Tuning

Tuning
Educational Structures
in Europe

Closing Conference
Brussels, 31 May 2002

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1. Programme Closing Conference

Brussels, 31 May 2002

European Commission, Charlemagne Building, Room S3

Rue de la Loi/Wetstraat 170 (Metro Schuman)

09:00	**Coffee / Registration**
10:00	**Opening** by the EU Commissioner for Education and Culture, Mrs. Viviane Reding: *From Prague to Berlin, the EU Contribution to the European Higher Education Area*
10:15	**Statement** by the President of the European University Association, Prof. Eric Froment
10:30	**Tuning Project: Background, Methodology, Approaches and Main Outcomes**, presented by the Project Coordinators, Julia Gonzalez of Deusto University, Bilbao and Robert Wagenaar of the University of Groningen
10:50	**Generic Competences** (Line 1). Overall presentation and a Subject Area perspective. Moderator: Julia Gonzalez. Speakers: Jon Paul Laka of Deusto University and Peder Ostergaard of the Aarhus School of Business
11:15	**Coffee Break**
11:45	**Subject-specific Competences (knowledge and skills):** Common Reference Points for First and Second Cycle Degree Programmes (Line 2). Moderator: Volker Gehmlich of the Fachhochshule Osnabrück. Speakers: Seven Subject Area Co-ordinators / Tuning Experts
13:00	**Lunch Break**
14:30	**ECTS as a Credit Accumulation System** (Line 3) by Stephen Adam (University of Westminster) and Robert Wagenaar
15:00	**Approaches to Teaching, Learning and Assessment** (Line 4) by Lars Gunnarsson of Göteborg University and Ann Katherine Isaacs of Universita degli Studi di Pisa
15:15	**Conclusions and Recommendations** by the Project Coordinators Julia Gonzalez and Robert Wagenaar
15:30	**Tea Break**
16:00	**Panel Discussion on Next Steps** with representatives of EUA, EURASHE, ESIB, ENQA, UNICE and the European Commission. Moderator: Maria Sticchi Damiani of the University LUISS Guido Carli, Rome
17:00	**End** of the Conference

2. Tuning Educational Structures in Europe: Background

2.1. Introduction

The project Tuning Educational Structures in Europe was submitted to the European Commission at the end of 2000. It was intended as a two-year pilot project jointly coordinated by the University of Deusto in Bilbao, Spain and the University of Groningen in the Netherlands. The project was launched on 4 May 2001.

This closing conference marks an important step at which initial conclusions are presented to responsible actors. Further discussion and work are still needed and are underway. Nevertheless this conference serves to initiate the final phase of the project, which will involve a debate which is more focussed in terms and broader in scope.

The Tuning project began and developed in the wider context of constant reflection within higher education, demanded by the rapid pace of change in society. But the project is particularly marked by the context of the Bologna-Prague-Berlin process, which has provoked intent debate on the nature of educational structures. This debate is happening all across Europe, at institutional and national level. Tuning aimed to offer a platform for these debates to take place at a European level in the context of higher education.

The Tuning project sought to:

- "Tune" educational structures in Europe, and thereby aid the development of the European Higher Education Area.
- Open up a debate on the nature and importance of subject-specific and general competences, involving all stakeholders, including academics, graduates and employers;
- Identify and exchange information on common subject-based reference points, curricula content, learning outcomes and methods of teaching, learning and assessment;
- Improve European co-operation and collaboration in the development of the quality, effectiveness and transparency of European higher education by examining ECTS credits and other suitable devices to enhance progress.

It **did not** seek to develop any sort of unified, prescriptive, or definitive European curricula; to create any rigid set of subject specifications designed to restrict or direct the content, delivery or nature of European higher education; nor to end the rich diversity of European education, restrict the independence of academics and subject specialists, or damage local and national academic autonomy.

The creation of a European Higher Education Area was clearly implied in the objectives of Tuning. The changes that are occurring are an opportunity to further enhance quality in European university education.

The Pilot project aimed to enable European universities to make a joint reflection and debate on these issues, enabling comparative analysis, building upon their experience and conferring a European dimension to the undertaking. The project used a discipline-based approach to arrive at understanding and consensus about the nature of degrees and in particular the issue of 1st and 2nd cycles. There were seven Pilot groups, together representative of university studies and methodologies in general, in the areas of Business, Educational Sciences, Geology, History, Mathematics, Physics and Chemistry. In addition, certain other disciplines contributed to the Tuning project as synergy areas: Languages, Engineering, Humanitarian Development, Medical Sciences, Law and Veterinary Sciences.

Tuning is a university-led project. It presents the motivated and generous work of 128 academics from 105 University departments across the length and breadth of Europe (see map on p. 5). The work has been helped by formal consultation via questionnaires, to which a total of 7,125 people responded (comprising 5,183 graduates, 944 employers and 998 academics). This is not to mention the informal teamwork, reflection and debate provoked at the level of departments, disciplines and countries.

The final results of the Tuning Educational Structures in Europe project will be published towards the end of 2002. For now, this booklet presents some **preliminary results** and it is hoped that this final conference will lead to fruitful debate and discussion on the results, their implications and the future of higher education in Europe.

The Management Committee, Tuning Educational Structures in Europe Project

2.2. Tuning Project Objectives and Outcomes

Besides the Bologna, Prague, Berlin process, the project also needs to be seen in the context of the Salamanca convention of the European universities (March 2001), at which the European universities declared that:

"European higher education institutions recognise that their students need and demand **qualifications which they can use effectively for the purpose of their studies and careers all over Europe. The institutions and their networks and organisations acknowledge their role and responsibility in this regard**, and confirm their willingness to organise themselves accordingly within the **framework of autonomy**."

"Higher education institutions endorse the move towards a **compatible qualification framework** based on a main articulation in undergraduate and postgraduate studies."

The objectives outlined in the first Tuning Document and the progress that has been made towards them are discussed individually below.

1. **To create five European discipline-based networks** that can present encourage innovation and quality in the joint reflection and exchange, also for other disciplines.

During the course of the tuning project there have been not five but **seven networks** working in synergy, of which five (Business, Education Sciences, Geology, History and Mathematics) were newly created and two (Physics and Chemistry) already existed. Existing networks such as CLIOHNet (History), EUPEN (Physics) and the Chemistry Thematic Network have become involved, and numerous discipline-based discussions, debates and presentations have taken place at national and international levels within all the disciplines involved. Of the 105 university departments participating in these seven networks, we can say that most have done so at a significant level of work and achievement, and have responded very quickly to the high pace demanded by the project. This work will continue until the final report is published.

2. **To bring about a high level of Europe-wide convergence in Higher Education** in the five main subject areas (Mathematics, Geology, Business, History and Educational Sciences) by defining commonly accepted professional and learning outcomes.

It is through the work of the many institutions and academics involved at national and international level, that it is possible to reach an initial definition of what is common, diverse, and dynamic in higher education in Europe. This understanding is the path to a convergence which respects and promotes diversity. The work is naturally discipline-based and has extended to seven subject areas in all.

3. To **facilitate transparency** in the educational structures and to further innovation through communication of experience and identification of good practice.

The meetings and discussions that have taken place throughout the project have been very participatory and highly relevant. In particular the debates that took place during the meetings and which have continued via email between the meetings have contributed greatly to the project's success. The general co-ordinators believe that in general the levels of debate, exchange of views and awareness have been very significant at all levels.

Transparency in relation to degrees has been attempted by the creation of the lines of analysis favouring common terminology and tools for understanding.

4. To **elaborate a methodology for analysing** common elements and areas of specificity and diversity, and how to tune them.

The methodology has been elaborated on the basis of four lines of analysis of degrees, with the aim of discovering how to make them "more legible and transferable." This is in accordance with the Bologna Declaration, which calls for the "Adoption of a system of easily readable and comparable degrees."

The four lines are as follows:

Line 1: General and academic skills

Line 2: Knowledge, Core Curricula and Content

Line 3: ECTS as an accumulation system

Line 4: Methods of teaching and learning, assessment and performance, and quality

This methodology to move forward is regarded as one of the main contributions of the project and is an **anticipated outcome**.

5. To **develop professional profiles and learning outcomes**, as reference points, in the five plus two main subject areas (Mathematics, Geology, Business, History and Educational Sciences, as well as the two synergy groups of Physics and Chemistry) by defining commonly accepted professional and learning outcomes.

The seven working groups have after debate and exchange of views identified a set of subject-related competences. Indications have also been given of the most suitable location: in the first and/or in the second cycle.

A second **anticipated outcome** is developing these professional profiles and learning outcomes.

6. To **develop and exchange information** in relation to the development of curricula in these seven areas, and **develop a model curriculum structure** for each area, enhancing the recognition and European integration of diplomas.

Subject maps and **core curriculum papers** have been prepared for the seven subject areas. A significant level of analysis and comparison has been taken place.

7. To **associate other subject areas** where a similar process can be incorporated through synergy.

Two of the associated subject areas, Physics and Chemistry, have followed the Tuning process in full, becoming groups 6 and 7 of Tuning. Among the areas, where related projects are already underway, are Engineering, Languages, Humanitarian Development, Veterinary Science, Law and Medicine.

8. To **build bridges** between this network of universities and other appropriate **qualified bodies** in order to produce convergence in the five main subject areas

Part of the work towards this objective is still to be done, since the Tuning Steering Committee decided to postpone meeting professional bodies until the analyses were more completed in order to have some concrete elements on the table to debate.

In the near future the Tuning groups will be engaged in mapping the existing reality of Europe with respect to professional bodies and associations at national and European levels within each field, and to develop contact with such bodies in relation to each subject area. This corresponds to another **anticipated outcome** of the project, a platform for discussion with professional bodies.

9. To **act in a co-ordinated manner** with all the actors involved in the process of tuning of educational structures (Ministries, Conferences of Rectors, and Universities).

The Conference of Rectors have been aware of Tuning since the start and were asked for their assistance in selecting participating Universities. In several countries the Rectors have developed close links with Tuning. The European Universities' Associations have been present and active in all the Steering Committee meetings throughout the Tuning project. The national Ministries have been informed and in some countries have developed a significant working relationship with the Tuning Project.

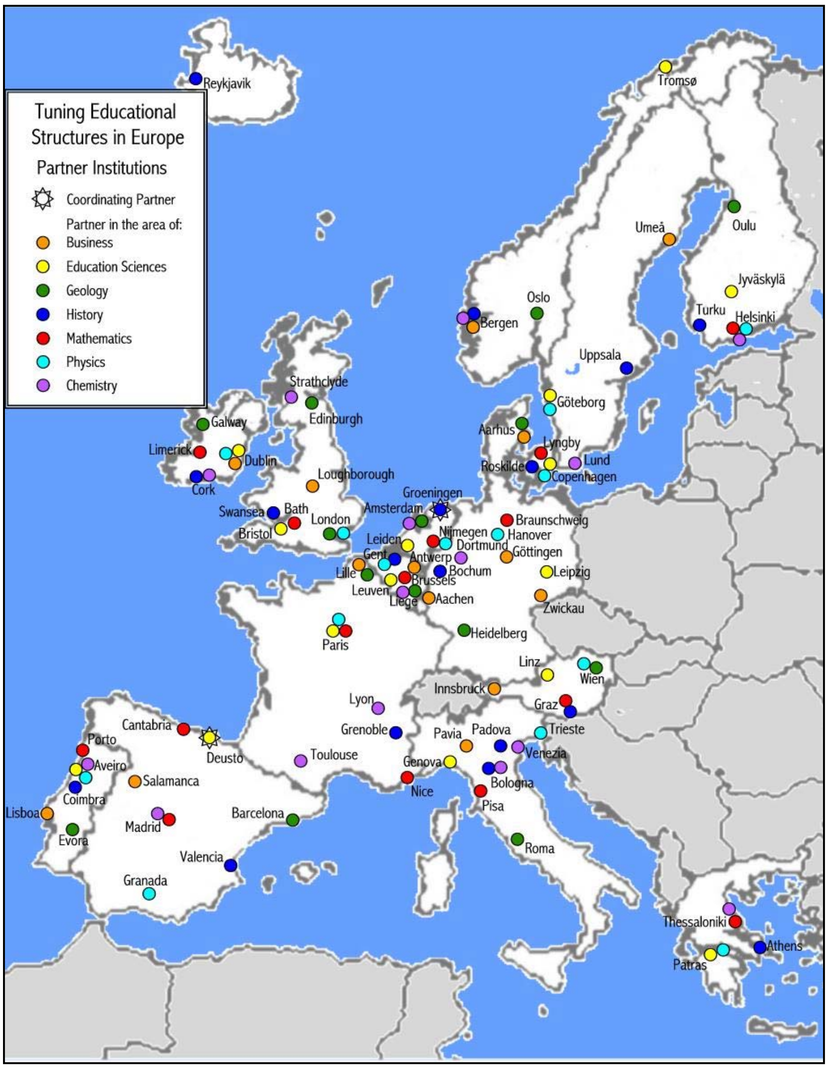
In another respect the Tuning project has tried to build on what has been achieved before with respect to other Thematic networks and other projects. This has led to the continuous presence of international experts in both the Steering Committee and the subject area groups in order to enable this co-ordinated action.

The work followed in line 3, apart from providing an important line of analysis of **European credits** as units in the whole architecture of higher education, is envisaged to lead to another **anticipated outcome**: a common methodology for measuring workload. This is in accordance with the Salamanca Declaration, which states that "Universities are convinced of the benefits of a credit accumulation and transfer system based on ECTS and on their basic right to decide on the acceptability of credits obtained elsewhere." It is also in accordance with the Prague Communiqué in which "Ministers emphasised that for greater flexibility in learning and qualification processes the adoption of common cornerstones of qualifications, supported by a credit system such as the ECTS or one that is ECTS-compatible, providing both transferability and accumulation functions, is necessary."

Three other expected outcomes still remain to be reached. One is the reflection on the process followed and the **identification of major obstacles to convergence**. Another is a set of **recommendations to the Ministries**, the Conferences of Rectors, the Universities and the European Commission. In this final part, the management committee will co-ordinate the work of the groups to conclude **these expected outcomes**, together with the preparation of the **final report**.

3. Participants

[Pages 7 and 8 printed separately in colour]



- **Pilot groups:** 105 university departments in 7 subject areas
- **Synergy Groups:** Thematic networks in other European fields acting in synchrony with Tuning
- **Professional bodies**
  - The European Universities Association (EUA)
  - The European Network of Quality Agencies (ENQA)
  - The National Conferences of Rectors
  - Other professional bodies
- Other **interested institutions**

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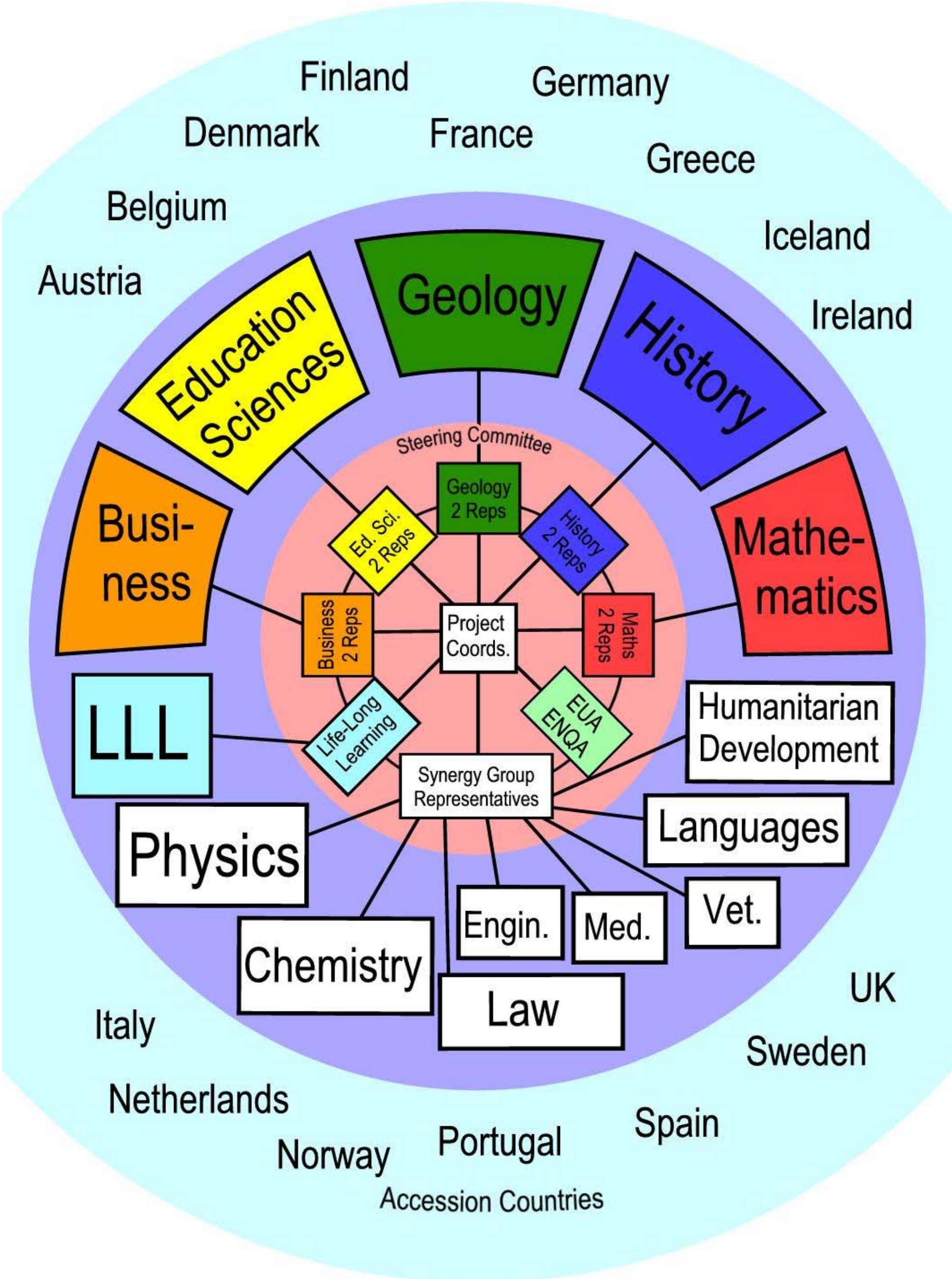
[Pages 13 and 14 printed separately in colour]

3.4. Organisational Structure



4. Line 1: Learning Outcomes: Competences

4.1. Executive Summary

The work on Line 1 of the Tuning project reflects the importance of focusing on competences alongside knowledge in joint reflection at the level of European universities. These are seen in the context of an adequate response to the paradigm of a primarily student-centred education, and as contributing towards a clearer definition of academic and professional profiles. Providing sets of dynamic descriptors, they add transparency to the debate on learning outcomes and hence facilitate mobility.

Mutual trust and confidence have been distinctive features of European cooperation. They are intimately linked with transparency. So is quality, which could be related with transparency of purpose, of processes and of outcomes. In each of these three the reflection and the identification of academic and professional competences may add an aspect of consistency. They are also relevant for the enhancement of employability, active citizenship and personal development in lifelong learning.

Also, in the creation of the European Higher Education Area, the joint study of competences together with knowledge by European universities will contribute to the development of easily readable and comparable degrees, and a system essentially based on two main cycles. Furthermore, the joint debate on the nucleus of competences and the articulation of levels and programmes by European networks can clearly enrich the European dimension of Higher Education. It also builds on the consistency of systems of accreditation by increasing information on learning outcomes, and contributes to the development of common frameworks of qualifications, hence promoting understanding, clarity and the attractiveness of the European Higher Education Area. Besides, an increase in transparency of learning outcomes and processes will definitely be a further asset for the encouragement and enhancement of mobility.

The Tuning project consulted with graduates, employers and academics in 7 subject areas (Business, Education Sciences, Geology, History, Mathematics, Physics and Chemistry), from 101 university departments in 16 European countries, by means of questionnaires, to which a total of 7,125 people responded (comprising 5,183 graduates, 944 employers and 998 academics). This is not to mention the informal teamwork, reflection and debate provoked at the level of departments, disciplines and countries. The objectives of this consultation were to initiate joint debate and reflection at institutional, subject area, and European levels, starting from a base of updated information reflecting the reality of the current situation. The consultation dealt with both generic and subject-specific skills and competences.

Thirty **generic** competences were selected from three categories: instrumental, interpersonal and systemic. Respondents were asked to rate both the importance and the level of achievement by educational programmes in each competence, and also to rank the five most important competences. The questionnaires were translated into 11 official languages and sent by each participating institution to 150 graduates and 30 employers of graduates in their subject area. The questionnaire for academics was prepared based on 17 competences judged most important by graduates and employers. For each of the competences, the respondents were asked to indicate: the importance of the skill or competence for work in their profession and the level of achievement of the skill/competence that they estimate they have reached as a result of taking their degree programme.

Consultation with stakeholders and joint reflection on up-to-date information and at European level is regarded as necessary for elaboration and reformulation of degree programmes.

Based on a preliminary analysis of the results, some initial conclusions can be drawn.

One of the most striking conclusions is the remarkable correlation between the ratings given by employers and those of graduates.

In relation to **importance**, these two groups consider that the most important competences to be developed are: capacity for analysis and synthesis, capacity to learn, problem solving, capacity for applying knowledge in practice, capacity to adapt to new situations concern for quality, information management skills, ability to work autonomously and teamwork.

Looking at the other end of the scale, there appear: understanding of cultures and customs of other countries, appreciation of diversity and multiculturality, ability to work in an international context, leadership, research skills, project design and management, and knowledge of a second language. One striking aspect is the concentration of the "international" competences in the lower part of the scale with respect to importance. This opens a number of questions which would need further analysis.

In relation to **achievement**, the items which appear highest in the scale, in the opinion of the graduates are: capacity to learn, basic general knowledge, ability to work autonomously, capacity for analysis and synthesis, information management skills, research skills, problem solving, concern for quality and will to succeed. Six of these items coincide with those that graduates and employers considered important and ranked highest in the scale. The remaining reflect the tasks which the universities have traditionally been performing for centuries.

Looking at the bottom of the scale, the competences are: leadership, understanding of cultures and customs of other countries, knowledge of a second language, ability to communicate with experts in other fields, ability to work in an international context, and ability to work in an interdisciplinary team. It is remarkable that these competences, with the exception of knowledge of a second language, all appear near the bottom of the table for importance. A number of open questions remain, which call for further reflection.

But it is the level of subject-related competences where Tuning makes perhaps its greatest contribution, since that **subject-related** competences are crucial for identification of degrees, for comparability and for the definition of first and second degree cycles. Each of the groups has identified a list of competences related to their subject and consulted with other academics to reflect on the relative importance of these competences and their best location at the level of first and second cycle. Because of the close relationship between this reflection and knowledge, this analysis appears in line 2.

4.2. *Why focus on competences?*

The Tuning project considers that the development of competences in educational programmes can significantly contribute to opening an important area of **joint reflection and work at university level in Europe about:**

1. the new educational paradigm;
2. the need for quality and the enhancement of employability and citizenship;
3. the creation of the European Higher Education Area.

4.2.1. Competences in the development of the new educational paradigm

The world is nowadays characterised by rapid change. A series of general factors such as globalisation, the impact of information and communication technologies, the management of knowledge and the need to foster and managed diversity, among others, make for a significantly different environment for education. Any reflections on the future developments of education must be placed in this context. The challenges of this change and the nature of these forces, as well as the speed with which they take place, have been widely documented in the literature and referred to by European Fora, International Organisations, and papers of the European Commission.[1]

A change is taking place in the teaching/learning paradigm, where approaches centred on the learner are increasingly important.

The "society of knowledge" is also a "society of learning". This idea is intimately linked with the understanding of all education in a wider context: the continuum of lifelong learning, where the individual needs to be able to handle knowledge, to update it, to select what is appropriate for a particular context, to learn permanently, to understand what is learned in such a way that it can be adapted to new and rapidly changing situations.

The need to recognize and value learning could also be seen as having an impact on qualifications and on the building of educational programmes leading to degree qualifications. In this context, the consideration of competences side by side with the consideration of knowledge offers a number of advantages which are in harmony with the demands emerging from the new paradigm.

Change and variety of contexts both require a constant check on social demands for professional and academic profiles. This underlines the need for **consultation**, and **constant revision of information on adequacy.** The language of competences, since it comes from outside higher education, could be considered more adequate for consultation and dialogue with groups not directly involved in academic life, and can contribute to the necessary reflection for the development of new degrees and for permanent systems of updating existing ones.

In the reflection on **academic and professional profiles,** competences emerge as an important element which can guide the selection of knowledge which is appropriate to particular ends. It presents an integrative capacity to choose what is appropriate from a wealth of possibilities.

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[1] European Commission DG XXII, 1995, 1997. Comission Staff working paper, 2000. Council of the European Union, 2001. Confederation of European Union Rectors' Conferences, 2001. Thomas, E., 2000. Haug, G & Touch, C., 2001. Mallea, J., 1998. Van Damme Dirk, 2001.

Trends are complex, often discontinuous processes whose effects on actors vary. However, the trend towards a "learning society" has been widely accepted and consolidated for some time. This involves a move **from teaching-centred to learning-centred education.** Reflecting on the different aspects which characterise this trend, the relevance of focusing on competences becomes apparent. The previous paradigm involved an emphasis on the acquisition and transmission of knowledge. Elements in the changing of this paradigm include[2]: education centred on the student, the changing role of the teacher, further definition of objectives, change in the approach to educational activities, shift in from input to output, and a change in the organization of learning. Each of these elements will be discussed in turn.

The interest in the development of competences in educational programmes is in accordance with an approach to education as primarily **centred on the student** and his/her capacity to learn, demanding more protagonism and higher quotas of involvement since it is the student who ought to develop the capacity to handle original information and access and evaluate information in a more varied form (library, teacher, internet, etc.)

This relates implicitly with the **changing role of the teacher,** from being the structurer of knowledge, the key player in the teaching and articulation of key concepts, as well as the supervisor and director of work of the student, whose knowledge he/she assesses. A student-centred vision gives the teacher more of an accompanying role, so that the learner attains certain competences. While the role continues to be critical, it shifts more and more towards containing higher levels of advice, counselling and motivation in relation to the importance and place of areas of knowledge, understanding and capacity to apply that knowledge, in relation to the profile which needs to be attained, personal interests, gaps and capacities, critical selection of materials and sources, organization of learning situations, etc.

The emphasis on students getting a particular competence or set of competences may also affect the transparency in the **definition of objectives** set up for a particular educational programme, adding indicators with higher possibilities for being measured accountably, while making these objectives **more dynamic** in taking into consideration the needs of society and employment.

This shift normally relates to a change in the **approach** to educational activities, teaching material and a great variety of educational situations, since it fosters the systematic involvement of the learner with individual and group preparation of relevant issues, presentations, organized feedback, etc.

Besides, the **shift in emphasis from input to output**[3] is reflected in student evaluation, moving from knowledge as the dominant (even the single) reference to include **assessment** centred on competences, capacities and processes closely related to work and activities as related to student development and in relation to academic and professional profiles already defined, also showing a greater wealth of assessment strategies (portfolio, tutorial work, course work...) as well as taking into consideration situational learning.

Finally, different ways of participating in education (full time, part time...) changing contexts and diversity also affect the **pace** or rhythm at which individuals and groups can take part in the educational process. This also has an impact not only on the form and structure of programme delivery but in the whole approach to the **organization of learning,** including more focused

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[2] Villa Aurelio, 2001
[3] Report of the Engineering Synergy Group, 2002. Tuning Educational Structures in Europe

programmes, more short courses, more flexible course structures, and more flexible delivery of teaching, with the provision of more guidance and support. [4]

4.2.2. Competences, the search for quality and the enhancement of employability and citizenship.

In the Salamanca Convention[5] **quality** was considered as a fundamental foundation, the basic underlying condition for trust, relevance, mobility, compatibility and attractiveness in the European Higher Education Area.

While compatibility, mobility and attractiveness will be dealt with in relation to the creation of the European Higher Education Area, it is important to look briefly into the role of education by competences, relevance of degree programmes as indicators of quality.

Mutual trust and confidence have been distinctive features of European cooperation. These are intimately linked with transparency. So is quality, which could be related with transparency of purpose, of processes and of outcomes.[6] In each of the three, the reflection and the identification of academic and professional competences may add an aspect of quality and consistency.

Relevance in the context of the Salamanca Convention relates particularly to employability, which needs to be reflected in different ways in the curricula "depending on whether the *competences* acquired are for employment after the first or the second degree." Employability, in the perspective of lifelong learning, is considered as best served through a diversity of approaches and course profiles, the flexibility of programmes with multiple exit and entrance points and the development of *generic competences*.

