within the tasks of this particular subject can also be established, where the necessary resources (classrooms, lecturers, multimedia gear, etc.) can be associated, defining the academic calendar and delivering a foreseen subject timetable. In figure 3, it can be observed how black lines indicate total time in 'week' units for the different groups of activities, and red color bars denote the time in 'minutes' for each of the considered activities.

In figure 3 Gantt chart, it should be distinguished between the initial planning and the monitoring. For initial planning, the following actions are reflected: a) Start – End for each activity, b) Assessments plan, c) Meetings plan, d) Tutorials plan. This plan provides, mainly to students, the following advantages: a) Time schedule of all matter contents with their foreseen dates, assessments, achieved marks, etc. b) Plan tested by other groups of students, which have included improvements, c) Tutorials control, d) Frequent questions, e) Needed (Actual, real) time for solving exercises, practical work, etc.

In the software tool, the monitoring this process is carried out by defining the so named "base line", which allows to update the schedule weekly or daily. Since these tasks are organized with a precedence system, the tool updates automatically the actual plan, assigning new dates for all pending activities.

Fig.1. Breakdown diagram for 'Matrix Algebra' topic with time schedule and resources (MindManager): Timed mind map.

Fig.2. Breakdown diagram for 'Spherical Trigonometry' topic with time schedule and resources
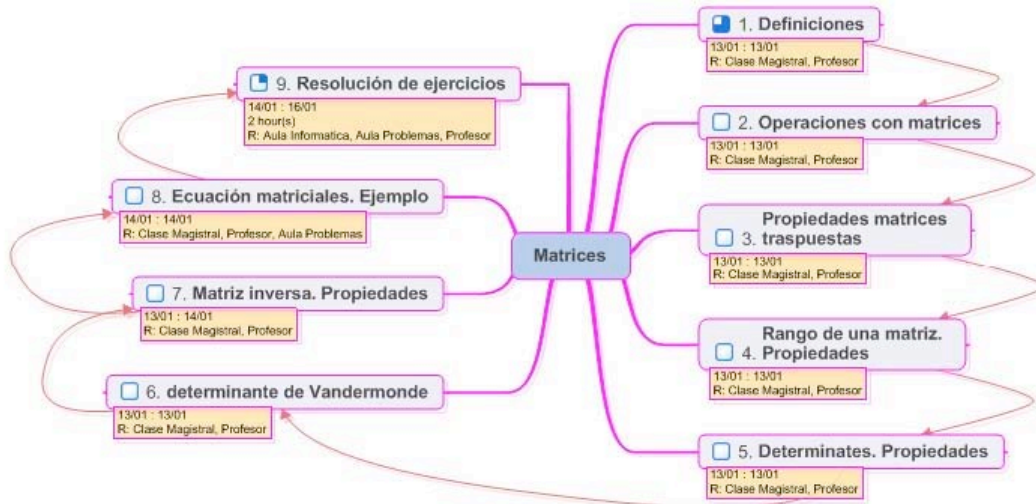
(MSProject).

Fig. 4 depicts an example of such "base line" applied to the previous situation, where it is possible to appreciate that by changing the units of the temporal scale to minutes, the software tool performs an updated plan of the activities. In addition, it is worth to note that for each task, the bars are
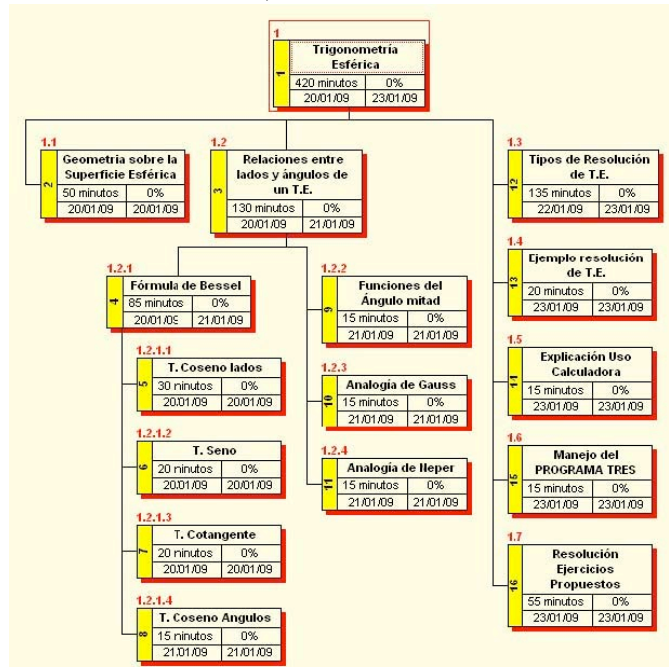
represented horizontally by means of two colors: the horizontal black bar on bottom side is the "base line" coincident with the initial schedule, whilst the horizontal blue or red bar on the top side indicates whether the task has been accomplished or is still pending, respectively. It is necessary to point out that for grouped or set of tasks, the side bars are represented in black and hashed black colors, informing about foreseen and consumed time for these groups of tasks respectively (Fig 4.).

