The educational modeling contributions to the software engineering teaching according to the experience in the new computer schedule of courses at the University Jaume I

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Abstract

Purpose: The aim of the present study is to analyze the progress of the students from the learning of Software Engineering at the University Jaume I (UJI), Spain. And from this teaching experience, to get to know the best way to improve the teaching of Software Engineering.

Results: The new schedule of courses in computer science has been applied during four years at the University Jaume I. From the teaching experience of the subjects forming the thematic area of Software Engineering at the UJI, we have observe that the progress of the students has been decreasing since the first year. These unsatisfactory results have made us consider a change in our teaching practice.

Conclusions: According to the obtained statistic results, we deem it necessary to think of improving our actual teaching techniques and to incorporate new Software Engineering tools, in order to support students in the understanding of Software Engineering courses.
1 Introduction

The University Jaume I - (the letters UJI will stand for it from now on in this paper) - was founded the 19th of February of 1991 [9] from University College of Castelló, previously belonging to Valencia University. Among the several areas offered, The Technology and Experimental Science Higher School was created to answer the demand of technical studies here there are included our two Computer Engineering courses: "Ingeniería Técnica en Informática de Gestión " (from now ITIG), which is distributed in a period of three academic years, and "Ingeniería Informática", (from now II) , which spans five academic years.

In this paper we will only contemplate the subjects included the subjects included in the thematic area of Software Engineering [14]. The contents of them are listed in the "Real Decreto..."[3] and the resolutions of the 20th of July 91 (BOE.[1][2]) and the further expanding of the UJI schedule [12][13]. The main aim of this thematic area is that the students reach the correct and sufficient knowledge and training to be able to face the study, development and control of any software project in their future professional career [7].

In the UJI Software Engineering as a compulsory thematic area includes two subjects in ITIG:
- F45: Systems Analysis and Design I (750 teaching hours, which 400 are theoretical and 350 are practical)
- F52: Systems Analysis and Design II (500 teaching hours, 250 theoretical and 250 practical)

There is also a variety of optional subjects among which students can choose, the three ones that are included in Software Engineering thematic area
- F28: Software Engineering (750 teaching hours)
- F13: Computer Auditory (500 teaching hours)
- Information Security (500 teaching hours), this subject will be offered next academic year.

All these subjects are offered in the last two years of ITIG.

NOTE: There is no point in dealing here with Software Engineering in II because the subjects related to it are located in the last two academic years, and the UJI has reached only its 4th years of existence.

In a previous study the teaching experience of lecturers and the evaluation of students results in this thematic area were analyzed, Campos[8]. In this paper we are trying to analyze and to tackle the problems and difficulties found up to now by our students. We also try to provide herewith the proposal of solutions we can suggest for the future. These lines of action will be put to work as soon as the teaching schemes are modified.
2 Methods

The following statistics were performed on all students registered in the subjects included in the Software Engineering thematic area of ITIG during the academic years 1992/1993, 1993/1994 and 1994/1995 although we should take into account that the data of this last academic year are not complete as exams are still in progress. Information has been obtained from official reports of the years mentioned above [4] [5].

The total of students evaluated is 411, the 73% are male students (300) and the 27% are female (111). Their average age is 20.

The treatment of graphics and figures has been performed the programs Microsoft Word for Windows (2.0) and Microsoft Excel (4.0).

In all tables the absolute values and percentages for the different marks have been included. The results are classified with the following symbols:

<table>
<thead>
<tr>
<th>Grade</th>
<th>Mark Range</th>
<th>Grade</th>
<th>Mark Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>A+</td>
<td>mark 10</td>
<td>C</td>
<td>from 5 to 6.9</td>
</tr>
<tr>
<td>A</td>
<td>from 8.5 to 9.9</td>
<td>D&amp;E</td>
<td>less than 5</td>
</tr>
<tr>
<td>B</td>
<td>from 7 to 8.4</td>
<td>npr</td>
<td>students who did not attend the exam</td>
</tr>
</tbody>
</table>

The standard evaluation of subjects has been divided into two parts:
1.- An exam with practical short problems to solve and theoretical questions. (60% of the final result)
2.- The development of a practical case, on which the students have been working all year long to be presented to the teacher as a final report. (40% of the final result).