In fact, the relationship between reflection and work on competences and employment is a longstanding one.[7] The search to find a better way to predict successful performance in the work place, moving beyond measurements of intelligence personality and knowledge is often regarded as the initial point. This emphasis on work performance continues to be of vital importance.[8]

From the perspective of the Tuning Project, *learning outcomes* go beyond employment to contain also the demands and standards that the academic community has set in relation to particular qualifications. But employment is an important element. In this context competences and skills can relate better and may help to prepare graduates for crucial problems at certain levels of employment, in a permanently changing economy. This needs to be one of the points of analysis in the creation of programmes and units through constant reflection and evolution.

The consideration of education for employment needs to run parallel with education for citizenship, the need to develop personally and to be able to take social responsibilities and, according to the Council's follow-up report to the Lisbon Convention[9], facilitating the access of all to education.

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[4] Thomas Edward, 2000
[5] EUA, 2001
[6] Willams Peter, 2002.
[7] McClelland 1973
[8] R. E. Boyatzis.
[9] Council of the European Union, 2001

4.2.3. Competences and the creation of the European Higher Education Area

The focus on competences in the Tuning Project is closely linked with the creation of the European Higher Education Area, and very explicitly with the Bologna process and the Prague Communiqué.

In relation to a system of **easily readable and comparable degrees** aimed at facilitating academic and professional recognition so that citizens can use their qualifications through the European HE Area, the introduction of Line 1 in Tuning sought to provide comparability and readability in reference to the competences (generic or subject-related) that the graduates from a particular degree aimed at attaining. In fact, the capacity to define which competences a programme seeks to develop, or what its graduates should be able *to know, understand and do,* cannot but add a further dimension to the degree transparency. They can also contribute to the development of both better-defined degrees, and systems of recognition that are "simple, efficient and fair", "reflecting the underlying diversity of qualifications" since competences add angles and levels, selecting knowledge appropriate to a particular profile. This works in favour of diversity.

As regards the adoption of **a system essentially based on two main cycles**:

The identification and initial discussion by a European body of academics of a set of *subject-related competences* for *first and second cycle* could be considered one of the major contributions of the project. In connection with knowledge, this is crucial for the development of European points of reference which could be considered common, diverse and dynamic in relation to specific degrees and the creation of frameworks of reference for clarification and further understanding of the relationship and nature of the qualifications.

Following on from this, joint reflection and work on competences and skills is an extremely important element in the work towards common standards and profiles for recognized joint degrees. Furthermore, the joint debate on the nucleus of competences and the articulation of levels and programmes by European networks can clearly enrich **the European dimension of HE.** It also builds on the consistency of systems of accreditation by increasing information on learning outcomes, and contributes to the development of common frameworks of qualifications, hence promoting understanding, clarity and the **attractiveness of the European Higher Education Area.**

An increase in transparency of learning outcomes and processes will definitely be a further asset for the **encouragement and enhancement of mobility.** Information which takes into consideration objectives expressed in the language of competences will present a more holistic perspective on the programme, but hopefully also will develop a systematic approach to each of the units in terms of the capacities which they will hope to gain. However, the specific contribution that Tuning in general and Line 1 in particular seek to offer relates particularly to the *mobility of professionals* and degree holders all over Europe, and has often been referred to as vertical mobility: the movement of graduates to take the second cycle of their studies in another country. In this respect the contribution of Tuning to the Diploma supplement is of great relevance.

4.3. The questionnaire

In the Tuning Project the debate on each of the lines follows one of the many different approaches possible. For the debate on skills and competences a questionnaire was proposed.

4.3.1. The objectives

The objectives of the questionnaire included:

- The wish to initiate the joint discussion on this field of competences and skills at the European level, based on consultation with groups from outside academia (graduates and employers) as well as from a broader base in relation to academics (beyond Tuning representatives from each of the subject areas involved).
- The attempt to gather updated information for reflection on possible trends and the degree of variety and change all over Europe.
- The desire to start from the experience and the reality in order to reach levels of diversity or commonality between the different countries, starting the debate from specific questions with concrete language.
- The importance of initiating the reflection and debate at three different levels: the *institutional level* (the basis and the first one to take place), the *subject area level* (a reference point for the HE institutions) and the *aggregate level* (a second reference point in relation to the situation at European level).

4.3.2. The content of the questionnaire

Definition of competences

Several terms: capacity, attribute, ability, skill, competence,... are used with an often interchangeable, and to some degree overlapping meaning. They all relate to the person and to what he/she is able of achieving. But they also have more specific meanings. Ability, from the Latin "habilis" meaning "able to hold, carry or handle easily", led to the word "habilitas" which can be translated as "aptitude, ability, fitness or skill."

The term skill is probably the most frequently used, with the meaning of being able, capable or skilful. It is often used in the plural, "skills," and sometimes with a more restricted meaning than that of competences. This explains the choice of the term competences in the Tuning Project. In the questionnaire to the graduates and employers, however, the two terms "skills" and "competences" appear together for a more encompassing meaning.

Competences tend to convey meaning in reference to what a person is capable or competent of, the degree of preparation, sufficiency and/or responsibility for certain tasks[10].

In the Tuning Project, the concept of competences tries to follow an integrated approach, looking at capacities via a dynamic combination of attributes[11] that together permit a competent performance or as a part of a final product of an educational process[12]. This also links with the work done in HE[13]. In Line One, competences and skills are understood as including **knowing and understanding** (theoretical knowledge of an academic field, the capacity to know and understand), **knowing how to act** (practical and operational application of knowledge to certain situations), **knowing how to be** (values as an integral element of the way of perceiving and

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[10] José M. Prieto, 2002
[11] Heywood, 1993
[12] Argudín, 2000
[13] HEQC Quality Enhancement Group, 1995/ Fallows, S. and Steven (edits),.2000/ The Quality Assurance Agency for Higher Education, 2001./ The Scottish Credit and Qualifications Framework, 2001

living with others and in a social context). Competences represent a combination of attributes (with respect to knowledge and its application, attitudes, skills and responsibilities) that describe the level or degree to which a person is capable of performing them.

In this context, a competence or a set of competences mean that a person puts into play a certain capacity or skill and performs a task, where he/she is able to demonstrate that he/she can do so in a way that allows evaluation of the level of achievement. Competences can be carried out and assessed. It also means that a person does not either possess or lack a competence, but commands it to a varying degree, so that competences can be placed on a continuum.

In the Tuning Project two different sets of competences were focused on: Firstly, those competences which are **subject-area related**. These are crucial for any degree and they are intimately related to specific knowledge of a field of study. They are referred to as academic-subject-related skills and competences. These give identity and consistency to the particular degree programme.

Secondly, Tuning tried to identify shared attributes which could be general to any degree, and which are considered important by particular social groups (in this case former graduates and employers). There are certain attributes like the capacity to learn, the capacity for analysis and synthesis, etc, which are common to all or most of the degrees. In a changing society where demands tend to be in constant reformulation, these general skills or competences also become very important. The first questionnaire tried to identify these so-called **generic** skills and competences and how they were valued, first by graduates and employers and then in the second questionnaire (first part), by academics.

This paper deals with the generic skills and competences, since subject-related competences have been analysed with an approach which was deemed adequate to the subject by the relevant groups of expert.

In the design and redesign of educational programmes, it is crucial that the University takes into consideration the changing needs of society as well as present and future employment possibilities. While these are not the unique consideration for the development of study programmes and degrees, they are of vital importance.

Obviously the list of competences and skills identified and able to be reflected upon is vast. The choice of a number of items to be included in a questionnaire is always partial and debatable. In order to prepare the **questionnaire for graduates and employers** a review of over twenty studies[14] in the field of *generic skills and competences* was carried out. A list of 85 different skills and competences was identified. They were regarded as relevant by institutions of Higher Education or companies. These items were categorised as instrumental, interpersonal and systemic. There is obviously a number of different possible classifications and it is recognized that no classification is perfect. Therefore some competences could be seen as bridging the categories. This is a possible working classification:

[14] Some of these studies are included in Fallows, S and Steven, C (2000) *Integrating Key Skills in Higher Education.* The other sources include Argüelles, A (1997); Boletin Educaweb (2001); Crump, S, et al. (1996); Dalton, M (1998); Davis, D, et al. (1998); Fraser, S, and Deane, E (1998); Funcion Universidad-Empresa (1999); Gonzi, A, Hager, P and Athanascu, J (1993); Heywood, L, et al. (2000); Marelli, A F (1998); Melton R (1997); Monereo, C and Pozo, J I (2001); OCDE (2000); Vargas, F, Casanova, F, and Montanaro L (2001).

- ***Instrumental Competences***: Those having an instrumental function. They include:
  - *Cognitive* abilities, capacity to understand and manipulate ideas and thoughts.
  - *Methodological* capacities to manipulate the environment: organising time and strategies of learning, making decisions or solving problems.
  - *Technological* skills related to use of technological devices, computing and information management skills.
  - *Linguistic* skills such as oral and written communication or knowledge of a second language.
- ***Interpersonal Competences***: *Individual* abilities relating to the capacity to express one's own feelings, critical and self-critical abilities. *Social skills* relating to interpersonal skills or team-work or the expression of social or ethical commitment. These tend to favour processes of social interaction and of co-operation
- ***Systemic competences***: those skills and abilities concerning *whole systems*. They suppose a combination of understanding, sensibility and knowledge that allows one to see how the parts of a whole relate and come together. These capacities include the ability to plan changes so as to make improvements in whole systems and to design new systems. Systemic competences require as a base the prior acquisition of instrumental and interpersonal competences.

The distribution of the competences mentioned in the sources consulted (without considering the frequency of repetitions of the same competence), based on the aforementioned typology, was as follows:

- Instrumental Competences (38%)
- Interpersonal Competences (41%)
- Systemic Competences (21%)

Looking at the frequency and trying to amalgamate related concepts the percentage changed, as follows:

- Instrumental Competences (46%)
- Interpersonal Competences (22%)
- Systemic Competences (32%)

It was interesting to note that interpersonal competences represented the greatest percentage in terms of the number of different competences (41%). However, since they appeared excessively varied and were not well-determined, when analysed by frequency, this percentage went down to 22%. It seemed that instrumental competences were well delimited and coincide across many different approaches; for instance, technological competence (understood as use of a personal computer) or linguistic competence (oral and written communication).

On the other hand, interpersonal competences are very dispersed. They refer to personal aspects (self-concept, self-confidence, locus of control, etc.) or interpersonal aspects as varied as assertiveness, interpersonal communication, face-to-face style, social commitment, etc.

In April, 2001 a draft of the first questionnaire for graduates and employers was prepared. Time constraints limited the participation of members in the initial stage of the questionnaire's design, although this would be desirable on future occasions. This initial draft tried to propose a balanced representation of competences from all three groups: instrumental, interpersonal and systemic. The provisional questionnaire was discussed at the first Tuning meeting and some items were changed by the Tuning members[15]. Some groups also added competences more directly related to their subject area. (Mathematics, History and Education Science.)

In May 2001, these suggestions were incorporated and the definitive questionnaire was prepared. Also incorporated, in both graduate and employer questionnaires, was a series of variables for identification considered important to the study.

The definitive questionnaires comprised the following 30 competences:

- **Instrumental competences**
  - Capacity for analysis and synthesis
  - Capacity for organisation and planning
  - Basic general knowledge
  - Grounding in basic knowledge of the profession
  - Oral and written communication in your native language
  - Knowledge of a second language
  - Elementary computing skills
  - Information management skills (ability to retrieve and analyse information from different sources)
  - Problem solving
  - Decision-making
- **Interpersonal competences**
  - Critical and self-critical abilities
  - Teamwork
  - Interpersonal skills
  - Ability to work in an interdisciplinary team
  - Ability to communicate with experts in other fields
  - Appreciation of diversity and multiculturality
  - Ability to work in an international context
  - Ethical commitment

[15] See the questionnaire on the Tuning website: www.relint.deusto.es/TuningProject/index.html or www.let.rug.nl/TuningProject/index.html or europa.eu.int/comm/education/tuning.html.

- **Systemic competences**
  - Capacity for applying knowledge in practice
  - Research skills
  - Capacity to learn
  - Capacity to adapt to new situations
  - Capacity for generating new ideas (creativity)
  - Leadership
  - Understanding of cultures and customs of other countries
  - Ability to work autonomously
  - Project design and management
  - Initiative and entrepreneurial spirit
  - Concern for quality
  - Will to succeed

Other interesting competences could have been included, for example "teaching ability". This would perhaps have provided a relevant perspective in relation to a significant sector of employment. The responses of employers might also have been affected by the use of the word "advanced" rather than "basic" in relation to knowledge or grounding in the profession. The former might have been given a higher rank.

The questionnaires were translated into the 11 official languages of the EU by Tuning members. Each of the Universities sent and received back the questionnaires from their graduates and employers and sent them on to University of Deusto where the questionnaires were processed.

Each of the Universities got back its own data file by e-mail and the graphs for the total and the different subject areas. By agreement and for confidentiality reasons, no graph or analysis was made at central level in relation to individual universities. Each university was expected to do the institutional analysis, and reflection at local level and bring this to the area group. They could, also, compare their own data with total and area results.

4.3.3. Procedure

The **procedure** requested of the coordinators at the participating universities with respect to the selection of the different samples was as follows:

Questionnaire for Graduates

- Every university participating in the study had to sample a total of **150 graduates**.
- The graduates selected were to have graduated within the last **3 to 5 years**.
- This criterion depended on the **number of graduates** that had graduated in this period, as well as the professional destinations of the graduates.

- If there were few graduates each year, the sample would include those graduating within the last 5 years. If there were a large number, then the sample would be limited to those graduating in the last 3 years. In those few cases where there were not enough graduates from the participating institution, graduates from other similar institutions in the same country were included.

- In relation to the professional destinations of graduates, given that the study was most interested in graduates who already were working, where graduates entered the world of work rapidly after graduation, the sample could be chosen among those who had graduated in the last 3 years. Otherwise, when graduates took longer to join the world of work, it was recommended to select the sample from those who had graduated in the last 5 years.

- The criterion of selection of the 150 graduates was at **random**. It was recommended that if there existed an **association of graduates** with an updated database of addresses, the selection was made by the above mentioned association. In this way we would avoid having questionnaires returned because they were sent to an out-of-date address.

- The corresponding university sends the questionnaires to its graduates with a letter in which, as well as presenting the questionnaire, it asks them to send it by return to the university within the space of 10 days.

- The questionnaire and the letter of introduction are sent along with a stamped addressed envelope for the return of the questionnaire.

Questionnaire for Employers

- Every university participating in the study has to gather information from **30 employers.**

- The criterion of selection was that they should be organisations which the university knew to employ its graduates, and/or organisations which in spite of not having proof that they had employed graduates of the university, seemed likely to be interesting places of work for these graduates. Within these guidelines, universities were free to select whatever employers they through appropriate. It has been suggested that a tighter control on the balance of different types of employers might have been exercised so as to obtain more representative results. However, this remains an open question.

- The corresponding university sent the questionnaires to the employers with a letter which, beside presenting the questionnaire, asked them to return it within 10 days.

- The questionnaire and the letter of introduction were sent along with a stamped addressed envelope for the return of the questionnaire.

Questionnaire for Academics

- Every participating university gather information from, at least, 15 academics in the area in which the subject university was participating.
- Each university sent the academics a questionnaire in electronic form that they were asked to return within seven days.

4.3.4. Type of Response Requested

The questionnaires required two types of response:

1. Importance / Level of Achievement
2. Ranking the five competences considered most important

For each of thirty competences, the respondents were asked to indicate:

- The **importance** of the skill or competence, in his/her opinion, for work in their profession and
- the **level of achievement** of the skill/competence that they estimate they have reached as a result of taking their degree programme.

To indicate this respondents were asked to use a scale of 1 = none to 4 = strong.

Asking about both aspects (importance and level of achievement) responds to the interest in finding where their institution stands in terms of thirty competences arranged into four categories, represented in the diagram below:

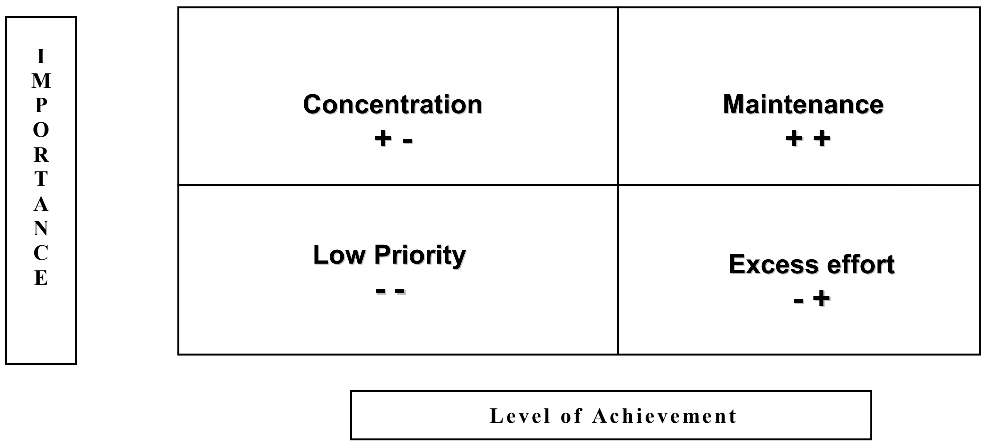

DIAGRAM 1. AIR (MARTILLA AND JAMES, 1997)

- *Concentration*: that is to say, competences that are considered very important but in which there is little achievement.
- *Low priority*: competences which are not considered very important and in which achievement is low.
- *Excess effort*: competences that are not considered very important but in which achievement is high.
- *Maintain*: competences that are considered important and in which achievement is high.

The importance of the chart is that it may help reflection and discussion at institutional level finding out the weak and strong points which could help to build policy (a matter of choice for the institution); to strengthen the weaker parts or even to get stronger at the strong points. What was really crucial was to place the development of system of consultation in context with the environment, and also to have the capacity to create systems which can help to develop joint strategies at the European level.

Ranking: As well as indicating the importance and level of achievement of each of the 30 competences, both groups (graduates and employers) were asked to indicate, in order, the five competences that they considered to be most important.

Commonly when people are asked to value the importance of different aspects of life, this valuation tends to be high. In general, the tendency is to value things as important, which can reasonably be considered as such, but without discriminating excessively between them. As we were conscious that this could happen in the case of competences, it seemed suitable to request that respondents would choose the five most important competences and rank them in order of importance. These two pieces of information, importance and ranking, seemed important for the work.

The questionnaire sent to **academics**, was divided into two parts:

The first part related to *generic competences.* The objective was to obtain a third perspective on generic skills and competences to compare with those of graduates and employers.

The content was based on the results obtained in the study of graduates and employers. Depending on this information, it was observed that there was a high level of agreement between graduates and employers on the 11 competences considered as most important by both groups. These 11 competences were included in the questionnaire sent to academics, as well as 6 others also considered as very important by graduates and employers. Academics were asked to rank these 17 competences in order of importance, in their opinion.

The second part of the questionnaire dealt with *specific, subject-related competences*.

The objective of this part was to find the first response, from a broader base of academics from the relevant areas, to the work done by each of the groups of Tuning experts trying to identify subject-related competences and to relate them to either first or second cycle of studies in their particular field.

The difficulty of this task is clearly understood by the Tuning members. Equally clear is the understanding that what is at stake is the development of reference points which, understood only as such and in a dynamic framework, could be of vital importance in the development of the European HE Area.

It may be considered that competences are always linked with knowledge but in the case of subject-related competences, this connection is even closer. The joint reflection at European level on what is common, diverse and dynamic, together with the identification of levels, is a crucial step towards the understanding and consequently the building of degrees, which can be taken and used throughout Europe.

The content of the second part of the academics' questionnaire was prepared by the Tuning working groups in the different areas. Despite of the fact that the questionnaire for each area was different, the way of responding was common. Respondents were asked, for each of the competences, to gauge the level of importance that it had, in their opinion, in both the first and second cycle.

The aim of both questionnaires was, as explained above, that of initiating joint reflection, so its main achievement needs to be considered as provoking reflection and debate. It is also important to note that the processes were conceived as having, as the bottom line of the joint discussion, the reflection that each of the Tuning participants brought to the group from his or her own institution, where the questionnaire results had the best context for interpretation. This objective affected the type and form of data collected.

4.3.5. Participants in the questionnaire

A total of 101 out of a total of 105 university departments participating in the Tuning Project took part in the consultation[16]. The choice of universities in the Tuning Project was a very complex process where the interest, the size of the country and the criteria of the local conference of Rectors had a place.

The data was first meant to be analysed at the level of the institution, to provide the maximum degree of meaning. Also the two indicators seemed different in this context. While the opinion on achievement seems very important at institutional level, particularly in relation to the graduates, it can be regarded more as a perception as it relates to aggregate data or in relation to the employers. However looking at **importance** it is questionable the degree to which the graduates, or even more employers, related to a particular institution or whether instead they responded to the degree of importance they attached to the particular item in terms of its relation to work or development. Hence, importance is at the base of the reflection.

Specifically, seven subject areas took part in the research: Business, Education Sciences, Geology, History, Mathematics, Physics, and Chemistry, in relation to graduates, employers and academics.

In each of these areas the following number of universities were invited to participate:

- Business: 15 universities, of which 14 participated
- Geology: 14 universities
- History: 17 universities and an international network for the study of university teachers (CLIOHNet)
- Mathematics: 15 universities, of which 13 participated
- Physics: 14 universities
- Education: 15 universities, of which 14 participated
- Chemistry: 15 universities, of which 14 participated

[16] In addition, for the questionnaire for Academics, the history thematic network (Cliohnet) also participated. Also in some, very limited instances, academics or graduates of other institutions giving similar degrees were consulted.

The **data** relating to the sample participating in the study are presented below.

Total

	Graduates		Employers		Academics	
	N	%	N	%	N	%
Business	921	17,8	153	16,2	153	15,3
Geology	656	12,7	138	14,6	145	14,5
History	800	15,4	149	15,8	221	22,1
Mathematics	662	12,8	122	12,9	122	12,2
Physics	635	12,3	85	9,0	121	12,1
Education Sciences	897	17,3	201	21,3	134	13,4
Chemistry	612	11,8	96	10,2	102	10,2
Total	5183	100,0	944	100,0	998	100,0

Although the intention of the consultation was to initiate a joint dialogue with social groups and the debates followed at institutional and subject area level could be considered the best results, the valuable work of 101 universities and the volume of data collected (5,183 questionnaires from graduates, 944 from employers and 998 from academics) deserve an attempt at some treatment for further reflection.

4.3.6. Methodology

The sample design was clustered, as respondents are clustered within Universities. Therefore assumptions of simple random sampling may not be valid as respondents are not strictly independent from each other. At the same time, Universities may show some cluster effect at country level.

Clustered design is widely used in research[17] and does not represent by itself a source of bias. Cluster sampling affects the survey sampling error of any estimate produced. The sampling error is increased depending on differences in measured items among clusters.

Based on data, this design effect due to cluster sampling may be estimated by intracluster correlation: high intracluster correlation indicates that differences among clusters are high, and therefore increases the survey sampling error. It should be noted that low intracluster correlation in any item, near to zero, indicates that a simple random sample would have produced similar results.

In relation to the results of the Tuning Questionnaire on generic skills and competences simple random sampling estimates and procedures were avoided in either univariate or multivariate analysis. All estimates and conclusions take into account the clustered nature of data at both University and country level through multilevel modelling.

It was regarded as the most appropriate approach since multilevel models take into account the clustered structure of data (i.e. does not assume that observations are independent as in simple

[17] Bryk, A.S. And Raudenbusch, S.W. (1992*)*
Draper, D. (1995)
Goldstein, H. (1992).
Goldstein, H. (1995).
Goldstein, H. And Spiegelhalter, D. (1996).
Goldstein, H., Rasbash, J., Yang, M., Woodhouse, G., Pan, H., Nuttall, D., and Thomas, S. (1993).

random sampling). These models have been widely used on educational data as their clustered structure, students within educational institutions, is always present.

At the same time multilevel modelling allows simultaneous modelling of individual and cluster level differences providing adequate estimates of standard errors and making appropriate any inference at both individual and cluster level.

In this context clusters are not regarded as a fixed number of categories of a explanatory variable (i.e. the list of selected universities as a fixed number of categories) but it considers that the selected cluster belong to a population of clusters. At the same time yields better estimates at individual level for groups with few observations.

Three different types of variables are analysed:

- Importance items: 30 competences rated on importance by respondents (Graduates and Employers)
- Achievement items: 30 competences rated based on achievement (Graduates and Employers)
- Ranking: based on the ranking of the five most important competences provided by graduates and employers, a new variable was created for each competence. For each respondent the corresponding competence was assigned five points if it was the first selected competence, four if it was the second one, etc... and finally one point if it was selected in the fifth place. If the competence was not chosen by the respondent, zero points were assigned. For the academics, who had to rank a longer list of seventeen competences out of the previous thirty rated by graduates and employers, this ranking was created using a similar transformation applied to a seventeen points scale: seventeen was assigned if the competence was chosen first, sixteen to the second competence, etc...

4.3.7. Results

Graduates

Intracluster correlations (Table 1, Table 2)[18] indicate to what extent universities are different from each other and the effect of clustered observations on sampling errors. The highest intracluster correlation is for *Knowledge of a second language* both as importance (0,2979) and achievement (0,2817). The next highest two are *Elementary computing skills*-Achievement (0,2413) and *Ethical commitment*-Importance (0,1853). From the list of items regarding importance, 21 out of 30 show intracluster correlations lower than 0.1 and from the list of items regarding achievement the proportion goes to 10 out from 30. Results seem consistent: when graduates rate universities, they seem to be more in terms of achievement than importance.

Means for all items were calculated taking into account the intracluster correlation using multilevel models for each item with no explanatory variables and allowing a random intercept for each level. At this stage three levels were considered: country, university and final respondent. Therefore the intercept in the model yielded the mean for each item with adequate estimates of the sampling error for each estimate.

[18] For tables 1-8 See Tuning website: www.relint.deusto.es/TuningProject/index.html or www.let.rug.nl/TuningProject/index.html or europa.eu.int/comm/education/tuning.html.

The results are shown in Table 3, Table 4 and Table 5. These results were displayed as confidence intervals (1-α=95%) in Figure 1, Figure 2 and Figure 3.

Employers

For the data collected from employers a similar analysis was performed. Multilevel modelling showed that the country effect – employers belonging to same country- seems stronger than the university effect -employers belonging to same university in the data collection process- compared to graduates as it would be expected. Means for all items were again calculated using multilevel models as it was done before.

The results are shown in Table 6, Table 7 and Table 8. These results were displayed as confidence intervals (1- α =95%) in Figure 4, Figure 5 and Figure 6.

Comparing Graduates with Employers

Importance ratings for Graduates and Employers were compared using again multilevel modelling adding a parameter to the model accounting for the difference between both groups. Thirteen items showed a significant difference (α<0,05). The highest difference corresponds to Ethical commitment with Employers rating this item higher than students. It is interesting to note that employers rate Ability to work in an interdisciplinary team significantly higher than graduates while in the case of Ability to work autonomously the case is just the opposite graduates rating this item higher than employers. These results are shown in Table 9.

Table 9. Significant differences in importance items. Employers vs. Graduates

Label	Description		Difference Employers vs. Graduates	α
imp28	Ethical commitment	Employers higher than Graduates	0,3372	0,00%
imp20	Ability to work in an interdisciplinary team		0,1463	0,00%
imp27	Initiative and entrepreneurial spirit		0,0979	0,07%
imp17	Teamwork		0,0957	0,04%
imp29	Concern for quality		0,0838	0,11%
imp25	Ability to work autonomously	Graduates higher than Employers	-0,1591	0,00%
imp8	Elementary computing skills		-0,1559	0,00%
imp9	Research skills		-0,1104	0,09%
imp3	Capacity for organisation and planning		-0,0900	0,04%
imp5	Grounding in basic knowledge of the profession		-0,0822	0,62%
imp11	Information management skills		-0,0739	0,35%
imp15	Problem solving		-0,0554	1,80%
imp16	Decision-making		-0,0552	3,51%

If the rankings of importance items obtained from each group are compared some interesting patterns are observed. This comparison is obtained joining Tables 3 and 6 as shown in Table 10.

