Supporting the Bologna Process in HE Information Systems

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Abstract

The Bologna process has far reaching implications for European HE institutions. Two of them require a clear support from the respective IS: the European Credit Transfer and Accumulation System and the Diploma Supplement. The paper presents the steps taken by the HEIS SIGARRA at the University of Porto to implement them. They include recording the student workload estimates by the professors for each course component; recording measures of the actual time spent in each component by a sample of students; calculating percentile based classifications; and issuing diploma supplements.

Keywords: European Credit Transfer and Accumulation System (ECTS); Diploma Supplement (DS); Higher Education Information System (HEIS).

1 New IS requirements implied by the Bologna process

The Bologna process in European HE institutions is having a strong impact through its requirements of degree comparability. Besides the pedagogic and curricula consequences, there are two relatively simple instruments that must be created: a new credit system and a more informative diploma [1].

The European Credit Transfer and Accumulation System (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 [2]. The Diploma Supplement (DS) is a document attached to a higher education diploma providing a standardized description of the nature, level, context, content and status of the studies that were pursued and successfully completed by the graduate. The Diploma Supplement provides transparency and facilitates academic and professional recognition of qualifications (diplomas, degrees, certificates) [2].

The development of an accumulation system, to be implemented at institutional, regional, national and European level, is one of the key objectives of the Bologna Declaration of 1999 [3]. In the Berlin Declaration of 2003, it is stated that every graduating student as from 2005 should receive the DS [4].

In this paper we present the strategy adopted in the University of Porto to implement the ECTS/DS in the SIGARRA [5] system. SIGARRA is an integrated Higher Education Information System (HEIS), developed and maintained within the university, and used by the majority of the university's institutions.

The adopted strategy is structured in four changes or additions to the IS.

2 Comparing credits

Even before Bologna Declaration has been issued, the SIGARRA system has been designed so that every course should clearly state, in its Course Information page (see fig. 1), which are the goals in terms of competences to be acquired, along with a more detailed description of the syllabus, the lecturers, the bibliography and software needed, and the assessment method. This information can be incrementally modified for each course edition.

The old credit figures associated to each course, based on the number of contact hours (lecture, tutorial and lab hours) have been complemented with new figures, subject to new rules. The figures should account for the total workload of the typical student, not just contact hours, and should total up to 60 per year. Assuming as an example that the student year is composed by 40 working weeks of 40 hours each, one gets 1600 hours per year, 26.7H of work per credit. But this is just a comparison figure, and varies with the programme and the student. The hard reference is the 60 credits per year for a full-time student. These figures are already part of the Course Information but they are not always very accurate because the approach is on its first steps and it is hard to define a priori the typical effort required by a whole course of about 55 lecturing hours.
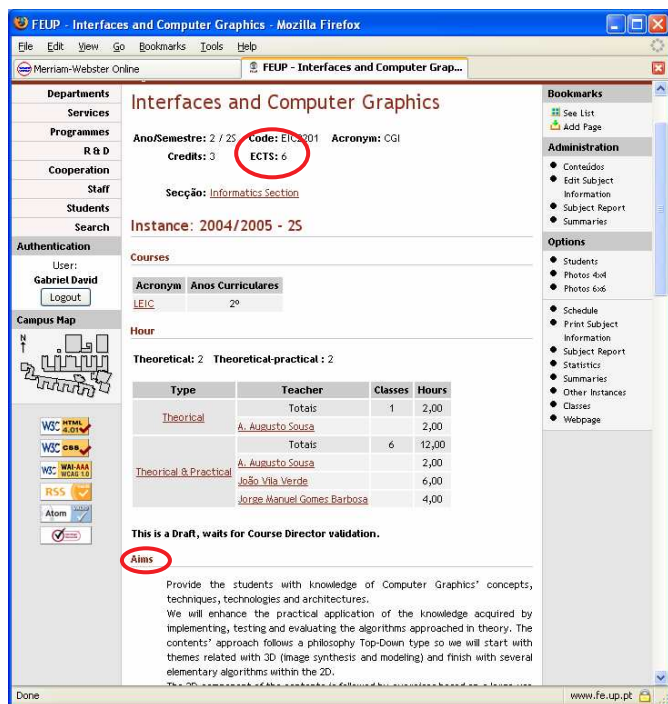
Figure 1: Course Information page.