3 Results

Results this year, as observed to this date seem to have worsened if compared to previous years.
Table 1. Software Engineering Subjects Results

<table>
<thead>
<tr>
<th></th>
<th>F45-92/93</th>
<th>F45-93/94</th>
<th>F45-94/95</th>
<th>F52-93/94</th>
<th>F28-93/94</th>
<th>F13-94/95</th>
</tr>
</thead>
<tbody>
<tr>
<td>A+</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>% A+</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>A</td>
<td>2</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>% A</td>
<td>2,86</td>
<td>2,88</td>
<td>0</td>
<td>0</td>
<td>8,7</td>
<td>0</td>
</tr>
<tr>
<td>B</td>
<td>12</td>
<td>16</td>
<td>4</td>
<td>13</td>
<td>8</td>
<td>14</td>
</tr>
<tr>
<td>% B</td>
<td>17,1</td>
<td>15,4</td>
<td>2,9</td>
<td>38,2</td>
<td>17,4</td>
<td>77,9</td>
</tr>
<tr>
<td>C</td>
<td>39</td>
<td>42</td>
<td>30</td>
<td>17</td>
<td>12</td>
<td>0</td>
</tr>
<tr>
<td>% C</td>
<td>55,7</td>
<td>40,4</td>
<td>21,6</td>
<td>50,0</td>
<td>26,1</td>
<td>0</td>
</tr>
<tr>
<td>D&amp;E</td>
<td>12</td>
<td>14</td>
<td>56</td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>% D&amp;E</td>
<td>17,1</td>
<td>13,5</td>
<td>40,3</td>
<td>11,8</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>npr</td>
<td>8</td>
<td>29</td>
<td>49</td>
<td>0</td>
<td>22</td>
<td>4</td>
</tr>
<tr>
<td>% npr</td>
<td>11,4</td>
<td>27,9</td>
<td>35,3</td>
<td>0</td>
<td>47,8</td>
<td>22,2</td>
</tr>
<tr>
<td>tot</td>
<td>70</td>
<td>104</td>
<td>139</td>
<td>34</td>
<td>46</td>
<td>18</td>
</tr>
</tbody>
</table>

Figure 1: Software Engineering Results by Subjects.
4 Discussion

As a conclusion of the analysis of results, we found it surprising that this year they did not attain the levels of last years, in spite of better resources and the teachers acquired experience.

One of the reasons for this might be the low capability of learning of students as signaled by Botella [6].

Next let's see and analyze some of the possible causes we think might influence these results:

a) Different academic origin of students taking ITIG. Some of them come from high schools, with a general education and without any specific computer training. Others come from professional schools specialized in Technical computer studies [4]. The first group find it hard to comprehend some of the basic knowledge in Software Engineering. The second one has learnt procedures through a more traditional line and therefore find hardships in fitting this more modernized system.

This lack of balance will hopefully be overcome in the future thanks to the Law for the Systems of Education in Spain (LOGSE) [6] [11].

b) When students get in touch with first subjects of Software Engineering they have scarce knowledge yet of business management and have little experience in administrative software applications. This situation prevents them from successfully getting at the analysis an understanding of a business computer system.
To solve this situation there is a project of modifying the courses schedule in which it is considered to teach the subjects related to business management before subjects dealing with Software Engineering are handled.

c) The difficulties met by students when developing a project of Software Engineering are similar to those met by a professional to adapt his working methods to structured methodologies [6] [10].

We plan to increase the amount of hours in the compulsory subjects, devoted to the teaching of methodologies. With the same aim we are going to encourage students to use these methodologies though the use of CASE tools they can find available in our facilities.

d) Students have proved they did not dedicate enough to the development of practical cases of Software Engineering projects. The poor results obtained can also show that some of the Software Engineering subjects need more hours devoted to practical work.

We intend to expand the time of Software Engineering compulsory subjects teaching, so as to get, on one hand, more time to teach methodological knowledge. On the other hand a new subject is being considered. This will be a thoroughly practical subject so that students can simulate a complete development of a computer project.

5 Conclusions

The academic results show that the level of transmission of contents to students has not attained success we desired. However, this cannot be seen as a failure but as the consequence of the youth of these studies and the continuous evolution of computer science, from the point of view of research as well as of its technical application.

Maybe there are continuous improvement to talk about in the fields of Software Engineering teaching and methodologies.

In the UJI we are making the effort to improve the quality and results of this training, considering both the non-stop advancing of computer science, in particular Software Engineering subjects, and the restricted economic and time resources we have available.

6 References


3 27913-REAL DECRETO 1460/1990, de 26 de Octubre, por el que se establece el título universitario oficial de Ingeniero Técnico en informática de Gestión y las directrices generales propias de los planes de estudios conducentes a la obtención de aquél. Boletín Oficial del Estado, 20-11-1990; 278: 34403.


8 Campos, C. & Coltell O. La Enseñanza de la Ingeniería del Software según el Nuevo Plan de Estudios en la Universidad Jaume I. Accepted in the *I Jornadas de Informática de la Asociación Española de Automática e Informática*, Puerto de la Cruz, Tenerife (Spain), 1995.