Table 10. Importance items ranking. Employers vs. Graduates

Graduates		**Employers**	
Label	Description	Label	**Description**
imp1	Capacity for analysis and synthesis	imp10	Capacity to learn
imp15	Problem solving	imp2	Capacity for applying knowledge in practice
imp10	Capacity to learn	imp1	Capacity for analysis and synthesis
imp25	Ability to work autonomously	imp15	Problem solving
imp11	Information management skills	imp29	Concern for quality
imp2	Capacity for applying knowledge in practice	imp17	Teamwork
imp8	Elementary computing skills	imp13	Capacity to adapt to new situations
imp13	Capacity to adapt to new situations	imp11	Information management skills
imp18	Interpersonal skills	imp18	Interpersonal skills
imp3	Capacity for organisation and planning	imp14	Capacity for generating new ideas (creativity)
imp29	Concern for quality	imp6	Oral and written communication
imp6	Oral and written communication	imp25	Ability to work autonomously
imp30	Will to succeed	imp3	Capacity for organisation and planning
imp17	Teamwork	imp30	Will to succeed
imp16	Decision-making	imp16	Decision-making
imp14	Capacity for generating new ideas (creativity)	imp12	Critical and self-critical abilities
imp12	Critical and self-critical abilities	imp8	Elementary computing skills
imp21	Ability to communicate with experts in other fields	imp20	Ability to work in an interdisciplinary team
imp5	Grounding in basic knowledge of the profession	imp27	Initiative and entrepreneurial spirit
imp4	Basic general knowledge	imp21	Ability to communicate with experts in other fields
imp20	Ability to work in an interdisciplinary team	imp4	Basic general knowledge
imp27	Initiative and entrepreneurial spirit	imp28	Ethical commitment
imp26	Project design and management	imp5	Grounding in basic knowledge of the profession
imp7	Knowledge of a second language	imp26	Project design and management
imp9	Research skills	imp19	Leadership
imp23	Ability to work in an international context	imp7	Knowledge of a second language
imp19	Leadership	imp23	Ability to work in an international context
imp28	Ethical commitment	imp22	Appreciation of diversity and multiculturality
imp22	Appreciation of diversity and multiculturality	imp9	Research skills
imp24	Understanding of cultures and customs of other c.	imp24	Understanding of cultures and customs of other c.

The correlation between both rankings is quite strong (Spearman correlation = 0.899) and shows some common groups of items at both extremes of the ranking. In order to create a combined ranking, groups of items were created for both graduates and employers so that any pair of items in the same group showed non significant difference in the importance rating mean. In this manner ten groups were created in the graduates ranking and seven in the employers ranking. Each item received the mean rank of the group in which it was included and finally the mean was calculated for each item using the mean rank of the graduates list and the mean rank of the employers list. This procedure created a ranking of eighteen levels where some of the items were tied (Table 11) which perhaps seems like a more adequate manner to present final results when such groups are to be compared.

Table 11. Combined ranking. Graduates & Employers

Label	Description	Combined ranking
imp1 imp10 imp15	Capacity for analysis and synthesis Capacity to learn Problem solving	1
imp2	Capacity for applying knowledge in practice	2
imp13 imp29	Capacity to adapt to new situations Concern for quality	3
imp11 imp25	Information management skills Ability to work autonomously	4
imp17	Teamwork	5
imp3 imp6 imp18 imp30	Capacity for organisation and planning Oral and written communication in your native language Interpersonal skills Will to succeed	6
imp14	Capacity for generating new ideas (creativity)	7
imp8	Elementary computing skills	8
imp16	Decision-making	9
imp12	Critical and self-critical abilities	10
imp20 imp27	Ability to work in an interdisciplinary team Initiative and entrepreneurial spirit	11
imp4 imp5 imp21	Basic general knowledge Grounding in basic knowledge of the profession Ability to communicate with experts in other fields	12
imp28	Ethical commitment	13
imp7 imp26	Knowledge of a second language Project design and management	14
imp9 imp19	Research skills Leadership	15
imp23	Ability to work in an international context	16
imp22	Appreciation of diversity and multiculturality	17
imp24	Understanding of cultures and customs of other countries	18

Academics

The academics were asked to rank seventeen items selected from the thirty item list given to graduates and employers. It is true that some respondents reported that it was somewhat difficult to give a specific ranking to certain items as they seemed equally important. The adequacy of ranking versus weighting in this context is debatable and the difficulty has been well understood. This is often the case when a long list of items has to be ranked but it is clear that given that all academics faced this same difficulty – and therefore some of the positions in the ranking were given somehow at random within a specific range- aggregate results should show this same close positions in the final ranking (and no significant differences between the ranking of these items as it will be shown in results).

A numerical variable was created for each item assigning seventeen points if the item was ranked in the first place, sixteen if it was ranked in the second place and so on. The mean of this variable for each item was estimated again by multilevel modelling as it is shown in Table 12 and Figure 7. Table 12 displays the items in descending order and therefore creating again a ranking of items. Given that the order is given just by the estimation, the mean differences between items were analysed in order to find if differences were significant. In this manner eight different groups of items were created so that any possible pair of means in the group showed no significant difference. Within each group the ranking of items could be considered interchangeable at some extent.

Table 12. Academics

Label	Description	Mean	StdErr	Item groups
imp4	Basic general knowledge	12,87	0,1906	**1**
imp1	Capacity for analysis and synthesis	12,70	0,3168	
imp10	Capacity to learn	12,23	0,2313	**2**
imp14	Capacity for generating new ideas (creativity)	11,47	0,1907	**3**
imp2	Capacity for applying knowledge in practice	11,00	0,3266	
imp12	Critical and self-critical abilities	10,14	0,3035	**4**
imp13	Capacity to adapt to new situations	9,88	0,2894	
imp5	Grounding in basic knowledge of the profession	9,01	0,3685	
imp6	Oral and written communication in your native language	8,81	0,2821	**5**
imp20	Ability to work in an interdisciplinary team	8,51	0,1829	
imp9	Research skills	7,67	0,3107	**6**
imp16	Decision-making	7,25	0,2389	**7**
imp28	Ethical commitment	7,01	0,2844	
imp18	Interpersonal skills	7,00	0,3124	
imp7	Knowledge of a second language	6,90	0,3239	
imp8	Elementary computing skills	5,64	0,1816	**8**
imp22	Appreciation of diversity and multiculturality	5,30	0,2681	

In order to compare the academics ranking to the previous ones, the thirteen items not present in the academics list were deleted from the graduates, employers and combined graduates-employers rankings and these rankings were reconstructed using seventeen ordered positions. The result is shown in Table 13.

Table 13. Rankings

Label	Description	ACADEMICS	GRADUATES	EMPLOYERS	GRAD&EMPL.
imp1	Capacity for analysis and synthesis	2	1	3	1
imp2	Capacity for applying knowledge in practice	5	3	2	3
imp4	Basic general knowledge	1	12	12	12
imp5	Grounding in basic knowledge of the profession	8	11	14	13
imp6	Oral and written communication in your native language	9	7	7	5
imp7	Knowledge of a second language	15	14	15	15
imp8	Elementary computing skills	16	4	10	8
imp9	Research skills	11	15	17	16
imp10	Capacity to learn	3	2	1	2
imp12	Critical and self-critical abilities	6	10	9	10
imp13	Capacity to adapt to new situations	7	5	4	4
imp14	Capacity for generating new ideas (creativity)	4	9	6	7
imp16	Decision-making	12	8	8	9
imp18	Interpersonal skills	14	6	5	6
imp20	Ability to work in an interdisciplinary team	10	13	11	11
imp22	Appreciation of diversity and multiculturality	17	17	16	17
imp28	Ethical commitment	13	16	13	14

The most striking difference is that academics rank Basic general knowledge in the first position of the list (although it should be remembered that shows no significant difference compared to the second ranked Capacity for analysis and synthesis) while both graduates and employers tend to rank this same item in the twelfth position. Spearman correlations are shown in Table 14 showing that employers and graduates rankings tend to be more similar among them than the academics ranking. Compared to graduates, most relevant differences are Elementary computing skills (fourth position for graduates and sixteenth for academics) and Interpersonal skills (sixth for graduates and fourteenth for academics). Compared to employers, most relevant difference is again Interpersonal skills (fifth for employers and fourteenth for academics).

Table 14. Spearman correlations

Academics	1			
Graduates	0.45588	1		
Employers	0.54902	0.89951	1	
Graduates&Employers	0.55147	0.95098	0.97304	1

Country Effects

Multilevel modelling allows the estimation of what could be considered a country effect, this is, a measure of the effect of the country as a whole on respondents. This effect was measured on the **thirty importance items** rated by graduates. The country effect was classified in three groups: strong effect (there are strong differences between countries), mild effect (the differences are weaker) and no effect (all countries seem to be equal). This classification is shown the following table.

Label	Description	
imp7	Knowledge of a second language	STRONG
imp25	Ability to work autonomously	STRONG
imp30	Will to succeed	STRONG
imp2	Capacity for applying knowledge in practice	STRONG
imp29	Concern for quality	STRONG
imp27	Initiative and entrepreneurial spirit	STRONG
imp20	Ability to work in an interdisciplinary team	STRONG
imp9	Research skills	MILD
imp4	Basic general knowledge	MILD
imp14	Capacity for generating new ideas (creativity)	MILD
imp28	Ethical commitment	MILD
imp26	Project design and management	MILD
imp22	Appreciation of diversity and multiculturality	MILD
imp13	Capacity to adapt to new situations	MILD
imp12	Critical and self-critical abilities	MILD
imp5	Grounding in basic knowledge of the profession	MILD
imp19	Leadership	MILD
imp17	Teamwork	NO EFFECT
imp16	Decision-making	NO EFFECT
imp18	Interpersonal skills	NO EFFECT
imp21	Ability to communicate with experts in other fields	NO EFFECT
imp15	Problem solving	NO EFFECT
imp10	Capacity to learn	NO EFFECT
imp1	Capacity for analysis and synthesis	NO EFFECT
imp6	Oral and written communication in your native language	NO EFFECT
imp11	Information management skills	NO EFFECT
imp23	Ability to work in an international context	NO EFFECT
imp3	Capacity for organisation and planning	NO EFFECT
imp8	Elementary computing skills	NO EFFECT
imp24	Understanding of cultures and customs of other countries	NO EFFECT

A graphic display for the items with a strong country effect are shown in Figures 8 to 14.[19]

Figures 15 to 17 display the same graphic for items where the country effect was non significant so the reader is able to compare the different graphic patterns between significant and non significant country effects.

[19] See Tuning website: www.relint.deusto.es/TuningProject/index.html or www.let.rug.nl/TuningProject/index.html or europa.eu.int/comm/education/tuning.html.

4.3.8. Initial Conclusions and Open Questions

The importance of the Tuning Project is to promote debate and reflection on competences at the **European level**, from a **university perspective** and from a **subject area approach**, offering a **way forward**. The level of reflection and development of competences and skills in the definition and development of university degrees in Europe is varied according to traditions and educational systems.

Another element in Tuning is that competences and skills are always linked with knowledge since it is understood that they can not be developed without learning in some field or discipline.

In this context and from the work and the debate done by the Tuning members, a number of initial conclusions can be drawn, while significant questions remain open to be dealt with in future work.

1. With regard to the **importance of competences:**

    - The development of competences and skills fits in well with **the paradigm of primarily student-centred education**. It emphasises that the student, the learner is the focus, and thus brings into discussion the changing role of the teacher. This is regarded as moving towards more of an accompanying role, guiding learning towards the attainment of particular well-defined objectives. It consequently affects the approach to educational activities and the organisation of learning, which shifts to being guided by what the learner needs to achieve. It also affects assessment in terms of shifting from input to output and to the processes and the contexts of the learner. However, how the competences are to be worked, realized and assessed and the impact of this change, both at individual level and at the level of European university structures, needs further reflection and debate

    - The **definition of academic and professional profiles** in degrees is intimately linked with the identification and development of competences and skills towards their attainment throughout the curricula. To reach this aim, the work of isolated academics is not sufficient, it needs to be approached in a transversal way through the curricula of a particular degree programme.

    - **Transparency and quality** in academic and professional profiles are major assets in relation to both employability and citizenship, and the enhancement of quality and consistency as a joint effort should be a priority for the European Institutions. The definition of academic and professional profiles and the development of the fields of required competences, add quality in terms of focus and transparency, purpose, processes and outcomes. In this context, the use of the language of competences at the level of the Diploma Supplement would be a quality step along both fronts.

    - The use of competences and skills (together with knowledge) and the **emphasis on outputs adds another important dimension** to balance the weight given to the length of study programmes. This is particularly relevant for lifelong learning.

    - In relation to the creation of the **European Higher Education Area**, the joint reflection, debate and attempts to define subject area competences as dynamic reference points could be of crucial importance for the development of easily readable and comparable degrees, for the adoption of a system essentially based on two main cycles and for the enhancement of mobility, not only of students, but particularly of graduates and professionals.

2. In relation to the practice of **consultation with social groups** before elaboration or reformulation of degree programmes, the Tuning members have observed a variation among the European Universities in the levels at which this practice is carried out. Also they observe a significant variety in the methods used for this consultation. In this respect, the Tuning members agree that the practice of consulting relevant social and professional groups is crucial and should be encouraged using the most appropriate form and manner in each case.

   - In the case of Tuning, the groups consulted were the most relevant ones: **graduates, employers, and academics.** Obviously, other groups could have been consulted as well. The relevance and possibility of other types of contributions remains an open question.

   - The Tuning members also agree that **joint reflection from the Universities based on updated data** is important in the development of adequate degrees. Echoing the Salamanca convention they recognise that students need and demand qualifications which they can use effectively for the purpose of their studies and careers all over Europe. This demands not only a reflection on what local social and professional groups value and demand from their programmes but also the perspective of broader trends taking place at the European level.

3. It is important to remember that **subject-related competences are crucial** for identification of degrees, for comparability and for the definition of first and second degree cycles. These competences have been analysed individually by the subject area groups. The identification and initial discussion of a set of subject-related competences for the first and second cycle could be considered one of the major contributions of the project towards the development of European points of reference.

4. With regard to **generic competences** in a changing society where professional profiles need to be well defined while keeping a dimension of openness to change and adaptation, some messages from graduates and employers to European Universities can be identified:

   - In relation to the **importance** given to different competences, the messages from graduates and employers are of crucial relevance. In fact, one of the most striking results of the questionnaire is the very high degree of correlation between the opinion of graduates and employers in relation to the importance and rank given to the different competences enumerated.

     - These two groups consider that the most important competences to be developed are: capacity for analysis and synthesis, capacity to learn, problem solving, capacity for applying knowledge in practice, capacity to adapt to new situations concern for quality, information management skills, ability to work autonomously and teamwork.

     - Looking at the other end of the scale, there appear: understanding of cultures and customs of other countries, appreciation of diversity and multiculturality, ability to work in an international context, leadership, research skills, project design and management, and knowledge of a second language. One striking aspect is the concentration of the "international" competences in the lower part of the scale with respect to importance. This opens a number of questions which would need further analysis.

- In relation to **achievement** in terms of the competences that the universities are considered to develop at the highest level, again there is a high level of correlation between the employers and the graduates. However, in this respect reference is only made to the *graduates* since it is considered that these would have the most accurate perspective.
  - The items which appear highest in the scale, in the opinion of the graduates are: capacity to learn, basic general knowledge, ability to work autonomously, capacity for analysis and synthesis, information management skills, research skills, problem solving, concern for quality and will to succeed. Six of these items coincide with those that graduates and employers considered important and ranked highest in the scale. The remaining reflect the tasks which the universities have traditionally been performing for centuries.
  - Looking at the bottom of the scale, the competences are: leadership, understanding of cultures and customs of other countries, knowledge of a second language, ability to communicate with experts in other fields, ability to work in an international context, and ability to work in an interdisciplinary team. It is remarkable that these competences, with the exception of knowledge of a second language, all appear near the bottom of the table for importance.
  - A wider reflection on these results is necessary. There are several questions: Whether the items reflected in the questionnaire are the right ones. What is the rate of change developing in the five years gap since the first and the last graduates would have finished their degree programmes. Whether there are competences which relate to emerging needs... etc. The importance of looking at the future and trying to anticipate developments.
- The scale of appreciation of the graduates and employers also has a high degree of coincidence with the ranking by the **academics** with a few exceptions
  - The first exception is the rank given to *basic general knowledge,* which for the graduates and employers shows a level of 12 out of 18 while for the academics it appears in first place. One point to note is that responses to questions involving the word *basic* may depend on the interpretation given to this word, which could change depending on the inclusion of questions referring to *advanced* knowledge.
  - The second item of difference is *elementary computing skills.* This varies between groups, being considered more important by graduates, less by employers and least by academics.
  - The third is *interpersonal skills* with much higher importance attached by graduates and employers (level 6) than by academics where it appears in a considerably lower position. In general, all the interpersonal skills tend to rank lower for academics than for graduates and employers. The majority of the competences which appear at the top of the scale both in terms of importance and achievement are instrumental and systemic.
- However, in relation to the issue of generic skills, several questions remain open. They include: is there a core of generic skills which may be identified and jointly developed? How many could be developed in a degree programme? Should the choice of competences be based on the different degrees or should they be characterised by institutional choices

and institutional strengths? Who should be responsible for them? Which are the most adequate methods for developing them through the curricula?

- Finally, as regards the variation of ranking and the impact by **country**, there are 13 items were there is no variation at all. Among them there are three of the competences which appeared at the top of scale and also two of those at the bottom. Seven items showed a significant country effect and demand further thinking.

These are only initial conclusions of a joint reflection at European level on the potential that competences have in the creation of the European Higher Education Area and in the enhancement of Higher Education as a whole.

There are a number of **open questions** for further study and reflection: Questions related to employment potential for graduates, the gaps between importance and achievement in a more detailed way and starting from closer to the institutional level, the emerging needs of society, and future demands, and the changing nature of learning as it needs to take place in a variety of contexts.

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5. Line 2: Knowledge / Core Curricula / Content

5.1. Introduction

One of the objectives of the Tuning project was to define level descriptors for the first and second cycle in the participating subject areas. As is well known, these subjects are:

- Business and Management
- Education
- Geology
- History
- Mathematics

In the course of the project it became apparent that the synergy groups which *Tuning* involved right from the beginning and which presented the link to the *Thematic Networks,* became more and more involved, adding their experience and their creative ideas. This in particular counted for two subjects, which acted in practice as groups 6 and 7 of the project:

- Chemistry
- Physics.

When following the reports of the subject area working groups, four phases of their development could be identified:

Phase 1: Informing

Phase 2: Storming

Phase 3: Norming

Phase 4: Performing

In **Phase 1** the group members informed each other about the present situation in their institutions, the type of programmes being designed and future perspectives. The information was amended by the various synergy groups which contributed effectively.

Phase 2 was characterised by questioning everything and anything. Hot discussions, long hours were necessary to get the steam out. This was also carried into the plenary sessions of the Steering Committee.

Then, **Phase 3**, the groups identified what was common, diverse and dynamic in their subject areas. They tried to find a common framework for those elements for which it was useful to have clear reference points. At the same time differences were highlighted and tested whether these were in fact useful divergences and as such an enrichment.

Finally, in **Phase 4**, the groups performed smoothly. Agreements were made, ideas outlined and everybody felt that it was now the time to really develop the project further. At the same time the rigidity of the project duration had to be accepted and therefore all groups were eager to present their results in a proper form. They worked very hard up to the last moment (and even longer than that) to be able to present their ideas to a wider public.

It should be stressed that all the following reports have been benefited from a cross-fertilisation: from the other subject area groups, the synergy groups, the plenary sessions, in fact, from the platforms of academics from European Member States which *Tuning* provided.

5.2. Conclusions

The conclusions from the various presentations are:

- There is a ***great willingness*** and ***openness*** of academics to exchange their views on subject-related competences and skills within their subject area.
- There is a ***significant common line of understanding*** of academics about subject-related competences and skills within their subject area.
- There is an ***identifiable common anxiety*** of academics as regards external pressure to harmonise contents of subject areas.
- There is a ***clear orientation from subject input towards learning outcomes*** in the design of study-programmes across subject areas, in particular, at higher level.
- There is an ***identifiable acceptance of the need of a quality assurance system*** to guarantee recognition of academic achievements.

Which leads to the following general results:

A common framework in ***first-cycle programmes*** is acceptable. It may be necessary to

- identify a ***basic common core*** which should be included in any study-programme of that respective subject area (Examples: Mathematics, Business Group) ***or***
- identify a ***common study-programme*** across several partner institutions in various EU Member States or even in the whole of Europe which may lead to double / joint / common degrees (Example: Eurobachelor of the Chemistry Group, Physics Group welcomes this too, examples also exist in the Business Area) ***or***
- identify subject areas which ***appear to be different*** but are in fact very similar if they are looked at closely (Example: Education Group) ***or***
- identify a ***set of learning outcomes*** (Example: Geology Group)

A common framework in ***second-cycle programmes*** appears to be counter-productive (across all Subject Areas).

This does not exclude

- forming partnerships, strategic alliances in the sense of the first-cycle (e.g. Joint Master Degrees). In fact, these may be wanted by academics, students or the labour market)

It may, however, mean

designing individual profiles at an identified level of second-cycle which could be based on

- vertical knowledge widening and deepening (specialisation of subject area)
- horizontal knowledge widening and deepening (additional related subject areas)
- diverse knowledge widening and deepening (additional unrelated subject areas)

satisfying stakeholder demands and to stress the diversity within Europe (Example: Business Group).

evaluating and accrediting study-programmes within the European Education Area which may be based on ***benchmarking*** (Mathematics Group).

Across the cycles it appears that the more the study-programme is geared towards a specified profession the more likely an agreement on a common core may be reached, if this is a profession which can be pursued across borders (Example: Education Group).

This means:

1. Tuning has identified three major characteristics of subject areas within the European Education Area. These are

- **Commonality**
- **Diversity**
- **Dynamism**

Commonality in terms of a common core at first cycle can exist. Common core subjects most times cover basics of a study-programme and often include subjects which help to understand the basic subject matters (e.g. mathematics to explain business phenomena). Common core subjects can be taught at any institution – they are interchangeable. *Tuning* has identified such areas. However, this does not mean that common core subjects stay as they are. A permanent update is essential.

Concerning specific subjects the situation is different. They deliver the flavour of a given study-programme and thus have to be taught where the specific competences of an institution are. They should be nourished as they highlight the ***diversity*** which is an advantage within the European Education Area and not a disadvantage as long as transparency is guaranteed and mutual trust is based on adhering to the quality criteria.

Whereas in the first stages of joint study-programmes e.g. the idea was to harmonise curricula today's objective of *Tuning* is – and this has been confirmed – that it is not wise to look for identities in every subject area but to highlight the differences as well. On the other hand it has also become evident that there is no standstill. What has been designed today may be obsolete tomorrow. Within the two years of the Tuning project it has become very obvious that a constant update is essential. This ***dynamism*** can be traced back easily by thumbing through the various Meeting Documents (1-4).

2. This result was possible through the ***discipline approach***. This methodology appears to be crucial to be able to distinguish clearer between the first and the second cycle and to describe the contents of the two levels. To understand what this means it is a useful exercise to analyse the various Bachelor-/ Master descriptors / benchmarks which have been published of late as recommendations, discussion papers etc, in particular those by the Quality Assurance Agency, UK; Accreditation Agencies, Joint Quality Initiative Informal Group.

3. Within the disciplines structures are identifiable to cluster subjects. In addition to subjects which aim at widening the knowledge of the learner there are others which focus on the deepening of the knowledge. This – in very broad terms – is reflected in the two cycles. *Tuning* emphasised a third cluster: Knowledge opening and transfer. Without this category knowledge acquisition is useless. Line 1 and 2 of *Tuning* clearly demonstrates this. Line 2 has no impact unless it is "opener" by tools such as information technology or foreign language skills or the

ability to organise oneself. At the same time it is essential that this acquired knowledge can be transferred to other areas. This may refer to other disciplines, regions, professions.

4. Within a very short period Tuning proved that clear objectives in education can be achieved if an adequate platform is installed. Such platforms at European level are a critical success factor to give academics the opportunity to exchange views, to discuss upcoming issues and to constantly update what is common, diverse and dynamic.

5. Finally, only by relating knowledge and subject related competences to profiles of academic degrees and to those of professions, transparency can be created and coherence identified across Europe.

Therefore it is strongly recommended to **continue the work with more disciplines in more regions.**

5.3. Business: Subject Related Competences

Introduction

Several attempts have been made to identify a way how credits can be allocated to the subject areas / modules or whatever they might be called. This has been a matter of much a debate and often neither presenters nor the audience were completely satisfied as at this point the formal approach (according to the workload) could be explained but this left a lot, including the nitty-gritty, to the "local heroes". Also this paper cannot offer a "100%" solution but it offers a "$99^{44/100}$%" pathway (the measure for purity according to Michael Porter, a management guru) which still leaves enough space for the local champions but also enough guidance to convince those reluctant to change.

In contrast to many other proposals the suggestion of this paper is a deductive rather than an inductive approach, in fact, it contains both elements. Both research in industry and university has been done and the method has been tested on many occasions. The proposal is not to start with a determination of time for individual activities of the student but with defining an overall structure of subject areas first (top-down) before workload per module is going to be evaluated in the final step (bottom-up).

Structuring of university programmes

Independent of names of individual subjects very similar subject areas /modules can be identified throughout all types of universities in all Member States. However, they may be represented in a given study-programme to a lesser or higher extent. In some first-or second-cycle study-programmes some of these areas may not be included at all or may not be defined as subjects (e.g. rhetorics). One of the reasons may be that some – in particular those referring to transferable skills - have been in the discussion of late due to the needs of industry (see e.g. Skill Needs Project of the EU), however, not all universities felt the necessity to add such areas to their syllabus. Also, some universities are of the opinion that such matters are inherent parts of the various syllabi anyway and do not have to be taught / learned in specific classes.

In the following the "widest" groups of subjects you can find are listed:

- ***core modules***, i.e. groups of subjects which make up the backbone of the respective science (e.g. in Business and Management (BM): Business in Context, Business Functions, Business Environment)

- ***support modules***: which complement the core modules to the extent that they help to clarify implications of e.g. business activities (e. g. in BM: Mathematics, Statistics, Information Technology)
- ***organisation- and communication skills modules*** (e.g. Learning skills, Working in Groups, Time Management, Rhetorics, Foreign Language(s)..., skills which many stakeholders have asked for a long time but which still are not necessarily included in the curriculum as independent modules yet
- ***specialisation modules /major/minor/ options / electives*** (mostly a list of areas out of which a student can choose one or several which he wants to understand to a larger extent (in BM for example these may be grouped according to business functions [logistics, marketing, finance...] or types of enterprises [SME, MNC,...] or geographical areas [Pacific Rim, Eastern Europe...] or business sectors [service-, pharmaceutical-, automotive industry...]
- ***transferable skills modules*** (e.g. work experience/placement, projects, dissertation, business games..., areas which should develop those competences which are needed to close the gap between theory and reality and which have always been in demand but still provide a problem for many graduates when entering the labour market)

These subject areas could also be grouped in the following way:

Knowledge Acquisition and Widening	**Knowledge Acquisition and Deepening**	**Methodology: Skills/Competences to learn and transfer**
Core modules Which syllabi are the essential characteristics of this degree programme? Without which course would no one consider this as the identified degree programme?	**Specialisation modules / major / minor / electives / options** Which areas could be identified – vertically, horizontally or laterally – for further useful studies? (vertical: specialisation in a narrow sense = deepening; horizontal: interdisciplinary = enlargement; lateral: unrelated subject areas, supplying additional areas, diversification	**Support modules** What else is needed to understand issues, identify and to express them in different ways? To which extent can a quantitative approach help to explain things?
		Organisation and communication modules How can I learn and organise myself? How can I present / express best what I want to say?
		Transfer modules How does theory relate to practice? How can I relate theory to practice? What are the methods?

The difference as regards these subject areas in cycle one or two are not based on the area as such but rather on the basis of the degree they are openly stated. As a general guideline one can say that the higher the level the more modules which deepen the knowledge are represented most. Also the basic study skills, i.e. organisation and communication modules, will tend not to be listed at higher level. On the other hand, transfer modules are most likely to appear to a larger extent at a higher level only. This could be demonstrated by the following model which serves as nothing but an example:

Cycle **Module**	**First Cycle 3 yrs**	**First Cycle 4 yrs**	**Second Cycle 1 yr**	**Second Cycle 2 yrs**
Core	30%		20%	
Support	25%		10%	
Organisation and Communication	10%		-	
Specialisation	10%		40%	
Transfer	25%		30%	
	100%	100%	100%	100%

Any other form of distribution is possible. This has to be decided by the various experts who design study-programmes. They will perhaps put the emphasis of some of these modules to express a certain profile (e.g. at universities of applied sciences the percentage of transfer modules is presumably higher than at traditional universities). Also, if some institutions do not want to offer any of these modules at any level, it is obvious that the percentage share of the others will increase (as shown above in the second cycle). In the Tuning project , e.g., the subject groups could identify a general framework for the various modules. There does not have to be a fixed percentage for the subject areas, rather a percentage range, e.g. "core modules" between 25-35% at first cycle level, and 20-30% at second cycle level. The distribution of the modules should always be left to the professors at departmental level (bottom-up approach). Tuning, however, could recommend the structure (list of modules – top-down approach).