It is also possible to quantify and classify all the resources needed to plan a particular subject. Fig. 5 shows a pie chart of such distribution for the considered subject (Maths I), where it is possible to appreciate the mentioned resource quantification. In turn, this information is capital for the Academic Affairs Service, so that it can plan efficiently this and other complementary resources.

Fig.3. Timed theme 'Spherical Trigonometry'.

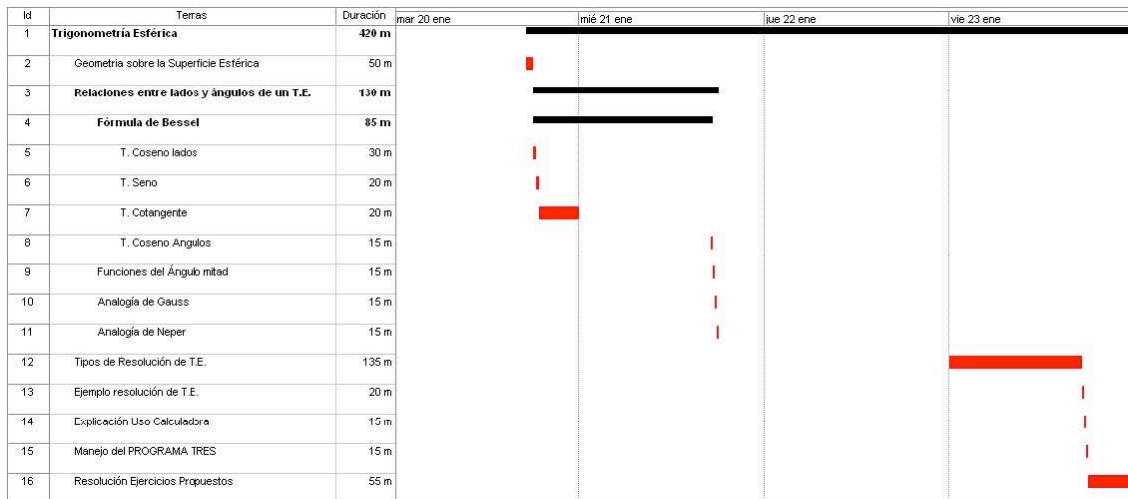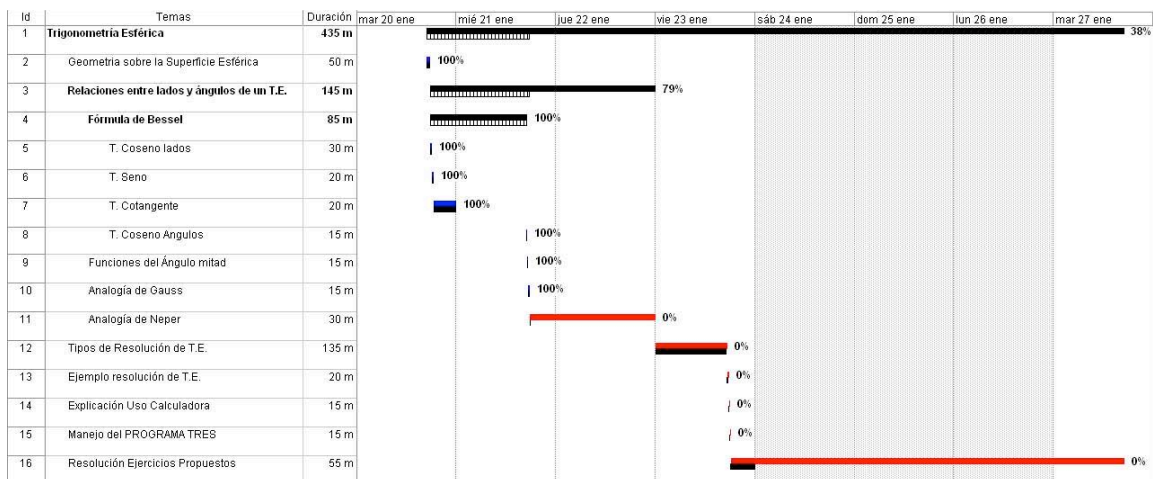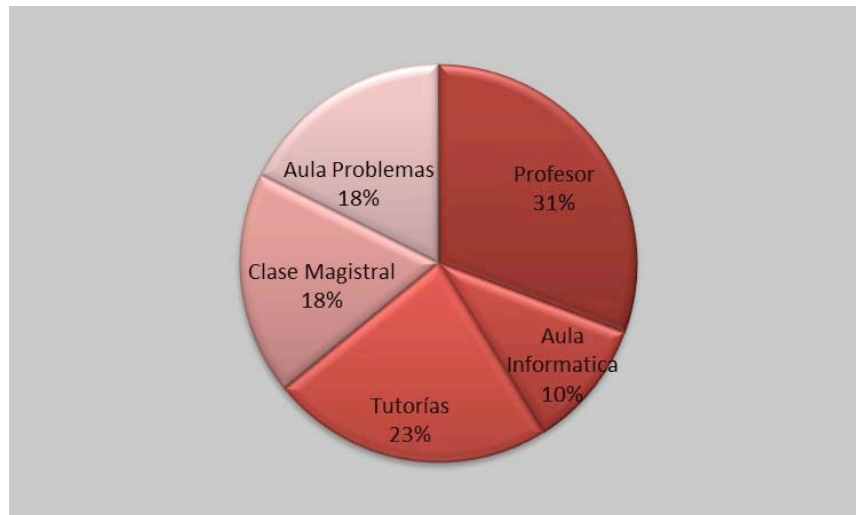| Id	Temas	Duración	mar 20 ene	mié 21 ene	jue 22 ene	vie 23 ene
1	Trigonometría Esférica	420 m				
2	Geometria sobre la Superficie Esférica	50 m				
3	Relaciones entre lados y ángulos de un T.E.	130 m				
4	Fórmula de Bessel	85 m				
5	T. Coseno lados	30 m				
6	T. Seno	20 m				
7	T. Cotangente	20 m				
8	T. Coseno Angulos	15 m				
9	Funciones del Ángulo mitad	15 m				
10	Analogía de Gauss	15 m				
11	Analogía de Neper	15 m				
12	Tipos de Resolución de T.E.	135 m				
13	Ejemplo resolución de T.E.	20 m				
14	Explicación Uso Calculadora	15 m				
15	Manejo del PROGRAMA TRES	15 m				
16	Resolución Ejercicios Propuestos	55 m				

