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International Credits in the European Higher Education Area (EHEA): the European Credit Transfer System (ECTS)

Abstract
U.S. universities with an interest in having students study at European universities need to understand the value of courses at those universities relative to credits at U.S. universities. The European Higher Education Area (EHEA) and the European Credit Transfer System (ECTS) were mandated by the Bologna Declaration in 1999 and are part of a strategic plan for creating an integration of the higher education systems in Europe by the end of the year 2010. The ECTS is an important part of this overall effort since its intent is to allow students to transfer credits among the diverse universities in different European countries. The countries involved in the EHEA are not limited to, nor all-inclusive of, member countries of the European Union (EU).

The process leading to the ECTS has been reasonably well accepted by European systems. As noted by the European Students Union (1), “The three-cycle system (bachelor, master, and doctoral degrees) and the ECTS are among the prime examples of successes of the Bologna Process…”

One significant difference between ECTS credits and typical U.S. university credits is that an ECTS credit includes not only lecture and laboratory times but also individual out-of-class work and exam times. According to the current ECTS system a 15 weeks semester of higher education corresponds to approximately 30 credits.

As a beginning comparison between U.S. and European systems (2), “Regarding undergraduate degrees, there is a clear trend across Europe toward assigning between 180 and 240 ECTS credits, equaling 3 to 4 years of full-time study, while graduate degrees at Master level normally carry 60-120 ECTS credits”.

This paper will discuss some of the variations in both courses and degrees, including the three-year bachelor degree. It will also discuss ways for U.S. institutions to understand possible equivalencies between the U.S. and ECTS systems.

1. …The European Students Union (2010). “Bologna at the Finish Line An Account of Ten Years of European Union.”
Background

Being concerned about the overall nature and competitiveness of European education, four Education Ministers from France, Germany, the UK, and Italy came together in 1998 to sign the Sorbonne Declaration on higher education. These concerns evolved into a meeting in Bologna in 1999 attended by twenty-nine Education Ministers from European countries. This meeting resulted in the Bologna Declaration. Both these events were in response to what was seen as the relative successes of the U.S. and UK approaches to higher education, and a desire to set up a European-based system that would result in an overall European Higher Education Area (EHEA). The purpose of the EHEA would be to “increase the international competitiveness of the European system of higher education” [1]. While more simply put as “making academic degree standards and quality assurance standards more comparable and compatible throughout Europe” [2], following are the objectives stated in “The Bologna Declaration of 19 June 1999” [3]:

- Adoption of a system of easily readable and comparable degrees.
- Adoption of a system essentially based on two main cycles, undergraduate and graduate.
- Establishment of a system of credits – such as in the ECTS system – as a proper means of promoting the most widespread student mobility.
- Promotion of mobility by overcoming obstacles to the effective exercise of free movement of credits.
- Promotion of European co-operation in quality assurance of education.
- Promotion of necessary European dimensions in higher education, particularly with regards to curricular development, inter-institutional co-operation, mobility schemes and integrated programs of study, training and research.

It is important to note that the Declaration is commitment by each signatory country to reform its own education system, not a reform imposed on them. It is also important to note that while many of the twenty-nine signatories to the Declaration are from countries that are members of the European Union (EU), the signatories include many countries that are not members. They are countries on the continent of Europe that are concerned with the higher education process, and are not limited to EU countries nor was their work subject to formal EU approval. However the European Commission (EC) actively supports the goals of the Bologna Declaration. Since the initial Declaration, there are now 47 countries in the Bologna process.

The progress toward the EHEA continues to be monitored by the participating Ministers. Since the Bologna Declaration in 1999 they have met a number of times to monitor and assess their own progress toward the EHEA – Prague in 2001, Berlin in 2003, Bergen in 2005, London in 2007, Leuven in 2009, and Budapest-Vienna in 2010. As a result of these meetings, changes and improvements to the Bologna Declaration have occurred, an example of which is the change from two cycles (undergraduate and graduate, essentially master degrees) to three cycles (bachelor, master and doctorate).

It should be noted that as with any process put forth and organized by the political organizations of sovereign states, the Bologna Process does have its detractors, particularly among the academic community. One argument is that the Process is an attempt to minimize competition within Europe in order to make it more competitive internationally, while at the same time reducing costs.
**Introduction**

There is increasing interest in the part of educational institutions to develop relationships with institutions outside of their own country, often called by a term such as “internationalization”. For many U.S. institutions, this includes working with European institutions. To be able to work effectively with European institutions, a U.S. educator must understand the European Credit Transfer System – the ECTS – as it exists in the European Higher Education Area (EHEA). The reader should note that the system has been expanded to become a credit accumulation system, and as such it is alternately known as the European Credit Transfer and Accumulation System, although the same ECTS acronym is used.

Given that the ECTS is defined by the participating European countries, the Ministers of Higher Education of participating European countries issued this statement during their meeting of 2003: “Ministers stress the important role played by the European Credit Transfer System (ECTS) in facilitating student mobility and international curriculum development. They note that ECTS is increasingly becoming a generalized basis for the national credit systems. They encourage further progress with the goal that the ECTS becomes not only a transfer but also an accumulation system, to be applied consistently as it develops within the emerging European Higher Education Area”.