Implications for ECTS

If the study-programmes have identified the percentages for the various modules, this should be agreed upon by those who are responsible for the respective study-programme. This automatically leads to the limits of credits which are available for the various modules. If, e.g. in the above mentioned example 30% of the first cycle, e.g. a three year BA-programme, is reserved for core modules, a maximum of 54 credits can be achieved in all courses which fall within this category of modules. This is demonstrated in the following table.

Cycle **Module**	**First Cycle 3 yrs**	**First Cycle 4 yrs**	**Second Cycle 1 yr**	**Second Cycle 2 yrs**
	% - credits	**% - credits**	**% - credits**	**% - credits**
Core	30 = 54	30 = 72	20 = 12	20 = 24
Support	25 = 45	25 = 60	10 = 6	10 = 12
Organisation and Communication	10 = 18	10 = 24	-	-
Specialisation	10 = 18	10 = 24	40 = 24	40 = 48
Transfer	25 = 45	25 = 60	30 = 18	30 = 36
	100 = 180	100 = 240	100 = 60	100 = 120

Here again, the various experts at "local" level have to find out what their course preference is as regards the distribution across the various elements. As this process has to be encouraged for the other modules as well, it becomes evident – knowing the wishes and wants of professors – that a clearing has to be made to find a final distribution. However, the framework stays the same.

Additionally it is advisable, not to have any figure of credits for a module. An agreement should be made beforehand "top-down" that e.g. a module should carry at least 5 credits or a multiple of this (10, 15...). Tuning could help here again. There might be an understanding in the various subject areas to have this figure (or any other as a minimum). Experience shows that the credits awarded to a module should be about 5 or 6 as this in turn determines the number of modules per year/semester. Whereas in some countries you find the maximum number of modules per semester which a student can take limited to three – which means that each module carries 10 credits or two carry 5 each and one 20, e.g. – other institutions in other countries allow e.g. up to six, which in turn means that all modules carry 5 credits. Experience with ECTS gives evidence that a lower number of credits does not lead to a greater flexibility but just the opposite as more and more professors tend to look for an exact translation of their contents of a subject in that of the other institution. The less this is possible the more they have to accept the ECTS terms of a workload of a semester. Also, modules with 1 or 2 credits mean that hardly one hour per week of workload is scheduled. It is worthwhile to consider that such subjects should rather be amalgamated with others so that a module is being designed.

Cycle **Module**	**First Cycle 3 yrs***	**First Cycle 4 yrs**	**Second Cycle 1 yr****	**Second Cycle 2 yrs**
	% - credits	**% - credits**	**% - credits**	**% - credits**
Core	60	70	5	20
Support	45	60	5	10
Organisation and Communication	15	25	-	-
Specialisation	15	25	20	50
Transfer	45	60	30	40
	180	240	60	120
Range of B-/M-level	180 - 240		60 – 120	
Max. for M-level	300			

Note:

* *this refers to a full-time programme (min.40 weeks, 1.400-1.800 hrs workload).*

*** It is most likely that there will not be a Master programme of 40-45 weeks = 1.400-1.800 working hours. If so the reality will be more than 45 weeks and more than 1.800 hours. Only then will this lead to more than 60 credits. The present – mainly British – Master-level programmes of one year most times last for at least 60 weeks (including examinations) and thus would lead to 90 credits. On the other hand one has to realise that these programmes were designed before the Bologna agreement and are not related to the present 3+2 or 4+1 discussion. 1-year Masters are perhaps possible when they build on a B-level programme in the same field. Even then, taking into account that normally a thesis / dissertation has to be written, the overall length of the programme will exceed 1 year = 40-45 weeks = 1.400-1.800 hrs of workload. If the Master level of a given course can be entered with any background, the duration is most likely to be at least 2 years.*

In other words: In a top-down approach "Tuning" determines the framework for the various subject areas on the basis of the agreement of the subject groups. In this way the workload and thus the credits are identified as a guideline. Then the institutions themselves and their specific staff – including the students - of the respective area, have to come to terms about the distribution within a subject area (bottom-up). If this was not done teaching staff and students would not feel involved, would not "own the credits" and this would most likely lead to disapproval and disregard in the future. However, at this level, the demands cannot go beyond the credit ceilings unless other subject areas need less workload. Taking our example further the following credit allocation agreed upon by the various professors etc. in Business and Management e.g. may evolve (taking the subject areas outlined above):

Cycle **Module**	**First Cycle 3 yrs***	**First Cycle 4 yrs**	**Second Cycle 1 yr****	**Second Cycle 2 yrs**
	% - credits	**% - credits**	**% - credits**	**% - credits**
Core	**60**	**70**	**5**	**20**
Business/Man.	20	30	5	
Business in Context	15	10		
Business Functions	15	20	-	
Business Environment	10	10	-	
Support	**45**	**60**	**5**	**10**
Mathematics	10	10	-	
Statistics	15	20	-	
Information Technology	20	30	5	
Organisation and Communication	**15**	**25**	-	-
Learn to learn	10	15		
Presentation etc.	5	10		
Specialisation	**15**	**25**	**20**	**50**
Logistics	15	25	20	
Transfer	**45**	**60**	**30**	**40**
Project	10	20	-	5
Business Game	5	10	-	5
Bachelor- Master-thesis	30	30	30	30
	180	**240**	**60**	**120**
Range of B-/M-level	**180 – 240**		**60 – 120**	
Range for total M-level	**270 – 300**			

These models only work if the teaching staff themselves have accepted the ceilings and distributed the predetermined credits to the various subjects of their respective area.

Line 2: Subject related Competences - Business and Management

Area	Skill / Competence	Modules: Knowledge widening (Basics) Learning objective	Examples
Business Environment	Analysis	Use the respective instruments	Industry analysis Market analysis PEST
Macro/ Micro-economic Environment	Analysis and Synthesis	Identify the impact of macro- and microeconomic elements on business organisations	Financial and Monetary Systems Internal Markets
Business Organisation	Analysis	Identify the constitutional characteristics of an organisation	Goals and objectives, ownership, size, structure,
	Analysis	Identify the functional areas of an organisation	Purchasing, production, logistics, marketing, finance, human resource
	Analysis and Synthesis Critical thinking	Define criteria according to which an enterprise is defined and link the results with the analysis of the environment to identify perspectives	SWOT Internal and external value chain
	Critical thinking Synthesis	Lessons learned: identify new developments of business organisations to cope with the changing environment	Change strategies, i.e. Strategic Alliances, Globalisation

Area	**Skill / Competence**	**Modules: Knowledge deepening (Vertical)** **Learning objective**	**Examples**
Business Organisation	Analysis and Synthesis	Understand details of business functions, types of business enterprises, geographic regions, size of enterprises, business sectors and link them with the basic knowledge	Logistics etc. MNCs, Asia-Pacific etc., SMEs, automotive industry
	Analysis and Synthesis Critical thinking	Identify related issues and understand their impact on business organisations	Business Ethics Cultural Management
	Analysis and Synthesis Critical thinking	Managing a company (tools and concepts): Planning and control	Strategy design and implementation Benchmarking, TQM etc.
	Analysis and Synthesis Critical thinking	Audit an organisation and design consultancy plans	Tax Law, Investment, Case studies, Project work
		Modules: Knowledge deepening (Horizontal) Learning objective	
Business and Law	Analysis and Synthesis Critical thinking	Understand the principles of Law and link them with business / management knowledge	Competition Law Intellectual Property
Business and Engineering	Analysis and Synthesis Critical thinking	Understand the principles of engineering and link them with business / management knowledge	Operations Management Gantt methods Information Technology
		Modules: Knowledge deepening (diversification)	
Ethics	Analysis and Synthesis Critical thinking	Understand the principles of ethics, identify the implications for business organisations, design scenario	Exploitation of human resources, environment
Psychology	Analysis and Synthesis Critical thinking	Understand the principles of psychology, identify the implications for business organisations, design scenario	Working in groups, teams, behavioural studies

The dissertation / thesis could also be put into this table. However, it listed among the transferable skills. This, of course, depends to a large extent on the objective of the
dissertation which is very much linked to the respective study-programme and / or to the type of institution

Area	**Skill / Competence**	**Modules: Knowledge Opening (Support)** **Learning objective**	**Examples**
Mathematics/ Statistics	Analysis and Synthesis	Identify and use adequate tools	Market research Comparative ratios
Information Technology	Analysis and Synthesis	Identify and operate adequate software Design information systems	Data base
Accounting	Analysis and Synthesis	Understand and use bookkeeping and financial systems	Profit and Loss Account Balance Sheet
Technology	Analysis and Synthesis	Understand technology background and understand its impact for new / future markets	Basics in engineering

Area	Skill / Competence	**Module: Knowledge Opening (Organisation and Communication)** Learning objective	Examples
Any subject	Soft skills	Learn-to-learn, i.e. How, when, where – personal management	Rhetorics, presentation, working in teams
Foreign Language	Hard and soft skill	Understand the structure of the foreign language, learn vocabulary Understanding, reading, speaking, writing in a foreign language	Working in English as a foreign language

Area	Skill / Competence	**Module: Knowledge Transfer** Learning objective	Examples
Project	Analysis, Synthesis and soft skill (transfer) Critical thinking	Analyse a problem of an enterprise and design a solution	Entering a new market
Placement	Analysis, Synthesis and soft skill (transfer) Critical thinking	Work assignment (any type of organisation – depending on the objective of the respective study-programme)	Work experience in an enterprise for 20 weeks abroad
Dissertation	Analysis, Synthesis and soft skill (transfer) Critical thinking	On the basis of knowledge acquired identify the impact of culture on market research	The impact of culture on the intention to send out a questionnaire in Mexico

5.4. Education Sciences

5.4.1. Six preliminary remarks

A first preliminary remark will relate to the relevance of European Union education policies for both education- and teacher education studies. Education and training have become priorities of policies of the Council of the European Union within the framework of more comprehensive economic and social policies (cf. Lisbon process). Strategic objectives for the development of education and training systems in the European Union have been defined (Lisbon 2000, Stockholm 2001) and decision has been taken on a detailed work program at European level stressing actions to be taken at the level of the Member States of the European Union (Barcelona 2002). The important role teacher education has to take in educational reform has been explicitly mentioned. "Investing in competencies for all" (OECD 2001) has become a top priority. Knowledge – based and dynamic learning societies would depend on highly qualified education staff in a rich variety of contexts (e.g. lifelong learning, @-learning, inclusive education). As a consequence, the initial education and continuous professional development of education staff has become subject to rapid expansion, diversification and professionalization – and (productive?) uncertainties with the adequacy of solutions for the professional education of staff for the education sector developed yet. Against this background the paper will deal with problems with "knowledge / core curricula / content" for education- and teacher education studies.

A second preliminary remark will relate to the rationale of innovation for higher education studies in general and educational studies in particular. In his paper for line four of the Tuning project ("Teaching methods, knowledge, technology and assessment: an interlinked field") J. Lowyck has highlighted problems with an orientation on the status quo or the "state of practice" and discussed some challenging implications for higher education studies. Although acknowledging the relevance of the "state of practice" of programs of study, a restriction to it would imply a (repeated) tapping into an innovation trap (i.e. the focus on the development of solutions on already existing / persisting problems within predefined problem - spaces, which takes time and which – in times of rapid change – may meet these existing / persisting problems, but seem to be inappropriate as problems themselves have changed in the meanwhile or do not exist any more). This seems to apply especially to teacher education studies which reflect more opinions, beliefs, traditions and implicit assumptions rather than research - based argument, and do reflect changes of the context of education as well as research - based knowledge on teacher education to a limited extent only ("Teacher education is more a product of history rather than of logic", H. Judge 1990). Against this background and confronted with the many challenges of change a more innovative and research - based perspective will be adopted in dealing with problems with the "knowledge / core curricula / content" of educational science studies.

A third preliminary remark will relate to the definition of educational sciences. As agreed upon at the Copenhagen Tuning meeting (September 2001), educational sciences will be split up into the closely related areas education studies and teacher education. As a consequence, these areas are discussed separately searching for links wherever reasonable.

A fourth preliminary remark: This paper is primarily based on the more general Tuning documents. While focusing on "knowledge / core curricula / content" of education- and teacher education studies, it will consider in an integrative format the other three lines of the project (learning outcomes; ECTS as an accumulation system; methods of teaching and learning, assessment and performance). Papers submitted by the members of the area working group on educational sciences may be seen as a rich source in preparing this paper. In addition, the Q.A.A. document on education studies has been considered. The part on teacher education has strongly been influenced by work of the Thematic Network on Teacher Education in Europe (TNTEE) (cf. F. Buchberger, B. Campos, D. Kallos, J. Stephenson: Green Paper on Teacher Education in Europe. Umea 2000) and continuous work of the European Network of Teacher Education Policies (ENTEP) – both projects supported by the European Commission (DG XXII).

A fifth preliminary remark: While all these sources may be seen as highly relevant in dealing with programs for education sciences studies, they refer at the same time to a "missing link". Both for educational studies and teacher education more "in - depth" knowledge on programs of study of different providers would be necessary. Do the many differences especially of teacher education studies exist at a surface level only? Which (deep - level) communalities do exist between different programs of study? Thanks to the efforts of participants of the Tuning project more detailed information on programs of study has been made available for educational studies in seven European countries and for teacher education studies in five European Union Member States.

A final preliminary remark: This paper does not provide answers, but will address some key issues and raise a number of questions. Problem – solutions would call for collaborative problem – solving (at an institutional, national and European level).

In dealing with "knowledge / core curricula / content" of teacher education studies / educational studies, this paper will be structured into five chapters:

- How generally / specifically should "knowledge / core curricula / content" be defined?
- Can modularization be an option?
- Do educational studies have a common core?
- What are key components of teacher education programs?
- How necessary is a comparative in-depth study of educational- and teacher education studies?

5.4.2. How generally or specifically should "knowledge / core curricula / content" be defined?

The concept "curriculum" has usually been used in an inflationary way, and this situation may be seen as source of much misunderstanding and confusion both in institutional, national and transnational discussions.

In a strict meaning "curriculum" can be defined as "plan for learning" consisting of a coherent and integrated set of learning situations with

- explicit aims and objectives for learning,
- content,
- teaching/learning strategies ("methodologies") and cultures of learning,
- teaching/learning material, and
- procedures for assessment/evaluation of learning and teaching;
- in addition curricula structure learning situations (place, time, sequence), and
- have to be adapted both to the needs and learning pre - requisites of learners.

Adopting a constructivist perspective the focus is first of all on learning and the provision of learning situations ("powerful learning environments"). Secondly, aims and objectives, contents, teaching/learning strategies and the other components of the definition have to be seen both as mutually dependent and integrated avoiding e.g. a perspective of "curriculum" reduced to a list of contents/concepts.

Adopting this definition, a curriculum may be seen as "plan for learning" specifying main components of intentional learning. In this strict meaning the concept "curriculum" is usually restricted to rather small entities of learning (e.g. a particular institution of higher education). One may ask:

- Can "curricula" be feasible at a macro-level such as "national systems of higher education" or the level of the European Union.
- Which components of a "curriculum" can be considered in such "curricula" or "core curricula" (e.g. aims and content, teaching/learning strategies, assessment procedures, learning environments at which degree of specification)?

"State of the art – knowledge" accumulated in educational sciences suggests to restrict the concept "curriculum" to "plans of learning" adopted at a micro – level (e.g. particular institution of higher education).

Presenting a model for "knowledge / core curricula / content" for another field of higher education studies, one of the area working groups within the Tuning project has submitted a proposal based on three categories:

- concepts in curricula,
- course elements/examples and
- main achievement.

This approach might provide a general framework and orientation for particular fields of study. It offers ample space for interpretation. However, it might run the risk to lead to surface level agreement on one side and, because its general nature, to misunderstanding on another. Explicit statements how these three categories have to be materialized in concrete curricula have to be missed.

A number of other mechanisms for tackling problems of "knowledge / core curricula / content" of (higher) education systems has been developed such as the (British) Q.A.A. document on education studies. This document explicitly stresses that it is not a curriculum, but defines "benchmark statements" describing assumptions on the structure of the discipline. In addition this model focuses on "demonstrated achievements" (learning outcomes) of students. The Q.A.A. approach might provide input for problem solving within the Tuning project:

- Definition of a basic frame of the discipline (nature of the subject)
- Definition of some basic content areas and concepts including "transferable skills" (defining principles and subject strands)
- Definition of some basic principles for learning, teaching and assessment
- List of benchmark statements

One may ask a number of questions as regards an adoption or adaptation of the approach submitted by Q.A.A.:

- Does this structure defined remain too general on one side and at the same time too specific on another?
- Has this model a cultural bias?
- Who (which interest- and power groups) decides on the "nature of the subject" and the "defining principles and subject strands"?
- How can benchmark statements be combined with curriculum development at an institutional level?

As discussed in the Green Paper on Teacher Education in Europe, the following components need consideration when planning "knowledge / core curricula / content" in the field of teacher education- and education studies:

- Analysis of the professional roles teachers and graduates of educational studies are expected to fulfil depending on normative decisions within particular cultural and social contexts.
- Analysis of professional tasks of teachers and graduates of educational studies (e.g. teaching, educating, counselling, evaluating, innovating, researching)
- Analysis of qualifications necessary to fulfil professional roles and tasks (e.g. subject – specific or transferable qualifications)
- Adoption of explicit models of how these qualifications may be acquired (e.g. learning cultures and learning environments, teaching/learning strategies)
- Orientation of programs of study on professional roles, tasks and qualifications analysed.

Against this background and following at the same time the intentions of the Bologna process and the Tuning project one might ask:

- Which components of "curriculum planning" can best be achieved at which levels (transnational, national, and institutional), and how can these levels be interrelated to make optimal synergies?
- In which areas and to which extent can shared structures of "disciplines" (aims, contents, organizing principles, methodologies) be defined both in general terms and at a European level?
- Is it possible to define at a European level main aims and contents of educational studies and teacher education studies (common core) that would have potential to be shared?
- How can diverse normative conceptions underpinning different "curricula" be considered in "core curricula" at European level?
- Is it feasible to work on the development of entire "curricula" or more appropriate to work on the development of particular (shared) modules within entire "curricula"?

5.4.3. Modularization as an option?

Modules can be conceived as coherent components of programs of study in particular fields or disciplines. Modules usually comprise some 6–15 ECTS credits. They consist of the following components:

- Description of aims and objectives related to content
- Description of learning outcomes (knowledge, skills, transferable competencies)
- Teaching/learning strategies, learning situations and learning cultures
- Evaluation/assessment procedures
- Description of the workload of students
- Entry requirements

A recent discussion paper within the Tuning project has made explicit the many advantages as well as risks of modularized programs in higher education. As regards educational- and teacher education studies the following advantages seem to be related to modularized approaches:

- The focus on learning outcomes and the workload of students may help to increase the transparency as well as the efficiency of study programs.
- Modularization might contribute effectively to make study programs and learning of students within these more flexible.
- While a number of conditions may be seen as obstacles towards a coherent materialization of a European Credit Accumulation System both for educational- and teacher education studies, one may be rather optimistic that for substantial parts of educational studies and for a certain part of teacher education studies quality - assured modules can be developed. A (substantial) number of such modules could be integrated into particular entire programs of study depending on aims of an institution as well as personal needs of learners / students. The transparency and flexibility provided would permit to consider different structures and needs of different European higher education systems.

Against this background two questions will be raised:

- Accepting the duration / work load of first cycle and second cycle higher education studies, it needs clarification for which domains of knowledge, "core curricula" and content is it feasible to develop modules (of a working load between 6 – 15 ECTS credits) in educational- and teacher education studies?
- What would be the opportunities, challenges, constraints and effects of infusing different modules into existing and/or new programs of study in educational studies as well as teacher education especially as regards the "sequencing" of programs of study?

5.4.4. Do educational studies have a common core?

Higher education "education studies" in many European countries provide education and training for a rich variety of professional profiles including

- adult education,
- community work,
- counselling,
- curriculum development,
- education administration,
- health work,
- human resource management,
- inclusive education,
- information management,
- school pedagogy,
- special needs education or
- social pedagogy.

Despite the many differences specific to different countries (e.g. scope of programs, structural features of programs as cycle I or cycle II programs, learning cultures) the similarity of programs with their underpinning knowledge base (-s) may surprise. In addition similarities as regards the structure of programs seems to be remarkable. Many programs consist of general education studies (up to two years) followed by specific studies in a particular field chosen by the student and in – depth education studies.

With slight differences only in Finnish, German, Greek, Irish or Spanish contexts, the defining principles of education studies programs may be found in the above mentioned British Q.A.A. document. Programs for education studies should

- draw on a wide range of intellectual resources, theoretical perspectives and academic disciplines to illuminate understanding of education and the contexts within it takes place,
- provide students with a broad and balanced knowledge and understanding of the principal features of education in a wide range of contexts,
- encourage students to engage in fundamental questions concerning the aims and values of education and its relationship to society,
- provide opportunities for students to appreciate the problematic nature of educational theory, policy and practice,
- encourage the interrogation of educational processes in a wide variety of contexts,
- develop in students the ability to construct and sustain a reasoned argument about educational issues in a clear, lucid and coherent manner, and
- promote a range of qualities in students including intellectual independence and critical engagement with evidence.

As regards the knowledge base similarities may be observed in the following "core components" (cf. Q.A.A. document):

- processes of learning including some of the key paradigms and their impact on educational practices,
- relevant aspects of cultural and linguistic differences and societies; politics and education policies, economics, geographical and historical features of societies and contexts, moral , religious and philosophical underpinnings,
- formal and informal contexts of learning, and
- the complex interactions between education and its contexts, and its relationship with other disciplines and professions;
- orientation on transferable skills,
- courses in research methodology and
- (field) practice are common to most of the models.

Oriented on these "core components", the "common core" e.g. for the University of Leipzig (Germany) has been structured into five broad areas: (i) Education (Bildung und Erziehung), (ii) Development and learning, (iii) Societal conditions of education, (iv) Education systems (institutions, structures, legal aspects), (v) Problems of general didactics under multidisciplinary perspective.

Considering differences at a surface level and the many similarities as well as communalities at the deep – level structure of a shared knowledge base the development of shared cross – European modules seems to be feasible.

5.4.5. What are key components of teacher education programs?

"Teacher Education in Europe: Diversity versus Uniformity" has been the title of the contribution of F. Buchberger in the "Handbook of Teacher Training in Europe" (eds. M. Galton, B. Moon 1994). This title has reflected the fact that

- at a surface level structures, models and programs of study of teacher education seem to differ very much both within and between the different European countries,
- while some core components seem to be common to most of these.

Without going into detail comparisons of models of teacher education show that programs of study for primary level teacher education differ very much from those for secondary level teacher education. The main distinctive feature is the amount of study time devoted to the study of academic disciplines in particular academic disciplines.

As regards primary level teacher education the following components are represented in the programs of study of most teacher education institutions in Europe:

- Education studies (e.g. pedagogy, general didactics, educational psychology, ed. sociology)
- Subject-specific and/or domain-specific didactic studies in the different learning domains of primary school
- Teaching practice

As regards secondary level teacher education the following components are represented in the programs of study of most teacher education institutions in Europe:

- Studies in academic disciplines (usually two) other than educational sciences perceived to be indispensable for the teaching of corresponding "school subjects". These studies take most (usually some 90 %) of the study time available for students.
- Studies in Fachdidaktik / subject-related didactics. Studies in academic disciplines and subject-specific didactics usually take around 90 % of the entire study time.
- Education studies (see primary level teacher education).
- Teaching practice (which is not offered by all institutions of teacher education within their programs of study.

Although considered as enormously important (cf. European Network of Teacher Education Policies, Green Paper on Teacher Education in Europe) a research component with professional relevance has not become an integral component of most of the models of teacher education in Europe yet.

We will not claim at this place on the problematic situation with the knowledge base, "core curricula" and contents of programs of teacher education in a number of European countries. Many programs have to be characterized as opinion – based collection code curricula reflecting power games in the "social arena" of teacher education. Less political and lobbyist argument and more orientation on both research – based and professional argument might contribute to more adequate solutions (cf. for the USA the ambitious project of the National Commission for Teaching and Americas Future).

While developments in e.g. Finnish teacher education might provide ample input for the definition of problem spaces and problem solutions, or recent discussions e.g.. in Germany on the necessity of a "core curriculum" for teacher education reflect an increased problem awareness with problems of the knowledge base of teacher education, we will raise at this place the following questions:

- What are the aims and contents of education studies within teacher education both at primary and secondary level, and the education of other types of teachers (e.g. business studies, technical schools, special education, pre-primary level)?
- Which components are represented in different European programs of study of teacher education (education studies, academic studies, Fachdidaktik / subject-related didactics / curricular studies / teaching practice) to which extent, with which aims and contents as well as organizational formats?
- Which evidence is available for the effectiveness of different models of teacher education?
- How well is a science for teaching / for the teaching profession developed?
- How would it be possible to define coherent modules for teacher education studies?
- How could modules be made comparable in order to allow a cross - European accreditation and transfer of modules?
- A final question: How can research be implemented into programs of study and modules of teacher education?

5.4.6. How necessary is a comparative in-depth study of educational sciences studies?

Work done yet within the Tuning project has brought about very valuable information on different structures of study programs in educational sciences. This information may supplement items of work produced by the Thematic Network of Teacher Education in Europe or the European Network on Teacher Education Policies.

However, descriptions at a structural level on one hand and a definition of requirements for (teacher education) reform have to be supplemented by more accurate information on the current state of education studies and teacher education in the different Member States of the European Union. Making next steps towards a European Education Space and a European Credit Accumulation System seem to require as one of the many necessary conditions information on the recent state of education studies and teacher education studies.

Against this background this paper suggests as a next in the Tuning project a comparative in - depth study on programs of educational science studies in the Member States of the European Union. This study should provide a detailed overview and critical analysis of programs for educational- and teacher education studies (e.g. aims, contents, assessment/evaluation, learning cultures, models and structures, principles of governance). This study should be seen complementary to work on teacher education programs started already by EURYDICE in 2001.

As a result, components common to most (all) as well as differences in the programs could be made more explicit. The outcomes of this study could then form the basis for the development of programs of study and/or modules that could meet the expectations of the Bologna process, the Tuning project, and the education community (e.g. definition of some "common core elements" as a basis for developing "European" modules within a European Credit Accumulation System).

5.5. Geology

5.5.1. Introduction

This document, which has been compiled by the Geology Subject Area Group of the "Tuning Higher Educational Structures in Europe", describes the general characteristics of a "European core curriculum" in Earth Sciences or Geology (in future referred to as Earth Sciences for simplicity)[20]. Within Europe different types of higher education institutions offer programmes of studies that mutually differ in their general approach to teaching and learning and in the level they demand from students. It should be noted that the present document refers only to universities and that the considerations and recommendations presented below do not apply to other type of institutions. Our principal concern at this stage is with single first cycle (bachelor) programmes over three to four years, leading to an award in Earth Sciences, respectively Geology or related subject, but our recommendations often relate more broadly. The present statement should be seen as a starting point: departments and subject groups within the European higher education space will have the chance to demonstrate how benchmarking standards can be built on by the provision of additional or perhaps alternative opportunities.

[20] This paper is based amongst others on the UK QAA benchmark documents for History and for Earth and Environmental Sciences.

The only possible aim to agree on a "European core curriculum" in Earth Sciences should be to facilitate an automatic recognition of degrees in Earth Sciences in Europe in order to help mobility. Earth Science education is characterized much more by its approach, which concentrates on using selected knowledge in order to develop certain skills and qualities of mind, than by specific content. Indeed, degree programmes in Earth Sciences apart from serving the purpose of educating future earth scientists, also provide valuable general education, providing young people with a variety of transferable theoretical and practical skills: from problem solving and decision making in the light of uncertainty to operating in a variety of cultural environments and to the application of modern technology *etc. etc*. Therefore, although the importance of solid geoscientific knowledge is self-evident, a core curriculum in Earth Sciences cannot and should not be described in terms of a narrowly defined specific body of required knowledge, even if it is possible to indicate some subject matter that will, to some extent, form part of most programmes of study.