2.1 Explaining ECTS figures

So, besides recording the course official ECTS credits the Course Information has been enriched with a breakdown of the expected workload for each task that the average student must perform to accomplish the course aims. This list must be filled in by the corresponding professor before the lectures begin. Each assessment or occupation component of the course must be singled out with a short description and the estimate of its workload written down by the professor. It is also possible to associate dates or deadlines to the components.
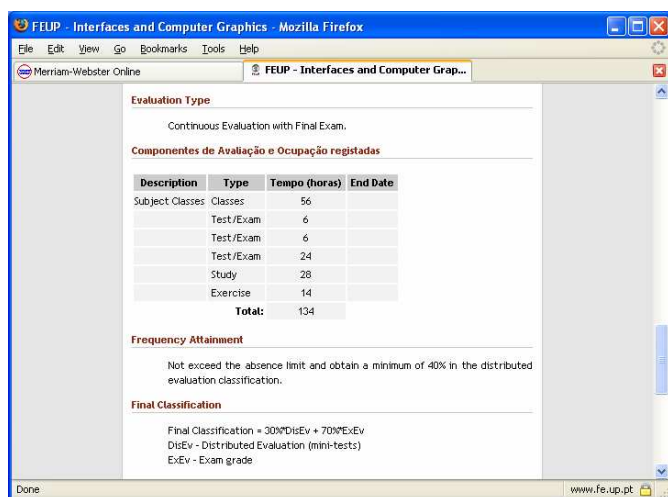

Figure 2: Assessment and occupation components.

The components are categorized according to the following alternatives:

- Classes (automatically filled-in)
- Self study;
- Exercise;
- Test/exam;
- Written report.

The purpose of this information is three fold. First of all, it is intended as a guide for the student, to help him organising the work. It can also be used by the programme director as a planning aid in order to coordinate assignment deadlines for the courses taken simultaneously by the same group of students and thus avoid excessive concentration. But it is the third result that acquires special interest in the context of this paper. The classification of components and the breakdown of workloads constitute an analysis tool, which enables a comparison between courses and programmes as well as the tuning of ECTS figures. In fact, this analysis can be seen as an explanation of those figures. It can help to fight the minimum effort trend of just transposing the old credit system into the ECTS.

As the system has been in use since a few months ago, there is not yet information enough to draw conclusions about the consistency of the estimates at the granularity of the curricular year. However, for the cases analysed the workload estimate is below the average value implied by the programme study plan. In a typical situation of 10 courses per year, the average workload per course is 160H (6 ECTS) and the existing distribution is shown in fig. 3.
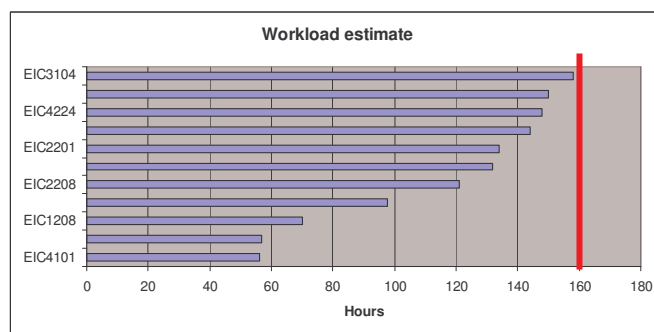

Figure 3: Workload estimates by professors.

The conclusion is that, according to the professors' own view, the programme workload demand is below what has been considered the reference. However, this is just an estimate which may turn out to be biased. So a monitoring task has been set up.

2.2 Monitoring student effort

The scope of the study is a single undergraduate programme. A sample of students is required to fill in, weekly, a timecard, summarising the actual dispended effort. To lower the burden of the procedure, a personalised on-line form has been prepared in the HEIS. Profiting from the enrolment data, after

login, the monitored student is presented with a half-filled form exactly with the courses he is following, lacking just the required measures.

Figure 4: Timecard form.

Notice in fig. 4 that, for each course, the form asks for measures by component category. It has been considered to provide information enough for the first year of monitoring.