The purposes of the ECTS are to both attach consistent credits to work at European universities so that those credits can be transferred among the institutions as well as to allow accumulation of those credits in the pursuit of a degree. The credits in the ECTS are based on the student workload required to achieve the objectives of a course or program. Typically these are specified in terms of learning outcomes and competencies to be acquired.

The author must also state that the entire system is still, like many EU directives, in a state of flux. Therefore the data presented are representative of the system but are not necessarily equal amongst all players. And also, with his limited exposure to the system, the author should not be considered an expert on its makeup.

**Credits within the ECTS**

More fully defined at the Berlin meeting of 2003, a bachelor degree within an ECTS-participating university consists of 180-240 credits, with one academic year normally consisting of 60 credits. The 60 credits are intended to be equivalent to 1500-1800 hours of study. A maximum requirement of 240 ECTS credits is allowed for the first cycle, equivalent to a bachelor degree. Therefore the typical bachelor diploma will require 3 or 4 years of study. To the best of the author’s knowledge this three-year bachelor diploma is accepted in the U.S. as equivalent to a four-year bachelor degree. This is true for acceptance to the Graduate School at the author’s home university. It should be noted that in many technical/engineering three-year bachelor programs, the several years prior to initiation of full-time study must be spent in taking preparatory classes and working in an internship related to the proposed area of study.

The second cycle, the master degree should take 90 to 120 credits, and the third cycle, doctorate, should not take longer than three years of additional study [4]. The European Students Union...
notes that “the legal status of doctoral candidates varies from being regarded as students in some countries to being regarded as early-stage researchers in others.” [5]

The ECTS also defines a standard grading scale:
- A: best 10% of students
- B: next 25%
- C: next 30%
- D: next 25%
- E: next 10%
- FX and F: fail

In this scheme FX means “fail-some more work required to pass” and F means “fail-considerable further work required”.

To compare the 1500-1800 hours “of study” expected for the 60 credits in one year, consider an approximate comparison with a two-semester year at a U.S. institution (your mileage may vary). If a U.S. student in a technical discipline registers for 16 credit hours each semester, s/he may have a semester load similar to this:
- One 4-credit course with 3 lecture hours and 2 lab hours/week
- Two 3-credit courses with 2 lecture hours and 2 lab hours/week
- Two 3-credit courses with 3 lecture hours/week
- Total: 19 class hrs/week, X15 weeks=285 class hrs/semester, X2 semester/year = 570 class hrs/year.

How does the ECTS system require 1500-1800 hours? They consider the number of hours spent in preparation, report writing, project work, research hours, independent study hours, etc. in the number of hours expected for each credit. This means that there is no universal equivalency standard for acceptance of courses from the ECTS system. Just as is the case when accepting courses from a non-ABET accredited US program into an accredited program, it is up to a student’s home university to decide on the acceptance criteria.

There are concerns about the overall student workload and the ability to match credits with learning outcomes: “there are two main challenges in fully implementing ECTS: measuring credits in terms of student workload and linking them with learning outcomes” [6].

**European Higher Education Area**
The European Higher Education Area (EHEA), as originally defined by and a result of the Bologna process, was officially launched in March, 2010, during the Budapest-Vienna Ministerial Conference by the education ministers of the participating countries. This accomplished one of the primary objectives of the Bologna Declaration. With its own website, [http://www.ehea.info](http://www.ehea.info), the EHEA maintains public communications amongst the countries participating in the process. The EHEA has defined its objective areas for the next decade through 2020 [7]:
- Social dimension
- Lifelong learning
- Employability
- Student-centered learning
As would be expected, the countries that make up the EHEA developed an educational quality standard, the “Standards and Guidelines for Quality Assurance in the European Higher Education Area”, available at http://www.bologna-bergen2005.no/Docs/00-Main_doc/050221_ENQA_report.pdf.

Internationalization

There is a great deal of interest among U.S. universities to establish or increase their students’ participation in international education activities, and these are certainly issues not unique to American institutions [8]. In the technical disciplines the International Association for the Exchange of Students for Technical Experience (IAESTE) has been active for years in facilitating both paid and unpaid international student exchanges. Started in 1948 IAESTE has grown to include institutions in 80 nations. IAESTE United States notes that their mission is “developing global skills in tomorrow’s technical leaders” [9]. There can be no doubt that having an international internship on a student’s resume is of great value during the job search.

Those not familiar with the European universities should note that one major difference between U.S. and European schools is the examination technique. Commonly (although not universal) in European schools the classroom semester/term is completed with no examination. There is then a defined study period of several weeks, and then the students return for a comprehensive examination in each class they have taken. If they fail the exam, there is a period to retake it prior to the start of the next academic term.

There can also be a significant difference in the start and end times of the academic terms between European schools and U.S. schools. This also must be determined at the outset. In two of the schools the author is familiar with, one in Germany and one in Switzerland, the spring term starts in March and ends in July, while the fall term starts in September/October and ends with exams in January.