By its nature the present paper does not provide a basis for judgements to be made about a particular student's learning achievement, or about academic standards and performance of individual departments or subject groups in individual countries. The latter cannot be but the responsibility of academic reviewers appointed by the Universities or other national bodies. Finally, the "core curriculum" outlined below cannot be used as a tool for automatic transfer between universities. Such transfer will always require consideration by case, since different programmes can get students to adequate levels in different but coherent ways, but an inappropriate mixing of programmes may not.

Guiding assumptions

1.2.1. Earth Science differs from many subjects in that we much less recognise a specific body of required knowledge or a core with surrounding options. We take it as self-evident that knowledge and understanding of the earth and its systems are of incalculable value both to the individual and to society at large, and that the first object of education in Earth Science is to enable this to be acquired. We accept variation in how the vast body of knowledge which constitutes the subject is tackled at undergraduate degree level. This is related to an approach which concentrates on using selected knowledge in order to develop certain skills and qualities of mind and which also seeks to respond to students interests.

1.2.2 Earth Sciences as a discipline, distinguishing it from other sciences, focuses on the understanding of Earth systems in order to learn from the past, understand the present and predict and influence the future. Earth Sciences provide a distinctive education by providing a multi-disciplinary and inter-disciplinary and, although reductionist methodology is involved, mostly holistic approach, comprehensive field training, and a range of spatial and temporal values and by encouraging graduates to use their powers of observation, analysis and imagination to make decisions in the light of uncertainty.

1.2.3. We recognise that the concepts, theories and methodologies of other sciences are themselves used by many earth scientists and applied to the Earth system. We, therefore, accept that training in relevant aspects of such basis disciplines will normally constitute a part of an Earth Sciences degree. We also recognise that especially with a view of application it might be appropriate to include relevant elements of humanities, economics and social sciences in degree programmes in Earth Sciences.

1.2.4. Important abilities and qualities of mind are acquired through the study of Earth Sciences. They are particularly valuable for the graduate as citizen and are readily transferable to many occupations and careers. Some of these qualities and abilities such as the ability to communicate ideas and information and to provide solutions to problems are generic, in that most degree programmes, notably in the other Sciences, impart them. But degree-level study in Earth Sciences also develops ways of thinking which are intrinsic to the discipline while being no less transferable. These include ~a four-dimensional view - the awareness and understanding of the temporal and spatial dimensions in earth process - ~the ability to integrate field and laboratory evidence with theory following the sequence from observation to recognition, synthesis and modelling, ~a greater awareness of the environmental processes unfolding in our own time, and ~a deeper understanding of the need to both exploit and conserve earth resources. These qualities of mind and abilities are most effectively and economically developed by deep and prolonged immersion in, and engagement with, the practice, methods and material of the subject itself. The cumulative acquisition of, and ability to apply transferable skills, and the development of students as competent earth scientists thus necessarily proceed hand-in-hand. The link between the two lies ultimately in the habits of mind or intellectual approach developed by students who have been trained as capable earth scientists. These will continue to inspire the application of their minds to other matters later in life.

5.5.2. Programmes, knowledge and skills

2.1 Introduction

2.1.1. The core curriculum of an Earth Sciences degree programme should be directed towards the development of an understanding of the key concepts, a sound background in the subject specific knowledge, and the development of transferable skills. In practice programmes will take the form of different thrusts, in relation to specific fields of application.

2.1.2. Earth Science is an essentially empirical science, in which the ability for prediction is based on the explanation that follows recognition. It covers a broad field, ranging from the scientific study of the physical characteristics of the Earth to that of the human influence on its environmental systems. Nevertheless an Earth Sciences degree programme should share the following important features:

- most tuition has an **holistic, multi-disciplinary and inter-disciplinary** approach
- the **integration** of **field studies, experimental** and **theoretical** investigations is the basis for much of the learning experience in Earth Sciences, but may be less significant in, but not absent from, courses in geophysics and geochemistry.
- **quantitative** and **qualitative** approaches to acquiring and interpreting data, with strong dominance of the quantitative approach in geophysics and geochemistry
- examination of the exploration for, and exploitation of resources in the context of **sustainability**.

2.1.3. Earth Sciences is so broad that as far as subject matter is concerned a large variation in degree programmes exists in European practice: some programmes encompass Earth Sciences in the broadest sense, while others are concerned with geology in a strict sense or with more specialist subjects.

2.2 Degree programmes broadly concerned with Earth Sciences

2.2.1 Degree programmes in Earth sciences typically involve:

- a systems approach to understanding the present and past interactions between the processes operating in the Earth's core, mantle, crust, cryosphere, hydrosphere, atmosphere, pedosphere and biosphere, and the perturbations of these systems by extra-terrestrial influences and by man

- the scientific study of
  - the physical, chemical and biological processes operating on and within the Earth
  - the structure and composition of the Earth and other planets
  - the history of the Earth and its spheres over geological time scales
  - the use of the present to understand the past and the past to understand the present

2.2.2 Typical programme elements might include:

- geophysics, geochemistry, geomathemathics, geoinformatics and geostatistics
- mineralogy, petrology, palaeontology, sedimentology, stratigraphy, structural geology and tectonics, general geology
- geomorphology, Quaternary studies, soil science, palynology and archaeological science
- palaeobiology, palaeoclimatology, palaeoecology and palaeo-oceanography
- hydrology and hydrogeology, environmental geoscience, meteorology, climatology, glaciology and oceanography
- geological, geomorphological and soil mapping, remote sensing applications
- volcanology, ore geology, petroleum geology, geomaterials, geotechnics, and economic geology

Depending on the positioning of institutions within the broad field of Earth Sciences degree programmes will normally include some, but not all, of these elements.

2.2.2a. An Earth Sciences degree programme requires underpinning knowledge especially in the fields of Chemistry, Physics, Biology, Mathematics and Information Technology, some of which may properly constitute part of the Earth Sciences curriculum.

2.2.2b. Material relevant to the applications of Earth Sciences are elements of Law and Economics, Town and Country Planning, Human Geography, Politics and Sociology, and Management, Business and Safety studies.

2.2.3 Applications of the subject areas might include developing exploration and exploitation strategies for resource industries (e.g. hydrocarbons, minerals, water, bulk materials, industrial minerals), site investigations for civil engineering projects including waste disposal and land restoration, and understanding and developing mitigation measures for geohazards such as floods, earthquakes, volcanic eruptions and landslides, environmental assessment, impact monitoring, modelling and prediction which provide a framework for decisions concerning environmental management (e.g. the management of surface and ground water, human, agricultural and industrial waste, natural and semi-natural habitats).

2.2.4 The subject area overlaps with others such as environmental sciences, social science-based environmental studies, biology, chemistry, physics, mathematics, civil engineering, geography and archaeology. Earth Science is defined by many to include engineering geology, mining engineering, petroleum engineering and physical geography, while some would also include oceanography and meteorology.

2.2.5 The subject area promotes an awareness of the dual context of the subject in society, namely that of providing knowledge and understanding for both the exploitation and the conservation of the Earth's resources.

2.3. Subject knowledge

Each undergraduate Cycle 1 degree will have its own characteristics with a detailed rationale for the content, nature and organisation as outlined in the relevant programme specification. While it is recognised that degree courses will vary considerably in the depth and specificity to which they treat subjects, it is expected that all graduates should be acquainted to some degree and depending on subject matter choice with:

- modern earth processes, including the understanding of the cycling of matter and the flows of energy into, between and within the solid Earth, hydrosphere, atmosphere, pedosphere and biosphere
- the principles of stratigraphy and the concept of Uniformitarianism
- plate tectonics as a unifying concept
- some palaeontology
- some mineralogy, petrology and geochemistry
- some tectonics and geophysics
- relevant terminology, nomenclature, classification and practical knowledge
- relevant chemistry, physics, biology and mathematics

2.4 Graduate key skills

2.4.1 The term 'Graduate' Key Skills is employed here to imply that the skills work is being undertaken and eventually passed in an higher education context and the student is following a coherent, structured progression of learning. It is noted that 'skills" is defined in a broad sense and that the skills listed below often have a high cognitive content consistent with the expectations of undergraduate programmes.

2.4.2 The Graduate Key Skills that should be developed in an Earth Sciences degree programme is subdivided into the following headings:

- Intellectual Skills
- Practical Skills
- Communication Skills
- Numeracy and Information and Communications Technology (ICT) Skills
- Interpersonal/Teamwork Skills
- Self-Management and Professional Development Skills.

2.4.3. Whereas these skills will normally be developed in a subject-specific context, they have wider applications for continuing personal development of students and in the world of work.

2.4.4. Intellectual skills

- recognising and using subject-specific theories, paradigms, concepts and principles
- understanding the quality of discipline related research

- analysing, synthesising and summarising information critically, including prior research
- collecting and integrating several lines of evidence to formulate and test hypotheses
- applying knowledge and understanding to address familiar and unfamiliar problems
- recognising the moral and ethical issues of investigations and appreciating the need for intellectual integrity and for professional codes of conduct.

2.4.5 Practical skills

- planning, organising and conducting, and reporting on investigations, including the use of secondary data
- collecting, recording and analysing data using appropriate techniques in the field and laboratory
- undertaking field and laboratory investigations in a responsible and safe manner, paying due attention to risk assessment, rights of access, relevant health and safety regulations, and sensitivity to the impact of investigations on the environment and stakeholders
- referencing work in an appropriate manner.

2.4.6. Communication skills

- receiving and responding to a variety of information sources (e.g. textual, numerical, verbal, graphical)
- communicating appropriately to a variety of audiences in written, verbal and graphical forms.

2.4.7. Numeracy and ICT skills

- appreciating issues of sample selection, accuracy, precision and uncertainty during collection, recording and analysis of data in the field and laboratory
- preparing, processing, interpreting and presenting data, using appropriate qualitative and quantitative techniques and packages
- solving numerical problems using computer and non-computer based techniques
- using the Internet critically as a means of communication and a source of information.

2.4.8. Interpersonal/teamwork skills

- identifying individual and collective goals and responsibilities and performing in a manner appropriate to these roles
- recognising and respecting the views and opinions of other team members
- evaluating performance as an individual and a team member.

2.4.9. Self management and professional development skills

- developing the skills necessary for self-managed and lifelong learning (e.g. self-discipline, self-direction, working independently, time management and organisation skills)
- identifying and working towards targets for personal, academic and career development
- developing an adaptable and flexible approach to study and work.

5.5.3. Learning, teaching and assessment

3.1 The Group considers that it is inappropriate to be prescriptive about which learning, teaching or assessment methods should be used by a particular programme. This is because Earth Sciences programmes may (e.g. based on the requirements of different subdisciplines) be differently oriented within Europe and within individual European countries and are embedded in diverse educational cultures. Different institutions, moreover, have access to different combinations of teaching resources and the variable modes of study include a range of patterns of study in addition to the traditional full time degree course. However, staff involved in course delivery should be able to justify their choices of learning, teaching and assessment methods in terms of the learning outcomes of their courses. These methods should be made explicit to students taking the courses concerned.

3.2 Learning, teaching and assessment should be interlinked as part of the curriculum design process and should be appropriately chosen to develop the knowledge and skills identified in section 2 and in the programme specification for the student's degree programme. Research and scholarship inspire curriculum design of all Earth Science programmes. Research-led programmes may develop specific subject-based knowledge and skills.

3.3 The Group believes that it is impossible for students to develop a satisfactory understanding of Earth Sciences without a significant exposure to field based learning and teaching, and the related assessment. We consider this learning through experience as an especially valuable aspect of Earth Science education. We define 'field work' as observation of the real world using all available methods. Much of the advancement in knowledge and understanding in our subject areas is founded on accurate observation and recording in the field. Developing field-related practical and research skills is, therefore, essential for students wishing to pursue careers in Earth Sciences. Additionally field-based studies allow students to develop and enhance many of the Graduate Key Skills (e.g. teamworking, problem-solving, self-management, interpersonal relationships) that are of value to all employers and to life-long learning.

3.4 Existing Earth Sciences programmes have developed and used a very diverse range of learning, teaching and assessment methods to enhance student learning opportunities. These methods should be regularly evaluated in response to generic and discipline-specific national and international developments and incorporated where appropriate by curriculum developers.

5.5.4. Performance levels

In this section levels of performance are expressed as statements of learning outcomes. It is recognised, however, that not all learning outcomes can be objectively assessed. Whilst it is relatively easy to examine knowledge of the curriculum, it is less easy to assess the ability to carry concepts across different strands of the discipline and extremely difficult to accurate measure the improvement in a student's cognitive skills. However, it is important to emphasise that levels of performance can only be established in terms of the shared values of the academic community as moderated internally and externally by academic quality procedures. In this respect and in order to facilitate mobility and the professional recognition of grades within Europe, the Group considers it necessary to develop a scheme that should enable comparison of the significance of grades (not the standardization) in individual European countries. It is felt that in general three levels of performance should be recognized:

- *Threshold* is the minimum performance required to gain a Cycle 1 degree
- *Typical* is the performance expected of students
- *Excellent* is the performance expected of the top 10% of students.

5.6. History: Common Reference Points for History Curricula and Courses

Third draft for discussion as 26 May 2002

with observations from discussion at Spring Meeting of CLIOHNet (Rouen, 24-25 May 2002)

5.6.1. Preliminary considerations

Defining common European reference points for History is an extremely delicate task. In contrast to the situation in some other subject areas, the ways in which History is conceptualised, structured and taught and its relationship to other disciplines are very different in the various European countries. The problems posed and the insights gained are nonetheless of more general use in defining strategies for other areas including those collaborating in the Tuning Project.

The Tuning Subject area group began its work on this theme attempting to define a 'core curriculum' for History. The term itself is very much open to discussion in general; in the case of History it became quite immediately clear that at present it means, or is taken to mean, widely different things in different national and institutional contexts. For this reason the group has decided to utilise the insights that have come out of mapping existing curricula with the objective of taking them into account in the formulation of general guidelines and reference points for the disciplinary area.

In general terms we may say that 'core curriculum' most often is taken to mean those contents and learning offers and outcomes which students is obliged learn, take up or achieve in order to receive a History degree. More specifically, it is usually taken to refer to those outcomes ***in the field of History*** which students must have achieved in order ***to receive a History degree***. (In some cases it is mandatory for History students to take courses ***in other related areas*** such as Geography or Art History, or to achieve skills in other areas such as Informatics, Languages, or Pedagogy. These courses, although they may be part of the requirements for receiving a History degree, do not seem to be considered part of what is normally understood to be the 'core curriculum' for History students. Nonetheless, it seems reasonable to consider them too in any future recommendations).

It is equally or even more important for the History subject area to define 'core curriculum' in another of its possible definitions, that is, the basic knowledge, skills and outlook which ***any student taking a History course*** should be given access to and hopefully make his or her own. This is because History is very often part of general education and the single student be required or wish to take a small number of credits in History. This is quite as important for the subject area as the issue of curricula for History students.

On the basis of these preliminary considerations it seems appropriate to speak of 'core curricula' in the plural, and to approach the topic first by mapping the present situation and considering the variety of logics and strategies represented.

5.6.2. Methodology

Because of the widely varying structure of the discipline as taught in the different participating countries, it seems reasonable first to try to understand where differences and analogies actually lie in the present systems. This endeavour regards both what is actually taught or learned, in terms of contents, skills and outlook, and how the teaching/learning experience is described and justified.

Other issues to be addressed are the progressive order -- if any -- in which certain contents are to supposed to be learned, the relationship of teaching/learning and research, and the specific issue of History 'core' for students whose main area of study is not History.

Further specific questions which should be investigated are, what are considered necessary or appropriate History studies for those who will become teachers at different levels? What are the related or even unrelated subjects, including ancillary subjects of various sorts which are recommended or required for History students? What linguistic knowledge, including that of ancient languages and of one's own language, is necessary or recommended? What is the place of the national or local history in the curriculum? Are there recommendations which can or should be made about history teaching/learning in an informal or life-long learning context?

A final aspect which is tightly related to all the above is that of teaching, assessment and evaluation methods. For purposes of clarity these will not be discussed in detail here as they are considered in a separate line of the Tuning agenda.

5.6.3. Findings

The History subject area group dedicated an important part of the second Tuning meeting (held in Roskilde) to explaining and 'mapping' possible ways of understanding the concept of 'core' in the different participating universities. The results are contained in an annex to the minutes of that meeting. This endeavour continued in the third meeting (Gent) along with the discussion of the first draft of the present document. This second draft has been prepared by incorporating the modifications suggested; furthermore a questionnaire for academics has been prepared and circulated; a draft of a general formulation of outcomes to be expected at the various levels considered (first cycle, second cycle, courses of study in which history forms a relevant part, history courses for students of other subjects) has been prepared and circulated.

The main conclusions which have emerged to date may be summed up as follows:

- Each national system must be seen as a coherent whole, in which the order, the contents, the teaching-learning and assessment methods are related to each other.
- A unanimous conclusion is the importance of defining the general ethical and heuristic reasons for studying-learning-teaching history.
- The elements that are in agreement (that is, which appear in all existing curricula) should appear in any proposed 'core curriculum': this would not be simply the minimum common denominator, but rather an agreement on necessary kinds of contents.
- It is important to point out the advantages the study of history offers to society and to individuals who study it as a degree programme or as part of their studies.
- The group underlines particularly the importance of **comparison** and **connection** (geographical, chronological) in historical teaching/learning and research.
- Other disciplines and competencies (the mother language, foreign language, Philology, Archaeology, Social Sciences etc.) are essential or advisable for the formation of a historian or more generally for the formation of a critical historical mentality.

5.6.4. Problems and insights

In general, it emerges from the survey carried out that there is something of a basic division between those systems in which the objective is first of all to transmit basic knowledge about different periods of history, often in a prescribed or in chronological order, subsequently dealing with more specific research topics and methodologies, and those which from the beginning seek to communicate a certain attitude or mindset, and deal immediately with research topics, giving less systematic attention to building up a framework of general knowledge. In the first case, with some degree of exaggeration, we might say that History is conceived of as an existing corpus of knowledge which can be arranged according to more basic or more specialised contents, and that the direct knowledge or experience of historiographical practice or research techniques should come in a second or third phase of studies. In the second case, notwithstanding quite relevant variations, we can say that history is understood to be a way of approaching reality which should be transmitted immediately, usually through actual examples of research or group work; whereas learning 'basic' contents is less immediately important, either because it is considered the task of secondary school studies or because it is thought that the essential thing is that the student know how to find and acquire such knowledge when needed.

We can usefully conceive of this division in terms not of dichotomy but of a range of possible combinations, each with its specific characteristics. The range of combinations, which includes other factors as well, can be represented in simplified form: At one extreme we find several countries where either by law or in practice, courses of study are organised to begin with general mandatory studies in History according to large chronological divisions (i.e. Ancient, Medieval, Early Modern, Modern, Contemporary or recent), and where the student begins to have autonomous contact with original documents in the second part of the course of studies. At the other extreme we find two typologies: on the one hand Germany (where after the initial Grundstudium phase, the teaching/learning offer is articulated on the basis of specialised themes according to the interests and expertise of the teaching staff) and Italy (where, until the current reform, courses did not need to be taken in a particular order and choice of subject matter was based to a large extent on research interests of staff although general knowledge had to be demonstrated at some point before receiving the final degree), and on the other Roskilde (not typical of Denmark insofar as it developed as an experimental University, but with some analogies to Uppsala), where the students from the very beginning of their University studies are asked to organise autonomous research groups in which themselves must define their theme, find the necessary materials to deal with it and prepare reports. All other systems fall somewhere between these extremes. In countries such as Germany and Italy where the existing system is very far from what we might consider the French or Spanish model, the tendency in adapting the systems to the Bologna-Prague process seems to be to define a progressive series of general contents, hence coming closer to the Franco-Iberian model. The traditional British and Irish system insists from the outset and in all courses on creating the necessary conditions for the student to accede to the historical perspective or mindset, which is considered to be of general ethical-political value for all citizens and not just those specialising in the subject.

We may note that such widely differing experiences and concepts of how the subject area is or should be organised makes it necessary to build up a new common reference point which takes into account the various points of view. For this reason the UK benchmarking document is useful as a 'checklist' to compare with the results of the autonomous work of the group rather than as a starting point to be modified on the basis of specific insights.

A general problem is that of articulating definitions and recommendations for 'core curricula' in levels. This must be done for a variety of levels: first and second cycle both for History students and for students who will take History as a second or minor subject. Also, as stated above, it seems appropriate to consider general objectives for single courses offered to students doing general studies.

Lastly, we should note this draft for discussion has been prepared before seeing the results of the survey of graduates and employers. It is likely that those results will suggest modifications and additions to the present formulation.

5.6.5. Suggestions and proposals

As stated above, in the various national systems history studies are organised according to different basic criteria. Since the general objective of any European core curriculum must be to use to maximum effect the rich diversity of the teaching/learning and research traditions, it is obvious that the first principle is to preserve that diversity while giving teachers and students (and to the extent possible, the broader public) an awareness of it and hence of the specificity of their own national outlook.

All systems have drawbacks and advantages and in practice have their own ways of achieving an appropriate balance. Nonetheless we might wish to formulate a general recommendation that various basic factors listed below be present in a balanced way, both in the first and the second cycle, and even in single courses designed for general students.

Hence:

I. Overarching objectives specific to History:

1. It seems reasonable to propose that all history teaching, in whatever quantity and at whatever level, have certain general overarching objectives. These naturally can be pursued in any framework, but should not be ignored. These may be defined as acquiring a rational, critical view and insight into the past in order to have a basis for understanding the present and for informed citizenship.

2. It seems reasonable that all history teaching, in whatever quantity and at whatever level, have among its objectives that of furnishing some precise knowledge of events, processes of change and continuities in a diachronic perspective. It is essential that the student, however early put into contact with original research, be able to orient him/herself in the more general chronological framework of the past.

3. It seems reasonable that all history teaching, in whatever quantity and at whatever level, transmit so far as is possible an awareness of the basic tools of the historian's craft, a critical approach to historical documents and an awareness of how historical interests, categories and problems change with time and in diverse political and social contexts.

These general elements should be kept in mind whenever Historical studies are planned, executed or evaluated. At whatever level, it is important to transmit the concept that History is a perspective and a practice which has its own history, rather than a definitive corpus of knowledge which can be acquired incrementally, piece by piece.

II. Articulation in cycles:

A particular problem appears to be defining realistic objectives or desired learning outcomes for the first and second cycle. It seems reasonable to calibrate the system starting from the objectives for the second cycle and adjusting those of the first cycle appropriately in order to avoid unrealistic expectations for the first cycle and a lack of distinction between the two.

In this regard the definitions contained in the Scottish benchmarking document has been helpful; the differentiations contained in the legal definitions of the two levels in the new Italian system have also been of use. A draft formulation of the outcomes to be achieved at the various levels is annexed (Annex 1)

III. Other disciplines in history curricula:

Although this is not universally the case today, there is some degree of consensus that history students should have adequate knowledge of some other disciplines related to the historical sciences (such as, purely as examples, geography, archaeology, statistics, and/or other literary, scientific or technical subjects according to the branch of history pursued).

Although reality is today much different from the ideal, linguistic abilities also are of particular importance for history students. Appropriate levels of written and oral expression and understanding of one's own language are obviously essential, although in no country is such knowledge automatic. History teaching should include attention to the specific statutes of writing and oral presentation within the discipline. Students also need ideally to have knowledge of several languages in order to utilize fully the historiographical literature and to approach research in a critical fashion. Even if their area of interest is their own country in a recent period they will benefit by being able to compare other realities with their own. Specific objectives for language training for history students can be defined (reading ability, scientific historiographical vocabulary, understanding of the formation of national languages as an historical process, etc.).

IV. National, regional, local History; European history; World History

In some systems national history is taught along with general history; in others there is a strong separation, and the national history is taught in different courses by different professors, even belonging to a separate department. In either case the student should be given the opportunity to accede to the insights which can be gained by studying both, albeit in different proportions.

Something of the same nature can be said for the relationship between history regarding prevalently the regional, national, European or broader world history. Mapping the strikingly different emphasis on history of different areas of the world in different universities and national contexts would provide interesting material for future analysis. In any case it is reasonable that the student have the opportunity widen his/her horizons in both directions, as the comparative approach to the teaching/learning of History is invaluable whether on a micro or macro scale. This could take the form of a recommendation.

The question of how European history itself may best be taught/learned is a subject which is receiving specific attention from the History Thematic Network CLIOHNet and in the curriculum development programme being carried out by 38 Universities operating under the name of CLIOH.

In this regard it seems reasonable for Tuning and CLIOH to collaborate, to give greater force to their reciprocal activities, insights and conclusions. Synthetically stated, CLIOH has prepared and is preparing a variety of tools and materials which make up an 'offer', an 'arsenal' which teachers and students can use to create 'CORE' modules (5 or more credits in general history for history and non-history students) which are based on the perception and the experience that the diversity of European traditions and historical narratives provides a privileged entrée into the way historical knowledge is constructed.

In addition to studying European history in this way, CLIOH proposes similar resources for teaching/learning about European integration and the ways the concept of Europe has been used and developed. Once again it seems reasonable to look for synergies with this pilot project in recommendations about teaching/learning European History in a comparative historical perspective.

IV. General skills

In defining the objectives of core curricula it is well to remember a series of skills and competencies which will be useful to all graduates, whether or not they will become professional historians. Such considerations will certainly have an effect on recommendations regarding teaching learning methods: self confidence, independent judgement, ability to make decisions, to gather information and to work with others for example can certainly be developed more effectively in some teaching formats than in others, and such aspects will need to be taken into considerations. Furthermore, the use of teaching methods which encourage capabilities not universally taken into account today (such as ability to work in teams, ability to organise projects) as well as those which enhance qualities more generally assumed to result from the study of History (such as mental discipline, effective writing and speaking, precision and intellectual honesty) should in practice improve the quality of the transmission of disciplinary knowledge as well.

VI. Lifelong Learning aspects

This topic has not yet been thoroughly discussed by the group. Nonetheless it may be pointed out that the general criteria outlined above under point I in this paragraph (overarching objectives specific to History) should apply to the teaching/learning activities, informal and formal, which may be offered in any context including Life-long learning programmes. This point is important, because there may be a potential clash between 'heritage' or 'identity' history and the rational critical historical outlook which is being proposed here. This problem regards the entire field, but perhaps is particularly important in the context of cultural or educational initiatives taking place outside normal academic institutions.

Annexes:

1. draft formulation of appropriate achievement at different levels.

2. list of subject specific skills

Annex 1

Third Draft for discussion as of 26 May 2002. Subject specific qualities, skills and competences to be developed in History Teaching/Learning at various levels of study.

Note: The following is a formulation in general terms of the level of achievement which should be reached by History Students completing each level of History studies.

Type of studies	Description of achievement
History courses for students of other subject areas	In all general history studies, including the case of those taking a single course in the subject area, the student should be encouraged to understand and to the extent possible make his or her own a historical perspective on reality. This should include acquiring or experiencing: 1. A critical, rational view of the human past, and the realization that the past affects our present and future and our perception of it; 2. Understanding of and respect for viewpoints moulded by different historical backgrounds; 3. A general idea of the diachronic framework of major historical periods or events; 4. Direct contact with the historian's craft, that is, even in a circumscribed context, contact with original sources and texts produced by professional historiographical research.
History as a relevant part of a degree in other or more general subjects (minor or double honours degree, degree in Letters, part of a teaching degree, etc.)	All of the above remain the general objectives. The level expected will be higher, the contents more ample and detailed, the experience of different methodologies and historiographical tools greater according to the amount of historical studies permitted in the study course organisation. In any case, to obtain mention of a relevant presence of historical studies in a degree, the student who has completed such a study programme should: 1. have general knowledge of the methodologies, tools and issues of at least two of the broad chronological periods into which human history is normally divided (such as Ancient, Medieval, Modern, Contemporary) as well as some significant diachronic themes; 2. should have demonstrated his/her ability to complete, present orally and to write up, according to the statute of the discipline, a circumscribed piece of research in which the ability to retrieve bibliographical information and documentary evidence and use it to address a historiographical problem is demonstrated.
History for first cycle History Degrees ("Bachelors'")	The general objectives remain as above; however the student at the end of a first level History degree should furthermore: 1. possess general knowledge and orientation with respect to the methodologies, tools and issues of all the broad chronological divisions which human history is normally divided, from ancient to recent times; 2. have specific knowledge of at least one of the above periods or of a diachronic theme; 3. be aware of how historiographical problems develop and how historiographical debate is linked to political and cultural concerns of each epoch; 3. have shown his/her ability to complete, present orally and to write up, according to the statute of the discipline a medium-length piece of research in which the ability to retrieve bibliographical information and primary sources and use them to address a historiographical problem is demonstrated.
History for a second cycle History Degree ("Masters'")	A student completing a second cycle degree in History should have acquired a reasonable competence in all the subject specific qualities, skills and competences which are included in the **list** below (Annex 2). He/she will have built further on the levels reached at the first cycle so as to: 1. have specific, ample, detailed and up-to-date knowledge of at least one great chronological division of human history, including different methodological approaches and historiographical orientations relating to it; 2. have acquired familiarity with comparative methods, spatial, chronological and thematic, of approaching historiographical research; 3. have shown the ability to plan, carry out, present orally and in written form, according to the statute of the discipline, a research-based contribution to historiographical knowledge, bearing on a relevant historiographical problem.