A more detailed approach could be to base the form directly on the course components. It would allow for a more direct comparison between professors' estimates and students' measures, at the cost of requiring more effort from the latter.

The data gathered will be compared to the estimates and the official credits. This study will be best done after the final marks are available, enabling normalisation by some criterion of "average student". It may be the present day average student, chosen among those who have been approved or a target average student profile the programme may want to induce. Disparate values may then be fed back to the credits assignment process and corrective procedures may follow.

The results obtained so far, extrapolated to the full semester are summarised in fig. 5. The analysis of the graphic based on a set of representative courses leads to the conclusion that the students actually spend a lot less hours studying than expected by their professors. The data is still very preliminary and the students may be not sufficiently accurate recording their timecards.
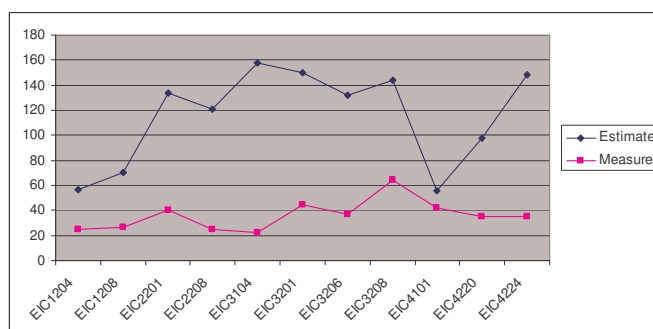

Figure 5: Preliminary comparison estimates/measures.

3 Comparing classifications

The definition of ECTS credits factors out variations in the style of study plan organisation, with more or less contact hours, with more or less independent modules. This is a first unavoidable step towards the objectives of comparability and transferability among different HE systems. The second step is obtaining independence from the specific classification system.

The main shift is to adopt a relative system, based on percentiles instead of an absolute grading. The absolute grading may still exist as an intermediate step and be based on a 0-10, 0-20, 0-100 scale, or other. The main point is to have the ability to order the students by grade. Then, the classification is done in a percentile scale of 5 levels of approval, A to E, according to the following table:

$$X_{0.1} \leq A \leq X_{max}$$

$$X_{0.35} \leq B < X_{0.1}$$

$$X_{0.65} \leq C < X_{0.35}$$

$$X_{0.9} \leq D < X_{0.65}$$

$$X_{min} \leq E < X_{0.9}$$

Table 1: Definition of classes.

The value X_p is the maximum classification such that $p \times 100\%$ of the students are graded above or equal to that value. X_{max} and X_{min} are resp. the maximum and minimum values in the set of approval classifications. This way, each class extends across a range in which the left limit is the smallest integer greater or equal than the limit in the table, and the right limit is the greatest integer lesser than the limit in the table (in class A it may be equal).

So it assigns A to the best 10%, B to the following 25%, etc.

Example 1. With 10 students, all with a distinct grade (11, 12, 13, 14, 15, 16, 17, 18, 19, 20):

$X_{0.9}$			$X_{0.65}$			$X_{0.35}$			$X_{0.1}$
11	12	13	14	15	16	17	18	19	20
E	**D**	**D**	**D**	**C**	**C**	**C**	**B**	**B**	**A**

The hard cases are $X_{0.35}$ corresponding to 3.5, a point between the 3rd and the 4th students. In such case $X_{0.35}$ takes the value of the 3rd student.

Ties may happen, though the method works better with lesser ties. The Portuguese law [10] establishing the ECTS system adopts the position that in the case a group of students with equal grade belongs to two classes, the whole group is considered as belonging to the first one, as there is no rationale to discriminate.