Fig.4. Monitoring of "Spherical Trigonometry" theme scenario, after a particular activity time modification. Fig.5. Maths I subject resources distribution chart (first semester)

Id	Temas	Duración	mar 20 ene	mié 21 ene	jue 22 ene	vie 23 ene	sáb 24 ene	dom 25 ene	lun 26 ene	mar 27 ene
1	Trigonometría Esférica	435 m								38%
2	Geometria sobre la Superficie Esférica	50 m	100%							
3	Relaciones entre lados y ángulos de un T.E.	145 m		79%						
4	Fórmula de Bessel	85 m	100%							
5	T. Coseno lados	30 m	100%							
6	T. Seno	20 m	100%							
7	T. Cotangente	20 m	100%							
8	T. Coseno Angulos	15 m		100%						
9	Funciones del Ángulo mitad	15 m		100%						
10	Analogía de Gauss	15 m		100%						
11	Analogía de Neper	30 m			0%					
12	Tipos de Resolución de T.E.	135 m				0%				
13	Ejemplo resolución de T.E.	20 m				0%				
14	Explicación Uso Calculadora	15 m				0%				
15	Manejo del PROGRAMA TRES	15 m				0%				
16	Resolución Ejercicios Propuestos	55 m								0%

3 CONCLUSIONS

Due to the challenges raised by the EHEA in organizing teaching staff and students, it is essential to experiment with new methods and tools to facilitate the teaching process. "Timed Mind Maps" are tools designed for active and participative teaching models based on systemic thinking philosophy. They have been presented through a practical application in a Mathematics subject in an Engineering degree. We have tried to demonstrate how "Timed Mind Maps", created using software packages like MindManager and MsProject, are able to provide basic tools that help lecturers in self organizing and managing teaching activities and resources.

We believe mind maps can significant add to the quality of university teaching as they promote **meaningful learning.** Among their main applications are: design of the academic subject program, activities and resource scheduling and monitoring by lecturers, increased student motivation to introduce mind mapping as a teaching methodology, provide information on the subject in real time to students, centralize in a single document support all existing virtual documents on the subject, resources (lecturers, rooms, …) management, etc.

As future steps, we think Ms-Project files can be used to monitor the effort that students are dedicating to each subject; work measurement is a crucial aspect of the adaption to EHEA. We aim at exploring the possibilities that this software provides for its concurrent use by all the students in order to monitor their effort and targets meeting while simultaneously acquiring skills in Project Management techniques.

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