Annex 2

List of Subject Specific Skills and Competences (on which the consultation with academics was based)
Skills referred to in definition of levels

1. A critical awareness of the relationship between current events and processes and the past.
2. Awareness of the differences in historiographical outlooks in various periods and contexts.
3. Awareness of and respect for points of view deriving from other national or cultural backgrounds.
4. Awareness of the on-going nature of historical research and debate.
5. Knowledge of the general diachronic framework of the past.
6. Awareness of the issues and themes of present day historiographical debate.
7. Detailed knowledge of one or more specific periods of the human past.
8. Ability to communicate orally in one's own language using the terminology and techniques accepted in the historiographical profession.
9. Ability to communicate orally in foreign languages using the terminology and techniques accepted in the historiographical profession.
10. Ability to read historiographical texts or original documents in one's own language; to summarise or transcribe and catalogue information as appropriate.
11. Ability to read historiographical texts or original documents in other languages; to summarise or transcribe and catalogue information as appropriate

12 Ability to write in one's own language using correctly the various types of historiographical writing

13 Ability to write in other languages using correctly the various types of historiographical writing

14. Knowledge of and ability to use information retrieval tools, such as bibliographical repertoires, archival inventories, e-references
15. Knowledge of and ability to use the specific tools necessary to study documents of particular periods (e.g. palaeography, epigraphy).
16. Ability to use computer and internet resources and techniques elaborating historical or related data (using statistical, cartographic methods, or creating databases, etc.)
17. Knowledge of ancient languages
18. Knowledge of local history
19. Knowledge of one's own national history
20. Knowledge of European history in a comparative perspective
21. Knowledge of the history of European integration
22. Knowledge of world history
23. Awareness of and ability to use tools of other human sciences (e.g., literary criticism, and history of language, art history, archaeology, anthropology, law, sociology, philosophy etc.)
24. Awareness of methods and issues of different branches of historical research (economic, social, political, gender related, etc.)
25. Ability to define research topics suitable to contribute to historiographical knowledge and debate
26. Ability to identify and utilise appropriately sources of information (bibliography, documents, oral testimony etc.) for research project
27. Ability to organise complex historical information in coherent form
28. Ability to give narrative form to research results according to the canons of the discipline
29. Ability to comment, annotate or edit texts and documents correctly according to the critical canons of the discipline
30. Knowledge of didactics of history
31. Other (specify)
32.
33.

5.7. Mathematics: Towards a common framework for Mathematics degrees in Europe

This paper reflects the unanimous consensus of the mathematics group of the project "Tuning educational structures in Europe", but it has not yet been discussed with the wider community of European mathematicians. Since the group does not pretend to have any representative role, we insist that any kind of action along the lines we sketch will require a much broader agreement.

Summary

- This paper refers only to universities (including technical universities), and none of our proposals apply to other type of institutions.
- The aim of a "common framework for Mathematics degrees in Europe" is to facilitate an automatic recognition of degrees in order to help mobility.
- The idea of a common framework must be combined with an accreditation system.
- The two components of a common framework are similar (although not necessarily identical) structures and a basic common core curriculum (allowing for some degree of local flexibility) for the first two or three years.
- Beyond the basic common core curriculum, and certainly in the second cycle, programmes could diverge significantly. Since there are many areas in Mathematics, and many of them are linked to other fields of knowledge, flexibility is of the utmost importance.
- Common ground for all programmes will include calculus in one and several real variables and linear algebra.
- We propose a broad list of further areas that graduates should be acquainted with in order to be easily recognised as mathematicians. It is not necessary that all programmes include individual modules covering each of these areas.
- We do not present a prescriptive list of topics to be covered, but we do mention the three skills that any mathematics graduate should acquire:

  (a) the ability to conceive a proof,

  (b) the ability to model a situation,

  (c) the ability to solve problems.
- The first cycle should allow time to learn some computing and to meet at least one major area of application of Mathematics.
- We should aim for a wide variety of flavours in second cycle programmes in mathematics. Their unifying characteristic feature should be the requirement that all students carry on a significant amount of individual work. To do this, a minimum of 300 ECTS credits should be necessary to obtain a Bachelor + Master.
- It might be acceptable that various non-identical cycle structures coexist, but large deviations from the standard should be grounded in appropriate entry level requirements, or other program specific factors, which can be judged by external accreditation. Otherwise, such degrees risk not benefiting from the automatic European recognition provided by a common framework, even though they may constitute worthy higher education degrees.

5.7.1. A common framework: what it should and shouldn't be or do

1.1 The only possible aim to agree on a "common European framework" should be to facilitate an automatic recognition of mathematics degrees in Europe in order to help mobility. By this we mean that when somebody with a degree in mathematics from country A goes to country B:

a) He/she will be legally recognised as holding such a degree, and the Government of country B will not require further proof of competence.

b) A potential employer in country B will be able to assume that he/she has the general knowledge expected from somebody with a mathematics degree.

Of course, neither of these guarantees employment: the mathematics graduate will still have to go through whatever procedures (competitive exams, interviews, analysis of his/her curriculum, value of the degree awarding institution in the eyes of the employer,...) are used in country B to get either private or public employment.

1.2 One important component of a common framework for the mathematics degrees in Europe is that all programs have similar (although not necessarily identical) structures. Another component is agreeing on a basic common core curriculum (allowing for some degree of local flexibility).

1.3 We should emphasise that by no means do we think that agreeing on any kind of common framework can be used as a tool for automatic transfer between Universities. These will always require consideration by case, since different programmes can get students to adequate levels in different but coherent ways, but an inappropriate mixing of programmes may not.

1.4 In many European countries there exist higher education institutions that differ from universities both on the level they demand from students and in their general approach to teaching and learning. In fact, to avoid excluding from higher education a substantial number of students, it is essential to keep the differences. We want to make explicit that **this paper refers only to universities (including technical universities)**, and that any proposal of a common framework designed for universities would not apply to other type of institutions.

5.7.2. Towards a common core mathematics curriculum

2.1 General remarks

At first sight, mathematics seems to be well suited for the definitions of a core curriculum, e.g. for the first two or three years. Because of the very nature of mathematics, and its logical structure, there will be a common part in all mathematics programmes, consisting of the fundamental notions. On the other hand, there are many areas in Mathematics, and many of them are linked to other fields of knowledge (computer science, physics, engineering, economics, etc.). Flexibility is of the utmost importance to keep this variety and the interrelations that enrich our science.

There could possibly be an agreement on a list of subjects that must absolutely be included (linear algebra, calculus/analysis) or that should be included (probability/statistics, some familiarity with the mathematical use of a computer) in any mathematics degree. In the case of some specialised courses, such as mathematical physics, there will certainly be variations between countries and even between universities within one country, without implying any difference of quality of the programmes.

Moreover, a large variety of mathematics programmes exist currently in Europe. Their entry requirements vary, as do their length and the demands on the student. It is extremely important that this variety be maintained, both for the efficiency of the education system and socially, to accommodate the possibilities of more potential students. To fix a single definition of contents, skills and level for the whole of European higher education would exclude many students from the system, and would, in general, be counterproductive.

In fact, the group is in complete agreement that programmes could diverge significantly beyond the basic common core curriculum (e.g. in the direction of "pure" mathematics, or probability - statistics applied to economy or finance, or mathematical physics, or the teaching of mathematics in secondary schools). The presentation and level of rigour, as well as accepting there is and must continue to be variation in emphasis and, to some extent, content, even within the first two or three years, will make all those programmes recognisable as valid mathematics programmes.

As for the second cycle, not only do we think that different programs could differ, but we are convinced that, to reflect the diversity of mathematics and its relations with other fields, all kinds of different second cycles in mathematics should be developed at different institutions.

2.2 The need for accreditation

The idea of a basic core curriculum must be combined with an accreditation system. If the aim is to recognise that various universities fulfil the requirement of the core curriculum, then one has to check on three aspects:

(a) a list of contents

(b) a list of skills

(c) the level of mastery of concepts

These cannot be reduced to a simple scale.

To give accreditation to a mathematics programme, an examination by a group of peer reviewers, mostly mathematicians, is necessary. The key aspects to be evaluated should be:

(a) the programme as a whole

(b) the units in the programme (both the contents and the level)

(c) the entry requirements

(d) the learning outcomes (skills and level attained)

(e) a qualitative assessment by both graduates and employers

The group does not believe that a (heavy) system of European accreditation is needed, but that universities in their quest for recognition will act at the national level. For this recognition to get international value, mathematicians from other countries must be included among the reviewers.

5.7.3. A common core curriculum and the Bologna agreement

How various countries implement the Bologna agreement will make a difference on core curricula. In particular, 3+2 may not be equivalent to 5, because, in a 3+2 years structure, the 3 years could lead to a professional diploma, meaning that less time is spent or fundamental notions, or to a supplementary 2 years, and in that case the whole spirit of the 3 years programme should be different.

The group did not attempt to solve contradictions that could appear in the case of different implementations of the agreement (i.e. if three years and five years university programmes coexist; or different cycle structures are established: 3+1, 3+2, 4+1, 4+2 have all been proposed). As we said before, it might be acceptable that various systems coexist, but we believe that large deviations from the standard (such as a 3+1 structure) should be grounded in appropriate entry level requirements, or other program specific factors, which can be judged by external accreditation. Otherwise, such degrees risk not benefiting from the automatic European recognition provided by a common framework, even though they may constitute worthy higher education degrees.

5.7.4. Some principles for a common core curriculum for the first degree (Bachelor) in mathematics

We do not feel that fixing a detailed list of topics to be covered is necessary, or even convenient. But we think that it is possible to give some guidelines as to the common contents of a "European first degree in Mathematics", and more important, as to the skills that all graduates should develop.

4.1 Contents

4.1.1 All mathematics graduates will have knowledge and understanding of, and the ability to use, mathematical methods and techniques appropriate to their programme. Common ground for all programmes will include

(a) calculus in one and several real variables

(b) linear algebra.

4.1.2 Mathematics graduates must have knowledge of the basic areas of mathematics, not only those that have historically driven mathematical activity, but also others of more modern origin. Therefore graduates should be acquainted with most, preferably all, of the following:

(a) basic differential equations

(b) basic complex functions

(c) some probability

(d) some statistics

(e) some numerical methods

(f) basic geometry of curves and surfaces

(g) some algebraic structures

(h) some discrete mathematics

These need not be learned in individual modules covering each subject in depth from an abstract point of view. For example, one could learn about groups in a course on (abstract) group theory or in the framework of a course on cryptography. Geometric ideas, given their central role, could appear in a variety of courses.

4.1.3 Other methods and techniques will be developed according to the requirements and character of the programme, which will also largely determine the levels to which the developments are taken. In any case, all programmes should include a substantial number of courses with mathematical content.

4.1.4 In fact, broadly two kinds of mathematics curricula currently coexist in Europe, and both are useful. Let us call them, following [QAA][21]:, "theory-based" and "practice-based" programmes. The weight of each of the two kinds of programmes varies widely depending on the country, and it might be interesting to find whether most European university programmes of mathematics are "theory-based" or not.

Graduates from theory-based programmes will have knowledge and understanding of results from a range of major areas of mathematics. Examples of possible areas are algebra, analysis, geometry, number theory, differential equations, mechanics, probability theory and statistics, but there are many others. This knowledge and understanding will support the knowledge and understanding of mathematical methods and techniques, by providing a firmly developed mathematical context.

Graduates from practice-based programmes will also have knowledge of results from a range of areas of mathematics, but the knowledge will commonly be designed to support the understanding of models and how and when they can be applied. Besides those mentioned above, these areas include numerical analysis, control theory, operations research, discrete mathematics, game theory and many more. (These areas may of course also be studied in theory-based programmes.)

4.1.5 It is necessary that all graduates will have met at least one major area of application of their subject in which it is used in a serious manner and this is considered essential for a proper appreciation of the subject. The nature of the application area and the manner in which it is studied might vary depending on whether the programme is theory-based or practice-based. Possible areas of application include physics, astronomy, chemistry, biology, engineering, computer science, information and communication technology, economics, accountancy, actuarial science, finance and many others.

4.2 Skills

4.2.1 For a standard notion like integration in one variable, the same "content" could imply:

(a) computing simple integrals

(b) understanding the definitions of the Riemann integral

(c) proving the existence and properties of the Riemann integral for classes of functions

(d) using integrals to model and solve problems of various sciences.

So on one hand the contents must be clearly spelled out, and on the other various skills are developed by the study of the subject.

4.2.2 Students who graduate from programmes in mathematics have an extremely wide choice of career available to them. Employers greatly value the intellectual ability and rigour and the

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[21] [QAA]The *Benchmark document on Mathematics, Statistics and Operational Research*, from the UK Quality Assurance Agency for Higher Education (http://www.qaa.ac.uk/crntwork/benchmark/phase2 /mathematics.pdf), was considered extremely useful and met with unanimous agreement from the group. In fact we have quoted it almost verbatim at some points.

skills in reasoning that these students will have acquired, their firmly established numeracy, and the analytic approach to problem-solving that is their hallmark.

Therefore, the three key skills that any mathematics graduate should acquire are:

(a) the ability to conceive a proof,

(b) the ability to model a situation,

(c) the ability to solve problems.

It is clear that, nowadays, solving problems should include their numerical and computational resolution. This requires a sound knowledge of algorithms and programming and the use of the existing software.

4.2.3 Note also that skills and level are developed progressively through the practice of many subjects. We do not start a mathematics programme with one course called "how to make a proof" and one called "how to model a situation", with the idea that those skills will be acquired immediately. Instead, it is through practice in all courses that these develop.

4.3 Level

All graduates will have knowledge and understanding developed to higher levels in particular areas. The higher-level content of programmes will reflect the title of the programme. For example, graduates from programmes with titles involving statistics will have substantial knowledge and understanding of the essential theory of statistical inference and of many applications of statistics. Programmes with titles such as mathematics might range quite widely over several branches of the subject, but nevertheless graduates from such programmes will have treated some topics in depth.

5.7.5. The second degree (Masters) in mathematics

We have already made explicit our belief that establishing any kind of common curriculum for second cycle studies would be a mistake. Because of the diversity of mathematics, the different programmes should be directed to a broad range of students, including in many cases those whose first degree is not in mathematics, but in more or less related fields (computer science, physics, engineering, economics, etc.). We should therefore aim for a wide variety of flavours in second cycle programmes.

Rather than the contents, we think that the common denominator of all second cycles should be the level of achievement expected from students. A unifying characteristic feature could be the requirement that all second cycle students carry on a significant amount of individual work. This could be reflected in the presentation of a substantial individual project.

We believe that, to achieve the level necessary to do real individual work in mathematics, the time required to obtain both degrees (Bachelor + Master) should be the equivalent of at least 300 ECTS credits. Arguments justifying exceptions to this minimum should be supported by external accreditation.

Whether this 300 ECTS credits should be split in a 3 years Bachelor, followed by a 2 years Masters, or whether a 4+1 structure is preferable, may depend on a number of circumstances. For example, a 3+2 break up will surely facilitate crossing between fields, where students pursue Masters in areas different from that were they got their Bachelors.

One aspect that can not be ignored, at least in mathematics, is the training of secondary school teachers. If the pedagogical qualification must be obtained during the first cycle studies, they should probably last for 4 years. On the other hand, if secondary school teaching requires a Masters (or some other kind of postgraduate qualification), a 3+2 structure may be adequate.

5.8. Physics: Main Points for an Operational Definition of Core Contents

LF Donà dalle Rose, F Cornet, E Cunningham, MC do Carmo, M Ebel, H Ferdinande, H Geurts, E Gozzi, WG Jones, J Niskanen, G Nyman, JC Rivoal, P Sauer, S Steenstrup, EG Vitoratos,

5.8.1. The "Essential Elements" of a degree course

In each country or university the structure of a degree course may be characterised by some specific *components,* which we name "compulsory components or elements" of that given degree course. As possible examples we quote here the core content (a very special compulsory element, see possible definitions below), the final year thesis work, the comprehensive exam(s), etc. The core content focuses on the "minimal" contents, which identify the degree course. The other compulsory elements are – rather – structural constraints, which may be satisfied by a variety of contents. Their occurrence in the curriculum and their *actual* content depends on a large extent on the institution/country and – quite often – on the student's choice.

Many possible compulsory elements are listed below. They are somewhat independent from each other and their proper and coherent mix yields the course curriculum. They are:

- Core content;[22]
- Course units, which can be chosen by the student from one or more predefined list(s);
- Course units, which are totally left to the free choice of the student;
- Final project/thesis work;
- Choice(s) from list(s);
- Free not-structured choice *or* Completely free choice;
- Other compulsory elements [comprehensive exam(s), intermediate project work, compulsory seminar, *stage* or placement…].

Sometimes the local teaching authority "strongly recommends" to attend units, which are not compulsory. This is a kind of "*soft* " compulsory element.

The Physics Tuning Network made a "*Survey of core contents and other compulsory elements",* which yielded some tables, where examples are given about how all these elements can be put together. These tables will become available in the forthcoming Tuning Final Report. The Physics Tuning partners were asked for detailed information about the course units/activities in

[22] See a definition below. We here make the choice of not using the terminology "core units" which may be ambiguous for several reasons (the same title often corresponds to different contents and/or level; the unit may have a different length in terms of credits depending on the institution, etc.).

their institution, trying to identify what is compulsory, i.e. both in terms of contents and of the other elements. From the survey, it appears that some of the compulsory elements are present in almost all the institutions of the Physics Tuning Network. These may be named *common compulsory elements.* The *core content* is by definition a compulsory element everywhere. Another quite usual compulsory element is the *final year project*. A thorough discussion of the results and features, which can be extracted from the quoted tables, is given below.

5.8.2. Definition of "Core Content"

Definitions may be preliminarily given with reference to three different contexts:

a. With reference to a degree course offered by a particular university: we define (core course units or) core content the set of course units/activities whose content is not left to the choice of the student but is compulsory and fixed by the academic authorities.

b. With reference to all the degree courses in the same field offered by the universities of a given country, two different definitions may be given:

b.1 - minimal core content, defined as the set of the course units/activities which are fixed by law or other national requirements, in order for a university to be allowed to award that given degree title/qualification[23];

b.2 - common core content: the set of the course units/activities whose content is common to all the degree courses, conferring the same title in the country. This set may be larger than the one, as defined at (b.1) just above, and it requires a study/survey in order to be identified. It has to do with the *whole* didactic offer of the degree course rather than with the *compulsory* part of its offer.

With reference to all the degree courses of a given ensemble of countries (e.g. EU, the European countries, etc) *:*

common core content: the set of the course units/activities whose content is common to all the degree courses, conferring the same or similar title and/or similar learning outcomes. Again this set requires a study/survey in order to be identified. Notice that in this case no supra-national requirements[24] are usually active. As an example, remind the EU Treaties, which explicitly state that no homogenising action can be carried out by the Union authorities in this field.

Moreover, very often, the units/activities are characterised not only by the type of contents but also by a corresponding number of credits. The above definitions can then be phrased in terms of credits, too. In this connection, the Socrates Thematic Network EUPEN, which is the *mother* of the present Tuning Physics Network, has provided an interesting and rich report[25] about the "*common core content*". The report is based on the data collected in the EUPEN 2001 Survey (part on behalf of EUPEN Working Group 2), which involved as many as 65 European Institutions (including associated countries). The main result of the analysis given therein is that the identification of the *common* core contents seems certainly possible in the physics 1st cycle[26], but it becomes rather questionable at the 2nd cycle level. In fact, the total number of

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[23] The partners of the Tuning Physics Network were asked in this connection: ***QUESTION 1 is this actually the case in your country?*** **☐ YES ☐ NO.** Their answers are reported in Table 1

[24] of either legal or other nature.

[25] This report will be found as an annex to the present paper in the Tuning Final Report (to be published).

[26] As to the precise meaning of the word "cycle", see Annex II.

"common *core credits*" is 125 credits in the first cycle and 51 credits in the second cycle, i.e. respectively 65% and (only) 35 % of the total average length in credits. New light is shed on this result by the discussion below, where the difference between the *common offer* versus the *common compulsory content* is further discussed.

5.8.3. The structure and the description of the Core Content

The core content itself may be required to satisfy some structural constraints. They are:

1. The existence of structural constraints, fixed by law or other national requirements, on the amount of credits relating to a particular type of units (e.g. basic mathematics, classical physics, modern physics, related subjects, etc.) which must be offered within the degree course. These constraints may be:

   a. Country specific[27];

   b. Institution specific[28].

2. The order in which units/activities must be taken by the student. Often a given unit needs as a pre-requisite the contents offered in a previous unit[29].

A Summary Table of the different situations/regulations, which exist in the institutions of the Physics Tuning Network – as yielded by the answer of the partners to the four questions, reported in the footnote 2, 6, 7 and 8 respectively – is shown in Table 1 below. In the Table the institutions are ordered according to the number of stated "YES", i.e. from a more regulated to a less regulated core content *structure*.

Table 1 - Summary Table of local and national requirements related to the core content

QUESTION	CONTENT	Hannover	Paris VI	Granada	Göteborg University	Patras	Trieste	I.C. London	TU Wien	Aveiro	Kobenhavn	Helsinki	Nijmegen	Dublin CU	Gent
1	minimal core content fixed by law and/or national requirements	Y	Y	Y	Y	Y	Y	Y	Y	N	N	N	N	N	N
2	national constraints on the amount of credits of a given kind/type	Y	Y	Y	Y	N	N	N	N	Y	N	N	N	N	N
3	local (i.e. institution) constraints on the amount of credits of a given kind/type	Y	Y	Y	N	Y	Y	N	N	Y	Y	Y	Y	N	N
4	the order in which (some) exams are taken is regulated	Y	Y	N	Y	Y	Y	Y	Y	N	Y	Y	N	Y	Y

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[27] The partners of the Tuning Physics Network were asked in this connection: ***QUESTION 2 Is this actually the case in your country*?** ☐ **YES** ☐ **NO.** Their answers are reported in Table 1.

[28] The partners of the Tuning Physics Network were asked in this connection: ***QUESTION 3 Is this actually the case in your institution*?** ☐ **YES** ☐ **NO.** Their answers are reported in Table 1 .

[29] The partners of the Tuning Physics Network were asked in this connection: ***QUESTION 4 Is this actually the case in your institution*?** ☐ **YES** ☐ **NO**. Their answers are reported in Table 1.

Of course the core content can be further detailed, by giving for a given university the set of units, which actually constitute the core content. For each of the units belonging to this set, the actual content, the number of credits, the level of the unit must be specified. The level may be specified in terms – for instance – of a *reference textbooks* or of a predefined and agreed *descriptive list*, which describes each unit in terms of its own specific contents and of the foreseen learning outcomes. Another quicker possibility is to attach to the unit a label, which specifies the level (e.g., B for Basic; A for Advanced; S for Specialised; …). However, past attempts in these directions never attained easy reproducibility and/or effective extension to a wider set of institutions

Other Problems in defining a Core Content in Physics

1. Two main approaches exist, when designing a Physics curriculum:
   - The initial years of the curriculum are common to the subjects of physics, mathematics, chemistry, (geology?, biology?…) and the students makes the choice of the subject only later (at the third year, e.g., see below the case of Copenhagen).
   - The *whole* degree course has "physics" as <u>the</u> key word
2. Our network has difficulty in defining a single core curriculum since our institutions offer degrees in physics, engineering physics, applied physics, theoretical physics, etc. Nevertheless experience shows (see for instance the already quoted EUPEN report; see also below) that meaningful results can be obtained even in this apparently not homogeneous sample of institutions.

The experience of the Tuning Physics Network

The Tuning Physics Network produced an analytical characterisation of the core contents and the other compulsory elements offered in each institution, on the basis of a rather detailed list of entries (see the column CORE CONTENT CHARACTERISATION in Table 2). Such a list (or grid) is made of two sub-lists, a first one of – so to speak – "broad" core contents and a second one of (other) compulsory elements, which were identified during the discussion. Each network institution was asked to allocate to each entry in the list the appropriate number of ECTS credits; these latter ones then characterise the degree course of that institution.

We got returns from 15 institutions[30]. At least two common discussions and several further checks from the partners confirmed the return from each institution. The returns from the institutions were grouped, according to the pattern of their present organisation of studies. We ended up with two groups, i.e.:

A. Institutions with a "Bachelors – Masters (BaMa)" organisation of studies (which mostly adopt the "3+2" scheme). The institutions are Kobenhavn, Granada, Nijmegen, Paris VI, Trieste, Dublin CU, Patras.

B. Institutions, which offer an Integrated Masters level degree course. The institutions are: Gent, Göteborg, Chalmers University of Technology, Helsinki (Physics), Imperial College London, Aveiro, Hannover, Technical University, Wien.

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[30] As already stated above, the details will be made available in the Tuning Final Report

Table 2 - Correspondence between the entries for the present core content characterisation (middle column), the EUPEN 2001 survey grouping (left) and the new grouping "Tuning 2002" (right).

	CORE CONTENT CHARACTERISATION and TWO POSSIBLE GROUPINGS		
LINE	EUPEN GROUPING GRID ITEMS in EUPEN QUESTIONNAIRE 2001	CORE CONTENT CHARACTERISATION	TUNING GROUPING 2002
1°	BASIC UNITS	basic mathematics	Mathematics and Related Subjects
2°	BASIC UNITS	mathematical methods for Physics	Mathematics and Related Subjects
14°	RELATED 1	computing	Mathematics and Related Subjects
15°	RELATED 2	numerical analysis	Mathematics and Related Subjects
3°	GENERAL PHYSICS (characterising I)	introduction to physics	BASIC PHYSICS
4°	GENERAL PHYSICS (characterising I)	classical physics (incl. demonstrations)	BASIC PHYSICS
5°	MODERN PHYSICS (characterising II)	quantum physics (incl. demonstrations)	BASIC PHYSICS
13°	LAB UNITS	laboratory	BASIC PHYSICS
6°	MODERN PHYSICS (characterising II)	analytical mechanics	Theoretical Physics
7°	MODERN PHYSICS (characterising II)	relativity, classical electromagnetism, etc	Theoretical Physics
8°	MODERN PHYSICS (characterising II)	quantum mechanics / theory	Theoretical Physics
9°	MODERN PHYSICS (characterising II)	statistical physics	Theoretical Physics
10°	MODERN PHYSICS (characterising II)	modern physics (atomic, nuclear and subnuclear, solid state, astrophysics)	MODERN PHYSICS
12°	MODERN PHYSICS (characterising II)	Comprehensive Physics (IC)	MODERN PHYSICS
11°	MODERN PHYSICS (characterising II)	applied physics	Applied Physics and Related Subjects
16°	RELATED 2	chemistry	Applied Physics and Related Subjects
17°	RELATED 2	electronics&related	Applied Physics and Related Subjects
21°	MINOR & OPTIONAL	choice(s) from list(s)	OTHER COMPULSORY ELEMENTS
22°	LAB UNITS	physics project(s)	OTHER COMPULSORY ELEMENTS
23°	LAB UNITS	advanced lab	OTHER COMPULSORY ELEMENTS
24°	FINAL YEAR PROJECT	final year project	OTHER COMPULSORY ELEMENTS
25°	MINOR & OPTIONAL	seminar (Hannover)	OTHER COMPULSORY ELEMENTS
18°	RELATED 2	technical drawing	Nonstandard Subjects
19°	VOCATIONAL	vocational	Nonstandard Subjects
20°	SKILLS	skills	Nonstandard Subjects
26°	VOCATIONAL	placement	Nonstandard Subjects
27°	COMPLETELY FREE	completely free choice	completely free choice

We adopted the choice of defining the length of a degree in terms of the credits' total and not of the duration in years. In this context and for the sake of transparency, it must be noticed that, among the degrees, whose length is 240 credits, the Dublin CU degree is a Ba degree, in the current European terminology. On the contrary, the London IC degree (a so-called integrated Masters level course, MSci) as well as the Gent, Göteborg (two institutions) and Helsinki degrees are all Ma degrees, with length equal to 240 credits. The case of Kobenhavn (300 credits) is a peculiar one, since during the first cycle it is common to study two subjects in parallel. Several combinations are possible concerning main subjects, such as physics, mathematics, chemistry, etc.. It is usually possible to study three subjects during the first year, then two subjects out of the three must be chosen for the next two years. In the second cycle only one subject is studied, being chosen out of the two subjects most studied during the first cycle.