Example 2. Again with 10 students, but including ties (11, 11, 13, 13, 14, 14, 17, 17, 19, 19):

$X_{0.9}$		$X_{0.65}$			$X_{0.35}$			$X_{0.1}$	
11	11	13	13	14	14	17	17	19	19
D	D	D	D	C	C	B	B	A	A

Notice that, class A should contain only 10% students, i.e. 1, although it really contains 20%, because there are two students ex aequo in the top position. By a similar reasoning, class E is empty.
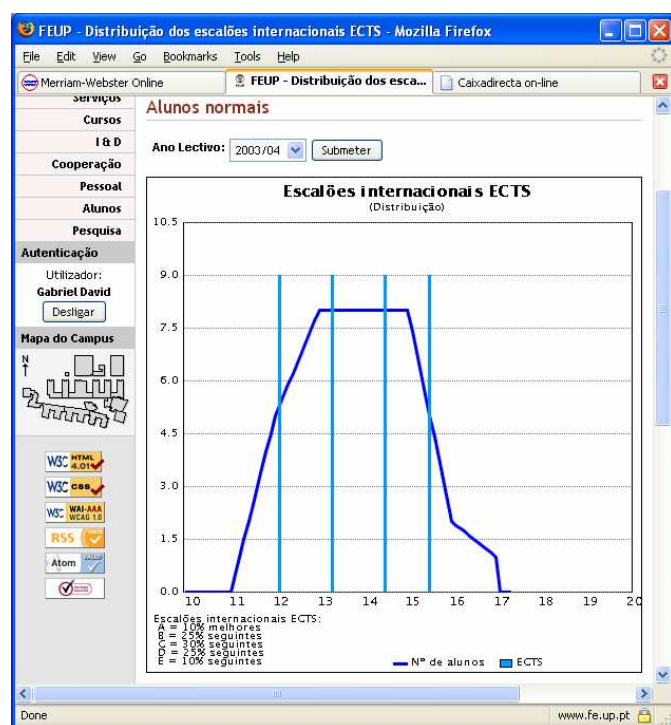

Figure 6: Example ECTS classes.

The method can be applied both to the result of a course or to the final classification of a whole programme (see fig. 6). In order to smooth yearly variations and to avoid distortions typical in small sets, the above mentioned law imposes two restrictions on the set of students to which the method is applicable: it must include, at least, 100 students and, at least, the students in the last three years. In the case the restrictions cannot be met, the result is the ordinal of the student in the

corresponding group of the year, along with the total number of elements in the set.

A practical point arising is the determination of the moment when the set of students is frozen for the calculation as, depending on local regulations, not all the results are known at the same time. In many situations it may be necessary to calculate and publish partial results. Although a posterior consideration of a new result could change previous calculations, that situation would be very difficult to manage. So, after a class is assigned to a student on a certain date, it never gets revised. The student may of course be part of posterior calculations but just to influence the class of the newer students.

A more intricate problem is the conversion from a class A-E back to a numeric absolute scale, 0-20 in the Portuguese case. The most obvious solution is to define a conversion table, assigning a fixed numeric counterpart to each class. This can be very unfair and somehow betrays the spirit of the ECTS grades. A tentative solution has been proposed [11] for the cases of mobility students, returning after a semester out with some ECTS grades to be fed back into his local records and eventually be part of the final grade.

The basic idea is to use the previous information about the specific student to guide an interpolation step. If the student is above the average, he will probably receive a better mark for the same class than the weak student, below the average will. This is achieved by collecting data from the last three years and using it to settle the limits of each class in a programme. Then a quasi linear interpolation, centred at the average value for the class, "corrects" the value according to the past academic history of the student.

4 Interoperable Diploma Supplement

The effort to build a comparable system may be seen as too relativistic. In order to compensate for this an increased stress is put on the definition of a clear set of competences to be developed through each curricular unit and on its corollary, the Diploma Supplement that conveys a large amount of descriptive information. SIGARRA is able to produce a printed version of the document. However, in the current context of mobility and electronic information interchange, an electronic version is a valuable functionality.

Due to the semi-structured nature of the document and to the open-endedness of its uses, XML technologies [8] were used to automate the production of the Diploma Supplement. With these technologies it is possible to produce documents in multiple output formats, applying XSLT transformations to the XML source. The XML schema defined includes the eight mandatory sections, with information [7]:

- identifying the holder of the qualification,
- identifying the qualification,
- on the level of the qualification,

- on the contents and results gained,

- on the function of the qualification,

- additional information,

- certification of the Supplement,

- on the national higher education system.