Technical Institutes

In general, European engineering-related schools fall into two categories:

- The universities, which teach a very theoretical curriculum
- The more profession-oriented institutes of applied science, a.k.a. the university-college sector, which teach an applied curriculum intended to allow their graduates to immediately segue into the engineering/technical job market.

The authors are familiar with two institutes of applied science, the Fachhochschule Braunschweig/ Wolfenbüttel in Wolfenbüttel, Germany, and the Hochschule Luzern/Technik+Architektur (The Lucerne University of Applied Arts and Sciences/Dept. of Engineering & Architecture) in Lucerne, Switzerland. The rest of this paper will examine in more detail the module system used to allow credit transfer amongst the European universities with the ECTS.
Module System
An example of a Core module system for a three-year course sequence is shown in Figure 1. This example is from HSLU/HTA Lucerne. As with so many school programs, this one is in a state of flux, and is not to be construed to be correct as currently applied, but as an example of a module system. Modules not shown would include topics in e.g. mathematics, social sciences, humanities, science, etc.

HTA Luzern: Bachelor Studies in Electronics: Core

Advanced/ Electives
- Power/AC Drives
- Electrical Power systems
- IT and communications
- DSP
- Info-tronics
- Process Control
- System Development
- Diploma Thesis Project (results!)
- 12 credits

Intermediate
- Energy, machines, and T&D
- Control Systems
- Analog and Digital Circuits/ systems- FPGAs
- System Programming
- Micro-controllers
- Networking/ Communications & Technology
- Engineering Tools and mathematics
- Product Development 2: 6-person teams
- Product Development 1: 6-person teams

Basic
- Math/Physics/ Electrical – DC circuits. Team taught.
- M/E - AC circuits & machines. Team taught.
- Applied Math – calculus
- Digital Electronics
- Programming I: OOP, Java
- Programming II
- Computer Structures & Information Transfer
- Foundations of Product Development- Mechanical
- Foundations of Product Development- Electrical
- Project 2: 3 ECTS
- Project 1: 6 ECTS

Core Modules: 15 of the basic & intermediate 6 cr. modules = 90 ECTS (European Credit Transfer System)
Additionally, a minimum of 3 elective modules must be chosen = 18 ECTS
All modules on this page are 6 ECTS unless otherwise noted.

Project Modules: 42 ECTS

Figure 1. Example of a three-year modular system

In the example shown in Figure 1, the “Basic” modules would be first-year modules, the “Intermediate” modules would be second-year modules, and the “Advanced/Elective” modules would be third year modules. Note the inclusion of projects or development modules each year, and the Diploma Thesis, which is typically a project worked on in teams of two that occupies the students full-time for 8-10 weeks, and results in a formal thesis at its conclusion. It is not a research project but rather a development project. During this project period no classes are taken, although again, this Diploma Thesis module is being changed.

In looking at the modular system, again recognize these general ECTS definitions/requirements:
- A minimum of 180 ECTS credits are required to receive a Bachelor diploma
• A credit is defined as equivalent to 25-30 workload hours, defined as a combination of lecture hours, lab hours, independent study hours, research hours, and/or other assignments. Student workload is the time necessary to complete all planned learning activities.

• A full semester/term consists of 30 ECTS credits, therefore requiring 750-900 workload hours. Semesters are typically 14-15 weeks of class time plus the examination time.

Most courses are taught in modules of 3 credits or 6 credits. Within the modules, the instructor may define the contact hours as lecture hours, lab hours, project hours, or a combination of all, plus the out-of-class hours. Within the modules then there may be (e.g.) 5 weeks of lecture, followed by 5 weeks of lab activities, followed by 4 weeks of a project.

Teamwork, for both the students and the faculty, is common. For example, in the basic math/physics/electrical courses shown in Figure 1, a faculty member from each of the three disciplines is involved in teaching the topics. In the basic Project courses, the students work in teams of 6-10, with guidance from 3-faculty teams from the various disciplines.

The 6-credit modules are defined as being taught the equivalent of one full day each week of the semester, which may be scheduled as, e.g.:

• A full day, broken into 6-8 55-minute lessons
• A half-day on Monday and a half-day on Wednesday, broken into 55-minute lessons
• Another combination of times, also including lab periods that will equal one full day.

At Wolfenbuttel, the academic schedule is based on a four-year pattern, and includes several instances of industrial practice, as noted in their brief overview schedule shown in Figure 2.
It is interesting to note that the pattern of module is at the discretion of the instructor at many institutes, and the department head is responsible for scheduling resources accordingly. It is also interesting to note that typically, for a scheduled laboratory period, there is no instructor present. The instructor is typically available in his/her office to answer questions, but essentially the students are presented with a set of deliverables they are expected to accomplish, and they are to then work together to meet their goals.

**Conclusion**

As can be seen, the U.S. faculty member interested in establishing academic relations with a European university must acquaint him/herself with a number of differences. As in U.S. schools, changes are ongoing, and this is true with both the overall Bologna process and with specifics at each university and university-college. At all three levels, bachelor, master, and doctoral, credit definitions must be carefully agreed to so that credits will be correctly accepted upon the student’s return to his/her home university.