The characterisation of the curricula through a list of specific core contents and a list of (other) compulsory elements was aimed at identifying the actual core content. Nevertheless it must be realised that, even in this framework, some uncertainty still remains in the identification. Take, as an example, the entries *Modern Physics* and *Applied Physics*: both of them are very broadly defined subjects and – therefore – their contents can vary from institution to institution, thus *smearing out* the concept of Physics Core Content or, in other words, providing some uncertainty in the definition of the core content.

Moreover it may happen that the "compulsory element" entry C*hoice(s) from list(s)* refers to a predefined list, which is very focussed as far as the content of the units listed therein is concerned. This again *smears out* the definition of core content, since in such a case all the units (to be chosen) may fall under a single specific "core content" entry.

In this same context care must be taken in order not to draw hasty conclusions from inspecting the returns from the Partners. It must be clearly borne in mind that the offer of the teaching/learning units is a much wider concept than the core content. What is core content in one institution, in another institution it may hide itself under another compulsory element [e.g. *Choice(s) from list(s)*], thus implying that this very content is not compulsory for *all* students. In particular it cannot at all be concluded that some core content entries, which are not mentioned in a given return, are *not offered* in the corresponding institution. In other words, we emphasise again that there is a clear conceptual distinction between what is common in the *offer* and what is common in the *core content.*

Some further clarifying remarks are:

- The row named *Skills* appears as a rather empty one in the returns. As a matter of fact only some institutions offer course units fully devoted to the development of general skills. In most of our institutions the skill training is provided (or *integrated*) in other parts of the curriculum. It can be generally stated that skills are developed in many more units than those explicitly mentioned by the returns.
- In some institutions the practical physics activity is integrated in other course units;
- The *Advanced Lab*, classified among the "core elements", is not teacher-oriented, rather it is research oriented and it is meant to be creative and to develop a competence rather than mere skills.
- The compulsory element "*Completely free choice*" is a kind of "buffer" element, whose use is quite widespread. Indeed, it allows an easy check of the total length of the curriculum in terms of ECTS credits.

For each institution we then sum the credits, which correspond either to the core contents or to the *other* compulsory elements. While the variation among the institutions witnesses the richness of different methodological approaches, we think that the average values of these quantities for the two above groups of institutions are meaningful. They are shown in Table 3 below. Do notice that we give three sets of values for the Group of institutions listed at point A above (i.e. values for the Ba cycle, for the Ma cycle, for the whole BaMa sequence).

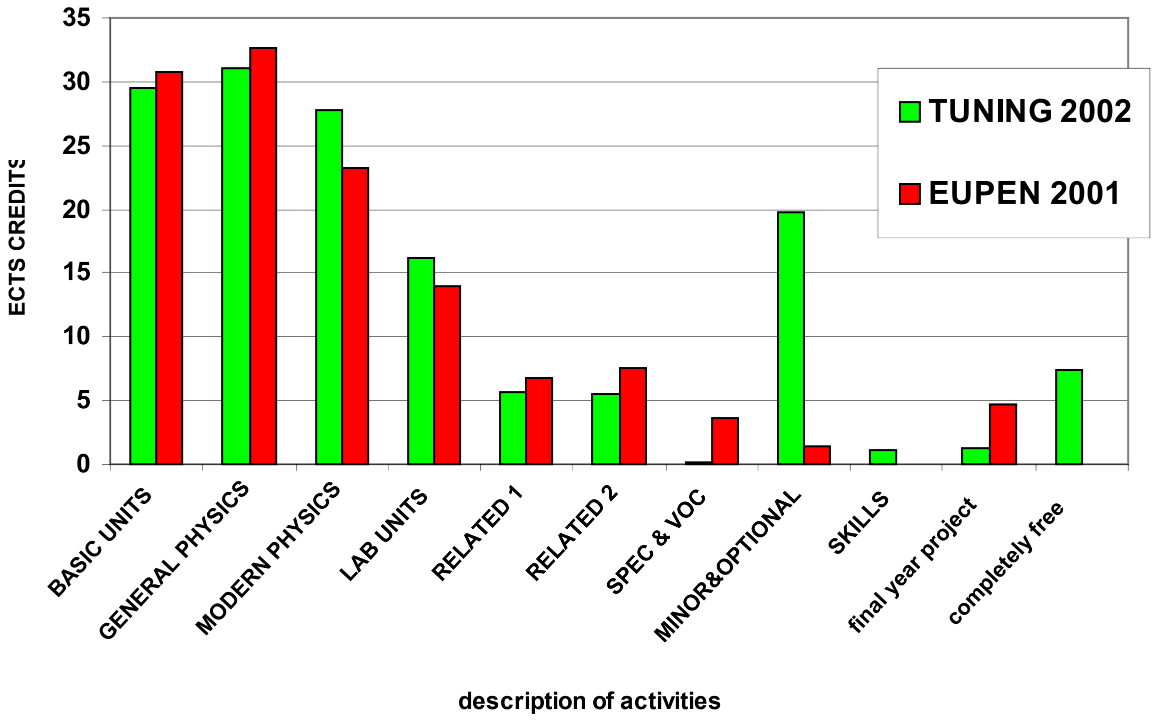
Table 3 - Average values (and dispersions) of the credit distribution over core contents and core elements for different groups of the Tuning partner institutions

	Bachelors (1st cycle)		**Masters (2nd cycle)**		**BaMa**		**Integrated Ma**	
	av	stdev	av	stdev	av	stdev	av	stdev
Total core contents	152.4	30.1	41.4	17.2	190.8	44.4	160.2	29.7
Total core elements	48.2	22.9	79.6	17.9	124.2	35.2	106.4	26.9
Total length (in credits)	200.6	27.5	121.0	2.4	315.0	23.2	266.6	29.4
Total core content *over* length	0.759	0.117	0.343	0.145	0.610	0.127	0.601	0.087

As to the "BaMa" institutions, it is worth noticing that the ratio "core content to total" becomes lower when going from the 1st cycle to the sum of the 1st and 2nd cycle. This is clearly due to the fact that in the 2nd cycle the amount of compulsory (core) contents is much lower than in the 1st cycle. On the other hand, it is reassuring to notice that the above ratio is quite similar (~60%) for the BaMa and for the Integrated Ma organisation of studies.

As a further check of our results, we grouped the entries of the two sub-lists into the items of the more general classification scheme or grid used in the EUPEN survey 2001. There is some freedom in carrying out the grouping operation[31], but this latter – once completed – allows a comparison between the data collected in the Tuning Network and in EUPEN. This is shown in the following Figure 1.

Fig. 1 - CORE CREDIT DISTRIBUTION IN PHYSICS
1st cycle, according to 2 different surveys
(TUNING 2002 =145.2 credits; EUPEN 2001= 124.7 credits)



The main point here is that the *common*[32] "core" content, as obtained from the Tuning data, is definitely similar – both in distribution over the items and in percentage over the total length – to the one found in the EUPEN 2001 survey. The percentage over the average "1st cycle (i.e. BA) length" it is 72.4%, to be compared with the EUPEN value of 65%. The higher value can be easily explained, considering the ways in which the question concerning the credit distribution over the grid entries of the two survey was put. While in the EUPEN case the short list of items focused on the *whole* didactic offer, in the Tuning survey the accent was from the start on the *compulsory* part of the offer, in terms either of contents or of other compulsory elements. As a matter of fact, a large

[31] see for instance Table 2 above.
[32] i.e. common to the 69% of the sample in each grid item.

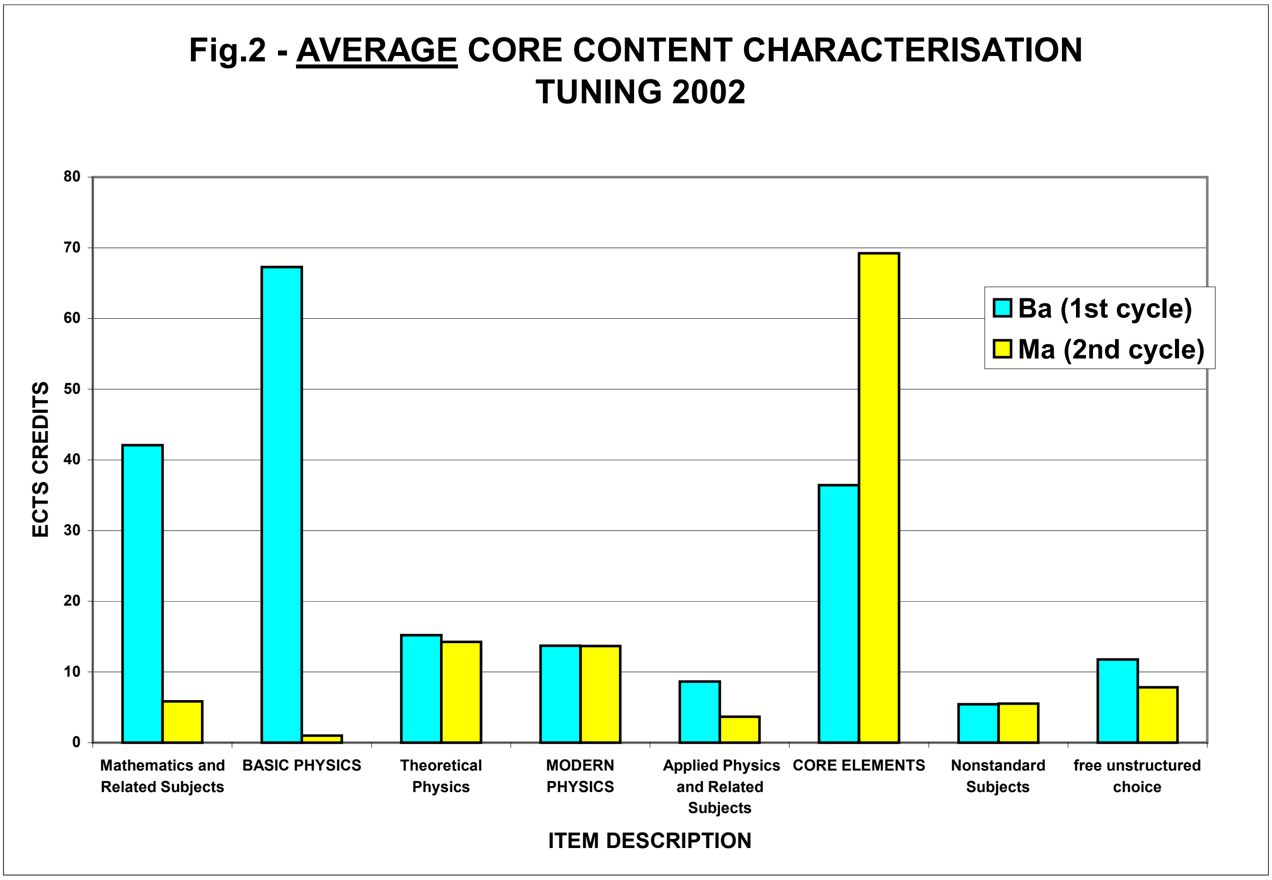
standard deviation in the EUPEN returns concerning the item "minor&optional" quite reduced the *common* part of the same item in the list.

Suggestion for a new grouping of the entries of the Tuning Survey

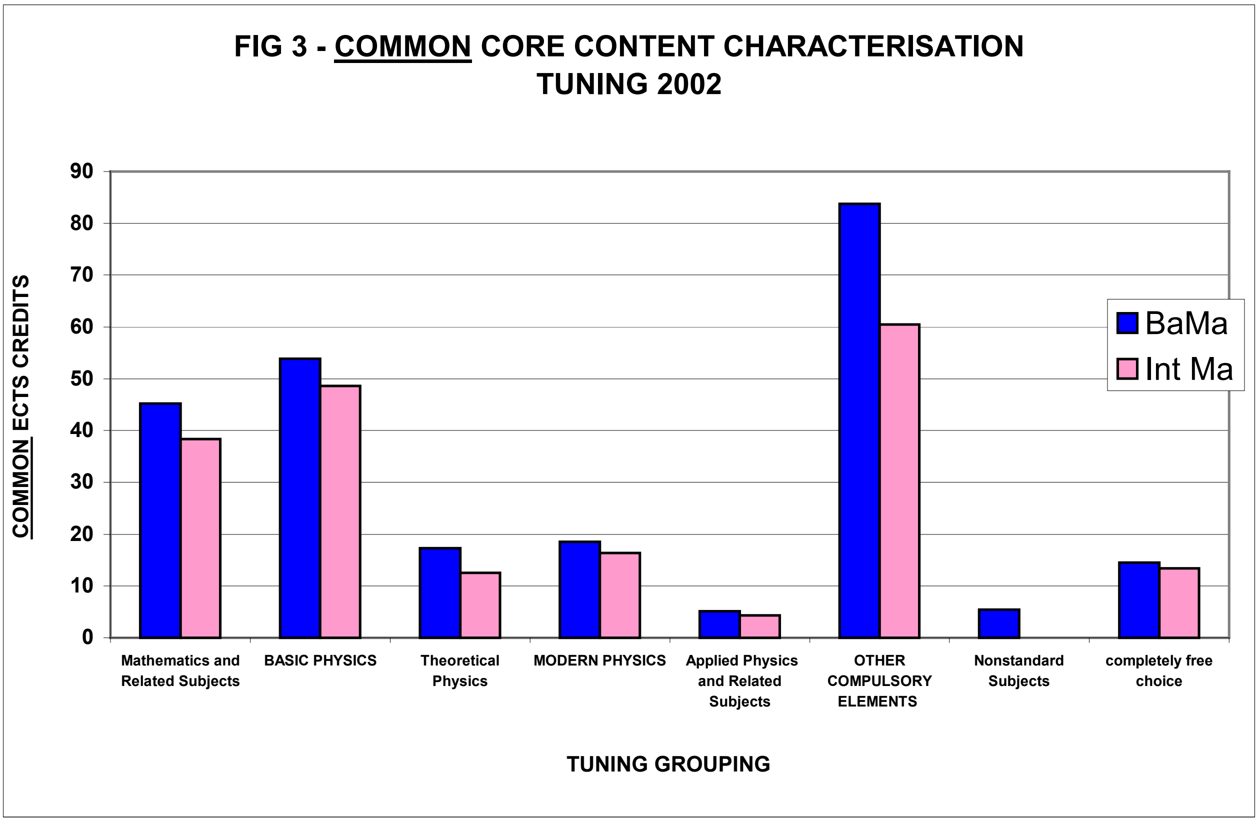
The entries of Tuning list can also be grouped into the items of a more general classification scheme, different from the one used by the EUPEN 2001 survey. This *new* scheme is again shown in Table 2, right hand side. It may become useful for a better understanding of the distinct core contents and in any case for further reference.

This *Tuning Grouping* consists of 8 items against the 27 entries of the detailed list (see Table2). By using the data returned by each institution, the credit distribution over the items of the *new* Tuning grouping may be easily calculated.

In the following Figures 2 and 3 we show the distributions over these items for the same groups of institutions as in Table 3. The Figure 2 compares the *average* credit distribution for the 1st and 2nd cycle of the institutions of group A. It confirms again the view, according to which the Ma cycle does not allow a meaningful definition of the core contents.



Most of its credits (57%) are devoted to "other compulsory elements". Of course, "basic Physics" plays a major role in the first cycle (33.5%), but it is almost vanishing in the second cycle. If we look at the *common* (i.e. common to 69% of the sample) credit distribution, the corresponding sum of credits is 72.6 % of the average total length, but if we exclude the items "other compulsory elements" and "completely free choice" this percentage reduces down to 57.4%. This latter number is comparable to the numbers quoted when commenting Fig.1.



In Figure 3 we present the *common* credit distribution for the "BaMa" institutions (Group A) and for the institutions offering a single integrated Masters level degree instead (Group B). The Figure confirms the rather close similarity of the two distributions, in very good agreement with the findings of Table 3 of the present paper. If the same two distributions, given here in terms of credits' *absolute* values, are translated into credits' percentage distributions, the variations among the two are always less than 1.8% per item, except for the item "other compulsory elements", which is 4% higher in the BaMa Institutions (its actual value is 26.6%). The *common* core content (neither including "core elements" nor "completely free choice") is respectively 46.2% and 45.1% of the average total length.

Summary and Conclusions

In this paper, we present a careful discussion of the concept of *core content* of a degree course, providing some operational definitions. We distinguish between actual *core content* and other *compulsory elements,* i.e. structural constraints, which may be satisfied by a variety of contents. When we refer to several institutions, in order to give a clear operational definition, the difference between the *common* didactic offer and the *common* compulsory part of the curriculum must be kept in mind. The word *common* here means those credits, which are allocated to a given item of a "content list" and which are common for each item to the 69% of the sample of the surveyed institutions.

On the basis of the returns from the partners of the Tuning network, we filled in a matrix, whose columns represent the institutions and whose rows are distinct *core contents* and "other" *compulsory elements*. The matrix will be available in the Tuning Final Report. From these data, grouping the entries in the rows according to two different schemes (EUPEN and Tuning approaches), we calculated the corresponding *common* credit distributions in Physics. The EUPEN approach is probably more appropriate when the characterisation of the *whole* didactic offer is aimed at. The Tuning approach puts the accent on the *compulsory* aspects of the curriculum.

We discuss the features of these distributions, on the basis of the different organisation of studies, which occur in the partner institutions. The most important conclusions are:

1) In a BaMa organisation of studies, the concept of core content has a really fruitful meaning only in the first cycle. In this cycle, according to the estimates, the *common* core content may vary from ~70% (EUPEN scheme, *didactic offer* oriented) to 57% of the credits' total (Tuning scheme, oriented on the *compulsory contents*).
2) When comparing both cycles *together* of the BaMa organisation with the single cycle of the Integrated Masters level organisation, we find that the corresponding credit distributions are quite similar. The *common* core content (neither including "other compulsory elements" nor "completely free choice") is respectively 46.2 and 45.1%, in terms of credit percentage over the total.

As it is to be expected, the *common* core content, if quantified with respect to the total length, decreases when going from the first cycle to either the sum of the two cycles or to the integrated cycle. In this context, see also the numbers in Table 3, where only *average* figures are reported.

Moreover a decrease occurs when going from the EUPEN to the Tuning approach. This latter decrease reflects the fact that that the *common core content* may quite differ from the *minimal core content* (by about 15% in our estimate for the first cycle). Indeed, the Tuning survey – focusing the attention on *all* "compulsory elements", among which the core content is *one* – definitely hides a part of what is common in the didactic offer, as already pointed out in Sections B and E above.

5.9. The Chemistry "Eurobachelor"

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Tuning Chemistry Synergy Group, European Chemistry Thematic Network

As a result of the *Bologna Declaration*, there are moves under way in a number of countries to revise their chemistry degree structures. These were previously either of the two-cycle or three-cycle type, and there are moves towards a general *three-cycle structure* (BSc/MSc/PhD). However, there is no general agreement on introducing the "3-5-8" model which has sometimes been misunderstood as the Bologna "recommendation". The post-Bologna process is indeed gathering momentum much more rapidly than many would have expected, and it now appears likely that the number of countries which will introduce a Bologna first cycle degree as defined by the He*lsinki conference* in February 2001 will be considerably greater than initially seemed likely. It thus seems timely to propose a model for such a degree in chemistry.

Although the *Helsinki consensus* was that a "bachelor-type" degree should correspond to 180-240 ECTS credits (3-4 years), there are indications that the 180 credit degree will become more common than the 240 credit degree, so that we have chosen to base our model on *180 ECTS credits*.

The common denominator in *chemistry* does seem to be the *BSc degree as cycle one*, with a three-year duration or, in some countries, up to four years. Thus is it logical to start by trying to define a *180 credit European BSc in Chemistry*. Those institutions which decide on 210 or 240 credits will obviously exceed the Eurobachelor criteria as defined here, but will hopefully use the Eurobachelor framework and define the remaining 30 or 60 credits according to principles which they will define (e.g. the Bachelor Thesis may well carry more credits).

This paper is concerned with *chemistry as a single subject*. The plethora of "Chemistry with..." and "Chemistry and..." degrees at UK universities will no doubt remain, and such degrees may be introduced elsewhere. While their outcomes may be expected to be similar to those of single-subject chemistry, the subject material covered during the achievement of these outcomes will be significantly different, and the students' chemistry-related knowledge will be lower.

In the context of *lifelong learning*, a first cycle degree could be seen as a landmark of progress in learning, achieved by a student who intends to proceed to a second cycle programme, either immediately or after a short break. Alternatively, it could be seen as an exit qualification for a student deemed not capable of completing the second cycle. The first of these viewpoints is the one taken in this paper. If a structure is made on the basis of the second viewpoint, then there will be difficulties when the student later wishes to use the exit qualification for the purposes of entry to a second cycle programme. It seems fundamental to the concept of lifelong learning that the difference between an *exit qualification* and an *entry qualification* must disappear.

We have attempted to *divorce our thinking as far as possible from present national models*, as these are either non-existent or diverge considerably. Although the UK and Ireland have well-established bachelor degrees, we have not incorporated the concepts of honours or pass degrees in our model for the BSc in chemistry, as these are not well understood in continental Europe and probably also not easily transferable.

Before presenting the model in detail, it seems advisable to list the options which should be available to any young chemist who obtains a Eurobachelor degree in chemistry.

As stated in the Bologna declaration, this qualification should be relevant to the European labour market, the emphasis lying here on the word "European". Thus it is necessary that the degree become an *accepted qualification* in all countries which are signatories to the Bologna/Prague agreements.

The chemistry Eurobachelor should, provided that his performance has been of the required standard, be able to continue his tertiary education either at his degree-awarding institution, at another equivalent institution in his home country, or at an equivalent institution in another European country. (At a later stage one can hope that *world-wide acceptance* of the Eurobachelor qualification will come into being). This continuation may either be immediate or, depending on the career planning of the individual, may take place after an intermediate spell in industry.

This continuation will often take the form of a course leading to an MSc degree, either in chemistry or in related fields. However, European institutions should pay regard to possibilities for providing "high flyers" with a direct or (perhaps more often) indirect transition to a PhD course.

It must be made clear at the outset that each institution providing Eurobachelor degree programmes in chemistry is *completely free* to decide on the content, nature and organisation of its courses or modules. Chemistry degree programmes offered by individual institutions will thus logically have their *own particular characteristics*. The depth in which individual aspects are treated will vary with the nature of specific chemistry programmes.

It is of pre-eminent importance that institutions offering Eurobachelor degrees aim for *high standards*, so as to give their students good chances in the national or international job market and a good starting point to transfer to other academic programmes should they wish to do so.

5.9.1. ECTS and Student Workload

A European average for the total student workload per year is close to 1500 hours. This corresponds to an average number of teaching weeks of around 25. Simple mathematics thus gives a theoretical workload of 60 hours per week if the student only works during this period. Thus it is important to have guidelines on student workload distribution. These should include definition of pre-examination study periods and examination periods separate from the teaching period.

The ECTS value of 60 credits per year corresponds to an average of 25 hours of student work for 1 credit, i.e. on average 1 credit for 1 contact hour per week. It must be taken into account that the total workload involved in a 1-hour lecture is different than that involved in 1 hour of practical work. Factors thus have to be introduced which should in the course of time become uniform within the area of chemistry.

5.9.2. The Diploma Supplement

All chemistry Eurobachelors should be provided with a Diploma Supplement in English and if required in the language of the degree-awarding institution.

5.9.3. Quality Assurance

The Prague agreement foresees that the European Network of Quality Associations (ENQA) will in future play an important role in establishing and maintaining European standards in university education. As far as the Eurobachelor in chemistry is concerned, it can also be foreseen that national chemical societies and their pan-European counterpart (the Federation of European Chemical Societies) as well as wider European chemistry organisations such as AllChemE will become involved in quality assurance procedures. It is important to put trans-national quality assurance procedures into place in order to achieve greater transparency.

5.9.4. Outcomes

The United Kingdom Quality Assurance Agency (QAA) has published useful "benchmarks" which provided a starting point for our discussions. It was not the intention of the QAA to "define a chemistry degree" but to provide a set of factors which should be considered by institutions when setting up degree programmes. Similarly, the outcomes listed below, unashamedly plagiarised from the QAA benchmarks, are intended to be indicative, rather than a prescription to be adopted word-by-word across all chemistry degree programmes. In modifying the QAA benchmarks, two aspects were particularly considered:

The benchmarks were written for an English BSc Honours degree, identified by QAA as a first cycle degree and yet leading directly to enrolment on a doctoral programme. The European BSc is intended only to prepare for entry to the second cycle, and some benchmarks have been deleted because they were considered more appropriate to the second cycle.

The benchmarks are intended to support education and employability, and it is recognised that many chemistry graduates obtain employment outwith the discipline. The recent Tuning survey of employers and graduates in employment shows the importance of those outcomes which look beyond knowledge and recall of chemistry. Some additions have been made in the light of the results of this survey.

5.9.5. Outcomes: Subject Knowledge

It is suggested that all programmes ensure that students become conversant with the following main aspects of chemistry:

- Major aspects of chemical terminology, nomenclature, conventions and units.
- The major types of chemical reaction and the main characteristics associated with them.
- The principles and procedures used in chemical analysis and the characterisation of chemical compounds.
- The characteristics of the different states of matter and the theories used to describe them.
- The principles of quantum mechanics and their application to the description of the structure and properties of atoms and molecules.
- The principles of thermodynamics and their applications to chemistry.
- The kinetics of chemical change, including catalysis; the mechanistic interpretation of chemical reactions.
- The principal techniques of structural investigations, including spectroscopy.
- The characteristic properties of elements and their compounds, including group relationships and trends within the Periodic Table.
- The properties of aliphatic, aromatic, heterocyclic and organometallic compounds.
- The nature and behaviour of functional groups in organic molecules.
- The structural features of chemical elements and their compounds, including stereochemistry.
- Major synthetic pathways in organic chemistry, involving functional group interconversions and carbon-carbon and carbon-heteroatom bond formation.
- The relation between bulk properties and the properties of individual atoms and molecules, including macromolecules.

5.9.6. Outcomes: Abilities and Skills

At Eurobachelor level, students are expected to develop a wide range of different abilities and skills. These may be divided into three broad categories:

a. Chemistry-related cognitive abilities and skills, i.e. abilities and skills relating to intellectual tasks, including problem solving;

b. Chemistry-related practical skills, e.g. skills relating to the conduct of laboratory work;

c. Transferable skills that may be developed in the context of chemistry and are of a general nature and applicable in many other contexts.

The main abilities and skills that students are expected to have developed by the end of their Eurobachelor degree programme in chemistry, are as follows.

a. Chemistry-related cognitive abilities and skills

Ability to demonstrate knowledge and understanding of essential facts, concepts, principles and theories relating to the subject areas identified above.

Ability to apply such knowledge and understanding to the solution of qualitative and quantitative problems of a familiar nature.

Skills in the evaluation, interpretation and synthesis of chemical information and data.

Ability to recognise and implement good measurement science and practice.

Skills in presenting scientific material and arguments in writing and orally, to an infomed audience.

Computational and data-processing skills, relating to chemical information and data.

b. Chemistry-related practical skills

Skills in the safe handling of chemical materials, taking into account their physical and chemical properties, including any specific hazards associated with their use.

Skills required for the conduct of standard laboratory procedures involved and use of instrumentation in synthetic and analytical work, in relation to both organic and inorganic systems.

Skills in the monitoring, by observation and measurement, of chemical properties, events or changes, and the systematic and reliable recording and documentation thereof.

Ability to interpret data derived from laboratory observations and measurements in terms of their significance and relate them to appropriate theory.

Ability to conduct risk assessments concerning the use of chemical substances and laboratory procedures.

c. "Transferable" or "soft" skills

Communication skills, covering both written and oral communication, in at least two of the official European languages.

Problem-solving skills, relating to qualitative and quantitative information.

Numeracy and calculation skills, including such aspects as error analysis, order-of-magnitude estimations, and correct use of units.

Information-retrieval skills, in relation to primary and secondary information sources, including information retrieval through on-line computer searches.

Information-technology skills such as word-processing and spreadsheet use, data-logging and storage,

Internet communication, etc.

Interpersonal skills, relating to the ability to interact with other people and to engage in team-working.

Study skills needed for continuing professional development.