This work has been based on a previous schema developed to represent a student record using XML [6].
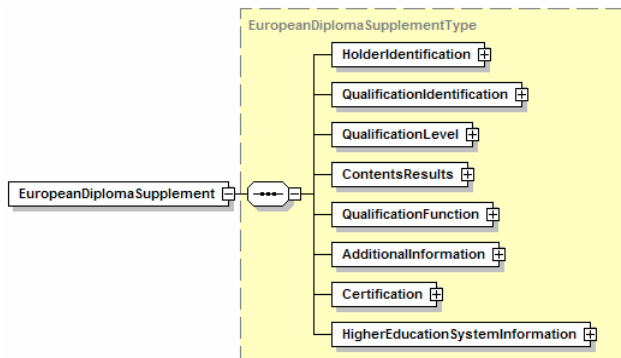

Figure 7: European Diploma Supplement Schema

The root of our schema is the EuropeanDiplomaSupplement element that includes 8 sections (see fig. 7). These sections are represented using the following elements:

- HolderIdentification: family name, surnames, date of birth and student identification code identifying the holder of the qualification.

- QualificationIdentification: name, title conferred, main fields of study, awarding institution, administering institution (if different) and language of instruction of the qualification.

- QualificationLevel: level, official length and access requirements of the qualification.

- ContentsResults: mode of study, programme requirements, programme details (including individual marks if available), grading scheme and overall classification of the qualification obtained.

- QualificationFunction: information about access to further studies and about professional status obtained (if applicable).

- AdditionalInformation: additional information about the qualification and sources/references where more information is available.

- Certification: the date the diploma was issued. Additional required information (signature, official post and official stamp) is included in the printed diploma.

- HigherEducationSystemInformation: information about the higher education system, providing a context for the qualification obtained.

These sections are mandatory and, when no information is provided, an explanation should be included.

Fig. 8 presents a detailed view of the element ProgrammeDetails. This element is part of the ContentsResults element and represents detailed information for each of the individual elements or parts of the qualification.
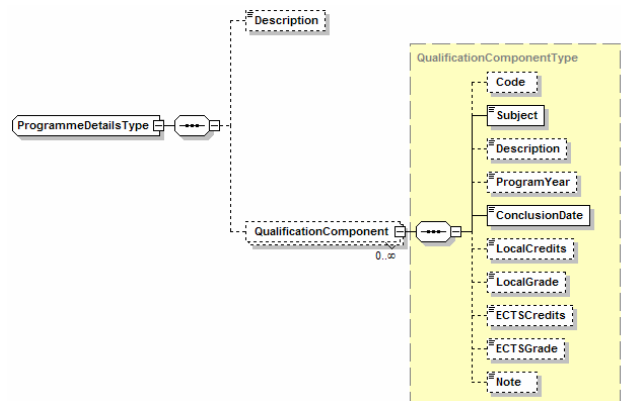

Figure 8: Element ProgrammeDetails

For each component of the qualification several details are included: internal code, subject and description, year within programme, conclusion date and achieved grades using both local scale and ECTS scale.

The existence of a standardized XML document allowed us to streamline the production of the Diploma Supplement for multiple platforms. Using different XSLT [9] transformations we are able to publish these contents to the web or print them to the final official documents. In Figure 8 this architecture is presented.
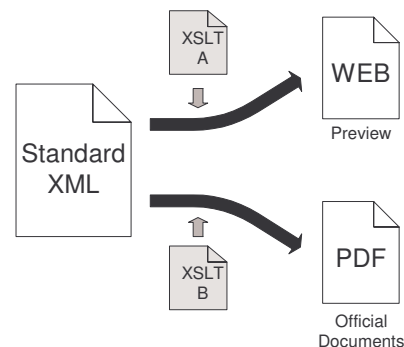

Figure 9: System Architecture for producing Diploma Supplements.

5 Conclusions

The implementation of the several coordinated efforts to support the requirements of the Bologna process in an HEIS

has been described and an analysis of the results already available has been produced. These include a comparison between the first attempt to assign ECTS credits to whole courses and the results obtained through component workload specification. It will not be possible to present significant results on the agreement between the latter and the student timecards because this experience is still being carried on. The automatic production of the Diploma Supplements is, by itself, a manifestation of a certain maturity of the underlying HEIS. Its natural complement is an interoperable version here partially presented by the corresponding XML Schema.

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