5.9.7. Content

It is highly recommended that the Eurobachelor degree course material should be presented in a modular form, whereby modules should correspond to at least 5 credits. The use of double or perhaps triple modules can certainly be envisaged, a Bachelor Thesis or equivalent probably requiring 15 credits. Thus a degree course should not contain more than 34 modules, but may well contain less. It must be remembered that 34 modules require more than 10 examinations per year.

Apart from the Bachelor Thesis, which will be the last module in the course to be completed, it appears logical to define modules as being compulsory, semi-optional, and elective.

While institutions should be encouraged to break down the traditional barriers between the chemical sub-disciplines, we realise that this process will not always be rapid. Thus we retain the traditional classification in what follows.

Compulsory chemistry modules will deal with:

Analytical chemistry, inorganic chemistry, organic chemistry, physical chemistry, biological chemistry.

Semi-optional modules will deal with:

Computational chemistry, chemical technology, macromolecular chemistry.

Non-chemical modules will deal with mathematics, physics and biology. It can be expected that there will be compulsory mathematics and physics modules.

Practical courses may be organised as separate modules or as integrated modules. Both alternatives have advantages and disadvantages: if they are organised as separate modules, the practical content of the degree course will be more transparent. Integrated modules offer better possibilities for synchronising theory and practice.

Modules corresponding to a total of at least 150 credits (including the Bachelor Thesis) should deal with chemistry, physics, biology or mathematics.

Projects leading to the Bachelor Thesis could well involve teamwork, as this is an important aspect of employability which is often neglected in traditional chemistry degree courses.

Students should be informed in advance of the expected learning outcomes for each module.

Distribution of credits for compulsory theory modules (recommended minimum):

Physics (5)
Mathematics (5)
General chemistry (*other titles may be used, e.g. foundations of chemistry)* (10)
Analytical chemistry (5)
Inorganic chemistry (20)
Organic chemistry (20)
Physical chemistry (20)
Biological Chemistry (5)

Distribution of credits for semi-optional modules in chemistry (recommended):

The student should study at least three of the following subjects, depending on the structure of the department: biology, computational chemistry, chemical technology, macromolecular chemistry. Each of these should correspond to at least 5 credits.

Additional semi-optional and elective modules:

These can be chemistry modules, but may also be taken from any other subjects defined by the appropriate Regulations. The course load should be organised in such a manner that the student distributes these models evenly across the 3 years.

Language modules (stand-alone or integrated) will often be semi-optional, as the Eurobachelor should be proficient in a second European language as well as his mother tongue.

5.9.8. Methods of Teaching and Learning

Chemistry is an "unusual" subject in that the student not only has to learn, comprehend and apply factual material but also spends a large proportion of his studies on practical courses with "hands-on" experiments, i.e. there are important elements of "handicraft" involved.

Practical courses must continue to play an important role in university chemical education in spite of financial constraints imposed by the situation of individual institutions.

There must also be an element of research involved in a Eurobachelor course; thus the Bachelor Thesis referred to above should be compulsory. This is important not only for those going on to do higher degrees, but also for those leaving the system with a first degree, for whom it is vital that they have personal first-hand experience of what research is about. Lectures should be supported by multimedia teaching techniques wherever possible and also by problem-solving classes. These offer an ideal platform for teaching in smaller groups, and institutions are advised to consider the introduction of tutorial systems.

Learning

We can help the student by providing him or her with a constant flow of small learning tasks, for example in the form of regular problem-solving classes where it is necessary to give in answers by datelines clearly defined in advance.

It is obviously necessary in this context to have regular contacts between the teachers involved in the modules being taught to one class in one semester to avoid overloading the student. Teaching committees with student participation seem to be an obvious measure here.

Assessment procedures and performance criteria

The assessment of student performance will be based on a combination of the following:

Written examinations
Oral examinations
Laboratory reports
Problem-solving exercises
Oral presentations
The Bachelor Thesis

Additional factors which may be taken into account when assessing student performance may be derived from:

- Literature surveys and evaluations
- Collaborative work
- Preparation and displays of 'posters' reporting thesis work

Since Eurobachelor programmes are credit-based, assessment should be carried out with examinations at the end of each term or semester. It should be noted that the use of ECTS does not automatically preclude the use of "comprehensive examinations" at the end of the degree course.

Written examinations will probably predominate over oral examinations, for objectivity reasons; these also allow a "second opinion" in the case of disagreement between examiner and student.

Examinations should not be overlong; 2-3 hour examinations will probably be the norm.

Examination questions should be problem-based as far as possible; though essay-type questions may be appropriate in some cases, questions involving the regurgitation of material "digested" by rote learning should be avoided as far as possible.

Examination papers should be marked anonymously and the student should be provided with feedback wherever possible in the form of "model answers".

Multiple choice questions should be used only when knowledge is tested using computer programmes.

Grading

The ECTS grading system will obviously form an integral part of the Eurobachelor assessment system. While the national grading systems will no doubt initially be used alongside ECTS grades, which are by definition ranking rather than "absolute" grades, it seems necessary to aim for the establishment of a recognised European grading system. In order to stimulate discussion on how ECTS can be converted to the European norm, we make use of the grading definitions produced in the QAA chemistry benchmarking paper to illustrate how grades in the Eurobachelor degree should reflect performance in the discipline of chemistry.

Students graduating at bachelors level in chemistry are expected to demonstrate that they have acquired knowledge, abilities and skills as defined above. There will however be significant differences in their performance. The following criteria are suggested as indicators of different levels of attainment.

Attainment Level α (highest):

- Knowledge base is extensive and extends well beyond the work covered in the programme. Conceptual understanding is outstanding.
- Problems of a familiar and unfamiliar nature are solved with efficiency and accuracy; problem-solving procedures are adjusted to the nature of the problem.
- Experimental skills are exemplary and show a thorough analysis and appraisal of experimental results, with appropriate suggestions for improvements.
- Performance in transferable skills is generally very good.

Attainment Level β:

Knowledge base covers all essential aspects of subject matter dealt with in the programme and shows some evidence of enquiry beyond this. Conceptual understanding is good.

Problems of a familiar and unfamiliar nature are solved in a logical manner; solutions are generally correct or acceptable.

Experimental work is carried out in a reliable and efficient manner.

Performance in transferable skills is sound and shows no significant deficiencies.

Attainment Level γ:

Knowledge base is sound, but is largely confined to the content of the programme. Level of conceptual understanding is generally sound.

Problem-solving ability is sound in relation to problems of a familiar type or those that can be tackled through the straightforward application of standard procedures and/or algorithms.

Experimental work is generally satisfactory and reliable.

Performance in transferable skills is largely sound.

Attainment Level δ:

Knowledge and understanding of the content covered in the course are basic.

Problems of a routine nature are generally adequately solved.

Standard laboratory experiments are usually carried out with reasonable success though significance and limitations of experimental data and/or observations may not be fully recognised.

Transferable skills are at a basic level.

Students who are awarded a bachelors degree in Chemistry should be expected to demonstrate knowledge, abilities and skills corresponding on balance to *at least* attainment level δ.

These levels have been given the letters α to δ in order to avoid confusion with the ECTS grading system. It could be envisaged that in the course of time a convergence between these levels and ECTS grading in chemistry could take place, subject to international consensus.

5.9.9. Conclusion

There is obviously no reason for those countries or institutions which already offer Bologna-type first cycle degrees of a high standard to make any change to their degree structures, since these are sure to find ready recognition in the newly-emerging "Espace Europe" in higher education. They do however consider that the arguments set out here will stimulate productive discussion within the framework necessary to provide for young Europeans tertiary educational structures which have a genuine European rather than as heretofore a purely national background.

6. Line 3: ECTS as an Accumulation System

6.1. Introduction

Credits play a major role in the comparability and compatibility of programmes of studies. Therefore, this topic has received a lot of attention. Already in the Bologna Declaration its relevance was stressed, that among others the following is required:

'Establishment of a system of credits – such as in the ECTS system – as a proper means of promoting the most widespread student mobility. Credits could also be acquired in non-higher education contexts, including lifelong learning, provided they are recognised by receiving Universities concerned'.

Although, this statement is not sufficiently specified – it touches both credits for mobility as well as accumulation – it was a first step. The Prague Communiqué shows the development of thinking:

> 'Ministers emphasised that for greater flexibility in learning and qualification processes the adoption of common cornerstones of qualifications, supported by a credit system such as the ECTS or one that is ECTS-compatible, providing both transferability and accumulation functions, is necessary'.

This is the logical outcome of the Salamanca Declaration of the Higher Education sector in which it is said that:

> 'Universities are convinced of the benefits of a credit accumulation and transfer system based on ECTS and on their basic right to decide on the acceptability of credits obtained elsewhere'.

In the project both the macro perspective and the micro perspective has been taken into account. For those reasons two strategy papers have been written. The first one focuses on the necessity of setting up a pan-European credit accumulation framework. The second one shows the relationship between educational structures, learning outcomes, workload and the calculation of ECTS credits. Both papers make clear that without a reliable workload based credit system, which all parties understand in the same way, the objectives of one European higher education area can not be reached.

The project tries to make clear that the only reasonable way forward, is to accept ECTS as the only European credit system and to develop it further as both a transfer and an accumulation system. This requires not only a common understanding of its underlying principles but also a common methodology for measuring workload. Although ECTS is one of the cornerstones in the comparability and compatibility of periods of learning and recognised qualifications, one of the conclusions of the project is that credits as such are not a sufficient indication for the (level of) the learning achievements. Besides credits, learning outcomes or competences are the other crucial elements. By defining the right learning outcomes, standards can be set with regard to the required level of discipline-related skills and general academic or transferable skills. ECTS credits are required as the building bricks for underpinning the learning outcomes.

6.2. Conclusions

The following conclusions can be drawn from the two strategy papers that are the result of line 3. For the sake of clarity the conclusions have been arranged into four interrelated categories: Educational structures, Learning outcomes / competences, ECTS and workload.

Educational structures

- Comparison requires not only comparable systems of higher education on a European level but also comparable structures and content of studies. The definition of learning outcomes / competences and the use of ECTS as a transfer and an accumulation system can accommodate these objectives.
- There is a clear relationship between educational structures, learning outcomes, workload and the calculation of credits in particular within the context of the Bologna Process. These elements are very relevant in the world of today where traditional teaching is partly replaced by new types of teaching and learning.
- The regular teaching and learning periods (including examinations and excluding re-sits) in Europe vary far less between countries than expected.
- Comparability of structures and recognised degrees / qualifications in both a national and an international setting is critical for today's student. It implies that the student will shop for study programmes that fit best to his or her abilities.
- Recognition of degrees between countries will not be stimulated when the differences in length prove to be unbridgeable or incomparable in practice.

Learning outcomes / competences

- Competitiveness requires the definition of learning outcomes / competences to be transparent and requires a credit system which allows comparison. In this respect the ECTS methodology and tools (learning agreement, transcript of records and – in future – level and course descriptors), relevant for both mobile and non-mobile students, are of crucial importance.
- Credits as such are not a sufficient indication for the (level of) learning achievements. The only reliable way to compare pieces of learning and study programmes offered by (higher) education institutions is to look at learning outcomes / competences.
- The definition of learning outcomes / competences is a responsibility of the teaching staff. Only specialists of the same field will be able to formulate useful learning outcomes, although it is useful to consult other stakeholders in society.
- On the basis of defined learning outcomes / competences credits are an important tool for designing curricula.
- Different pathways can lead to comparable learning outcomes. Therefore, the existing diversity in Europe can be fully maintained.
- Credit accumulation and transfer is facilitated by clearly defined learning outcomes.

A European Credit Accumulation and Transfer System

- One European higher education area requires that Europe agree on one credit system that should be used for both transfer and accumulation purposes. ECTS is such a system.
- ECTS should be developed into an over-arching pan-European credit accumulation and transfer system.
- ECTS as a Europe-wide accumulation and transfer system is an essential tool for the development of other, more flexible kinds of higher education: part-time studies, recurrent study periods (lifelong learning).
- As part of a European accumulation and transfer system it is required to develop a system of level indicators and course type descriptors.
- When ECTS is accepted on national levels as the official transfer and accumulation system it follows that credits will loose their relative value and only have an absolute value.
- 60 ECTS credits measures the workload of a typical student during one academic year. The number of hours of student work (that is, of the typical student) required to achieve a given set of learning outcomes (on a given level) depends on student ability, teaching and learning methods, teaching and learning resources, curriculum design. These can differ between universities in a given country and between countries.
- A full calendar year programme (12 months programme of teaching, learning and examinations) can have a maximum load of 75 credits (which equals 46 to 50 weeks).
- Credits allow calculation of the necessary workload and impose a realistic limit on what can actually be put in the whole course or in each academic year.
- Credits are not interchangeable automatically from one context to another.

Workload

- Calculation of workload in terms of credits is to a large extent discipline related, and is determined always by academic staff.
- The notional learning time of a student is influenced by at least the following elements: diversity of traditions, curriculum design and context, coherence of curriculum, teaching and learning methods, methods of assessment and performance, organisation of teaching, ability and diligence of the student and financial support by public or private funds. The notional learning time is the number of hours which it is expected a student (at a particular level) will need, on average, to achieve the specified learning outcomes at that level.

6.3. Principles of a Pan-European Credit Accumulation Framework: Good Practice Guidelines

6.3.1. Introduction

A fundamental aspect of the 'Tuning of educational structures in Europe' project is to aid the development of the European Credit Transfer System (ECTS)[33] into an over-arching pan-European credit **accumulation and transfer** framework. This is consistent with the Bologna process that seeks the creation of a European higher education area by 2010. Crucial to the construction of this area are the convergence of national educational structures and the exploration of points of similarity between academic subjects. The 'Tuning' project seeks to help achieve this by exploring common learning outcomes and practices in five subject disciplines.

The good practice guidelines set out below are designed further to underpin the creation of a European credit-based framework, linked to learning outcomes. They are consistent with the specific requirements established in the Prague Communiqué where:

> *'Ministers emphasised that for greater flexibility in learning and qualification processes the adoption of common cornerstones of qualifications, supported by a credit system such as the ECTS or one that is ECTS-compatible, providing both transferability and accumulation functions, is necessary. Together with mutually recognised quality assurance mechanisms such arrangements will facilitate students' access to the European labour market and enhance the compatibility, attractiveness and competitiveness of European higher education. The generalisation of such a credit system and of the Diploma Supplement will foster progress in this direction.'* [34]

The extension of ECTS to a fully operational credit accumulation framework is a process already underway by natural evolution but hampered by a lack of common approaches. It involves the creation of an extremely flexible pan-European credit-based system that encompasses all higher education activities. It must be: non-invasive; protect local and national autonomy; and be capable of widening access, fostering employability and enhancing the competitiveness of European education.

Currently, many European countries are adopting, or have already adopted national, regional or local credit frameworks to facilitate the modernisation of their education systems[35]. Indeed, increasing numbers have adopted the ECTS 60-credit per year credit-scale as the basis of their national systems. The drive to use credits is primarily for the reason that they provide flexibility to education systems. It is therefore sensible to develop an over-arching and common credit framework that serves to increase the transparency and comparability between diverse national

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[33] European Credit Transfer System (ECTS) was created following a pilot project run by the European Commission 1988-1995 to promote student mobility and the recognition of periods of study abroad.
[34] Communiqué of the meeting of European Ministers in charge of higher education in Prague on May 19th 2001, paragraph eight.
[35] For details see the report, *Trends in Learning Structures in Higher Education II* Report by Guy Haug and Christian Tauch and the Report by Professor Fritz Dalichow, *A Comparison of Credit Systems in an International Context.*

education systems. Such a system could be adopted wholesale as the national credit framework (as in Italy, Austria, etc.) or just used as a translation device against which an existing system is expressed.

The following principles and guidelines are designed to foster good practice in the creation of a flexible European credit accumulation framework[36]. They have been discussed and agreed by the participating groups in the Tuning project.

6.3.2. Aims of a Pan-European Credit Accumulation Framework

A European credit accumulation framework is a system that aims to:

- Enable learners (citizens, employers, etc.) across Europe to understand the full range and relationship between the various national, local and regional European higher education qualifications[37].
- Promote access, flexibility, mobility, collaboration, transparency, recognition and integration (links) within, and between, European higher education systems.
- Defend diversity, in the content and delivery of educational programmes and therefore national, local, regional and institutional academic autonomy.
- Improve the competitiveness and efficiency of European higher education.

6.3.3. The Nature of a Pan-European Credit Accumulation Framework

A credit framework is simply a system that facilitates the measurements and comparison of learning achievements in the context of different qualifications, programmes and learning environments[38]. It provides a standardised means of comparing learning between different academic programmes, sectors, regions and countries. The needs of lifelong learning, together with the increasing pace of educational change, encouraged by globalisation, reinforces the necessity to build credit-based bridges that connect different European education systems. The use of a common language of credit provides the tool to facilitate this process.

Therefore, a pan-European credit accumulation framework is intended to provide transparency and links between different educational systems. It is difficult to portray the exact nature of such a framework but any such system would need to have certain characteristics[39]. It would need to:

- Be applicable to all sectors of higher education and capable of articulating with other educational tiers.
- Cover all forms and modes of learning;
- Address all European educational systems and allow multiple exit points (bachelor/master);
- Allow transference with other non-European educational frameworks;

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[36] Such a framework must have core definitions and principles for it to exist.
[37] This document centres on higher education but can also equally apply to all qualifications as nations build seamless, integrated educational systems that encompass lifelong learning, as in Italy and Scotland.
[38] Including ‘on’ and ‘off’ campus learning.
[39] Most of these were previously identified in the 2000, *ECTS Extension Feasibility Project* by Stephen Adam and Volker Gehmlich.

- Promote the mobility of students and citizens and their qualifications;
- Facilitate student-centred learning;
- Permit the accreditation of prior learning (APL) and prior experiential learning (APEL);
- Enable the integration of new and developing units, degree programmes and modes of study;
- Distinguish between different levels and types of credit;
- Respect national and institutional academic autonomy and, therefore, be non-invasive and fully compatible with existing educational systems.

An overarching pan-European credit *accumulation* framework specifically refers to the introduction of a credit system that applies to all educational programmes and not just the parts that are currently offered in the ECTS framework for the purposes of international credit *transfer*. Therefore, under a credit accumulation system all study programmes are expressed in credits. It differs from a credit transfer system (ECTS) only in that it encompasses much more and has the potential to impact on all students and not just those few full-time students taking a small part of their first cycle qualification in another country[40].

6.3.4. Credits in a Pan-European Credit Framework

- Credits are just a system to express the equivalence (volume) of learning that takes place.
- Credits are only awarded for the successful achievement of learning.
- Credits that are awarded by one institution may be recognised by another, but the decision ultimately is always that of the (receiving) institution or national authority, which is being asked to recognise those credits for the purposes of access to, or exemption from, part of their own programmes of study.
- Credits are calculated from the base position of 60 credits being equivalent to one average European full-time year of learning[41] but such a yardstick is crude and requires further refinement.
- When credits are additionally linked to competences and learning outcomes they become easier to compare. Credits quantified in terms of learning outcomes gain a more sophisticated dimension and thus more clearly express their 'value' or 'currency'.
- Learning outcomes are precise statements of what a learner can do once credits have been successfully gained. Learning outcomes can be divided into subject 'specific' learning outcomes, and 'general' learning outcomes that cover transferable skills[42].
- Credits are most effective when they are allocated to learning programmes and expressed in terms of 'notional learning time', which is the average number of hours a

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[40] Put simply, ECTS is a sub-system of the more general pan-European credit accumulation framework. ECTS was originally designed to facilitate international credit transfer, whilst the pan-European framework is designed to assist the integration and transparency of all educational activities.
[41] As in ECTS.
[42] For example: communication skills.

student will take to achieve specified learning outcomes and thus successfully gain credits[43]. Under the ECTS system credits are allocated using this sort of top-down approach based on 60 ECTS credits per full academic year derived from the total student workload (notional learning time)[44] undertaken by a normal student to complete their studies. The increasing significance of non-formal (work-based) and informal (life experience) learning, recognised through Accreditation of Prior Experiential (APEL) systems, emphasises the importance of connecting time and competence-based approaches to credits.

- Within the Bologna process, first cycle (three or four years undergraduate) study would equate to 180-240 credits.

6.3.5. Credits and Levels

- Credit levels provide information on the complexity, creativity, sophistication and depth of learning. Level descriptors are statements that provide a general guide to the characteristics of learning that will be encountered. It is possible to identify various levels of credit in any educational programme as this can help to distinguish the progression of learning within a qualification and between different programmes.
- Credits provide little information on their own. They become more practical and useful when they are linked to 'levels' of study that provide this further information on the relative complexity and depth of learning. So credits become more useful when they are linked to both 'learning outcomes' and levels. This facilitates the process of recognition by those responsible for making judgements about them and potentially dangerous confusions can be avoided. The more information about credits that is provided the more useful they become.
- It is common for educational systems to differentiate qualifications and types of education provision in terms of the nature and volume of learning achieved at different levels. The development of any precise European-wide agreements about the nature of 'levels' may only happen in the long term. However, it is useful to direct those concerned with levels to make reference to the existing broad definitions of 'first' and 'second' cycle (Bachelor and Master) identified in the Bologna process[45].
- Existing regional and national credit systems should be encouraged to explain their own precise level descriptors using the Diploma Supplement, transcripts and other devices. Furthermore, the Diploma Supplement is the essential tool, *par excellence*, to clarify the nature, type and level of credits associated with any qualification.

6.3.6. Credits and Quality Assurance

- It is essential to link credits to quality assurance mechanisms in order to give them real application and thus 'currency' in the European area.

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[43] It is important to note (as stressed in the UK Scottish 'SCQF' and 'Credit Guideline' projects) that time will obviously, in practice, vary from student to student - hence it is an estimate.
[44] This 'notional learning time' includes all timetabled learning activities including lectures, seminars, exams, homework, etc.
[45] Indeed, the Bologna process is developing agreement about the basis of a broad qualifications structure that is crucial to the development and understanding of levels and credits within Europe.

- Credits have a significant link to academic standards. In particular, the explicit identification of assessment criteria in relation to learning outcomes and teaching/learning methods is essential for any credit system. The examination of the relationship and articulation between these elements is highly significant for the maintenance of quality.
- The explanation of credits (in terms of curricular context: levels, learning outcomes, notional time and assessment regime) aids the precise explanation and vindication of standards. Without such definitions and links credits remain simply crude statements about the volume of learning.
- International confidence in the quality of credits can only improve when national quality assurance mechanisms are rigorous, open, transparent and effective.

6.3.7. Conclusion

An effective pan-European credit accumulation and transfer system requires some common principles and approaches to credits. The more information and details that are given about the nature, context, level and application of credits, the more useful they become as a common currency for educational recognition.

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6.4. Educational Structures, Learning Outcomes, Workload and the Calculation of ECTS Credits

Management Committee of the Tuning Project. May 2002

6.4.1. Background

This paper has been produced in the framework of the project *Tuning Educational Structures in Europe*. The project finds its roots in the *Bologna Declaration* signed in 1999 by Ministers responsible for Higher Education from 29 countries. In the project 120 Higher Education institutions from the EU and EAA-countries participate actively in seven area groups: Business Administration, Educational Sciences, Geology, History and Mathematics. The synergy groups Physics and Chemistry work along the same lines. Tuning is designed as an independent, university driven project, which is co-ordinated by university staff members from different countries. The initiators are grateful to the European Commission for co-financing the project.

ECTS : European Credit Transfer and Accumulation System

1. The European Credit Transfer *System*

The European Credit Transfer System (ECTS) has been developed over the past thirteen years, and today is the most commonly used basis for measuring student workload in European higher education. Other – less widely used -credit systems are based on various criteria such as the importance of a subject or the number of contact hours in a course; ECTS credits describe only student workload in terms of time employed to complete a course or a course unit. This represents an approach to European learning and teaching which places the student at the centre of the educational process.

ECTS was originally tested and perfected as a **transfer** system in order to make it possible for Universities in different European countries to describe the amount of academic work necessary to complete each of their course units and hence to facilitate recognition of students' work performed abroad. In order to create a common basis for reciprocal understanding, at the beginning (1988) the assumption was made that a complete year's work in any European higher education institution for the students of the country itself was -- by definition -- equivalent to 60 ECTS credits. Credits were allocated, for the purpose of transparency in description, to each assessed (i.e. marked or graded) activity on the basis of a judgement as to the proportion it represented of the complete year's workload. Hence credits were allocated on a **relative** basis.

ECTS was not just credits: it also aimed at creating a simple and accurate means of communication between higher education institutions, faculties, departments, staff and students in order to facilitate reciprocal knowledge, understanding and trust. Standard forms were created: the ECTS Application Form, the Learning Agreement and the Transcript of Records. Full information about these tools can be found on the Europa server at www.europa.int.eu/comm/education/socrates/ects.

2. The European Credit Transfer and Accumulation *System*

In several countries ECTS or analogous national systems are used as official **accumulation** systems. This means that entire courses of study leading to recognised qualifications are described using ECTS credits. The basis for allocation of credits is the official length of the study programme: for example the total workload necessary to obtain a first cycle degree lasting officially three or four years is expressed as 180 or 240 credits. The single course units which must be taken to obtain the degree each can be described in terms of workload and hence of credits. Credits are only obtained when the course unit or other activity has been successfully completed and assessed (i.e. marked or graded).

When ECTS is used as an accumulation system certain rules apply. Credits measure only workload. They do not measure quality of performance, contents or level. These elements are described in other ways. The workload of any official learning activity completed can be expressed in credits and can be placed on a student's transcript of records. However credits can **only** be applied to completion of a recognised qualification when they constitute an approved part of a study programme.

When ECTS or analogous credit systems become official, credits receive **absolute** and no longer relative value. That is to say, credits are no longer calculated on an *ad hoc* proportional basis, but on the basis of officially recognised criteria. We should note that national credit accumulation systems based on ECTS principles allow not only national transfer, evaluation and recognition of work performed but also international transfer -- always in the respect of the principles of clarity which are the foundation of ECTS.

Furthermore we may note that as more and more countries adopt systems compatible with the Bologna declaration/Prague communiqué there has been a convergence and consensus around ECTS credits as a common measure of student time. In practice 1 ECTS credit is equal to roughly 25-30 hours of student work (that is, including contact hours, independent or guided study, etc.)

3. ECTS Today

As we can see, ECTS in thirteen years has developed from a pioneering system of communication between very different European systems and structures into a consolidated and expanding official system which is one of the foundations for the development of a European higher education area. It originally facilitated international student mobility and made possible an increase in reciprocal knowledge of study programmes especially designed for **full-time students**.

As ECTS develops into a Europe-wide accumulation system it also will be an essential tool for the development of other, more flexible kinds of higher education: part-time studies, recurrent study periods and in general what today is known as **"lifelong learning"**: that is, ECTS is a necessary tool for measuring and describing the many learning activities that European citizens will be increasingly engaged in during all periods of their life.

ECTS credits today are increasingly used as a tool for **designing curricula**. Because they express student workload measured in time, they allow higher education institutions to plan the most effective way to achieve desired results within the time constraints of the length of their degree programmes. ECTS credits also provide a useful means for monitoring results and improving teaching/learning performance. ECTS also facilitates student and teacher mobility by providing a common currency and transparency on content and weight of course material and information on assessment methods.

6.4.2. Introduction

This paper aims to offer more insight into the relation between educational structures, workload, credits and learning outcomes. The starting point is to recognise that in general the design and the implementation of a course of study leading to a recognised qualification or degree is based on a number of elements of which we mention here the following:

a) The set of "intended" learning outcomes;

b) The total number of credits required and its distribution over the several activities (such as the teaching/learning units; the thesis work, the comprehensive examination, etc.) involved in the qualification;

c) The actual academic contents offered to the students;

d) The teaching/learning methodologies and traditions appropriate to each institution.

This paper focuses on the concept and role of credits, trying to highlight their connections with learning outcomes and with other factors mentioned. Indeed the tuning process requires a clear definition of the concepts connected to credits, learning aims/objectives and results. This makes it necessary to reach greater clarity and knowledge concerning the following items:

1. The role of credits
2. Allocation of credits to courses
3. Overall curriculum designing
4. Credits and level
5. Calculation of credits in terms of workload
6. Comparison of length of academic years in Europe
7. Relation between workload, teaching methods and learning outcomes

It need not be stressed that all the topics mentioned are interrelated.

It also must be mentioned here that higher education has changed considerably during the last half century. A more socially oriented approach has gradually replaced the Humboldtian one. Forms of instruction designed for a numerically limited elite have developed into mass education systems. At the same time, the traditional and necessary link between university teaching and research has been put under pressure. During the last decades, education has followed the general tendency towards internationalisation. More than ever before, students are convinced that pursuing their studies at least partly abroad is in their interest. International mobility of a part of the labour force has become a reality. It is evident that, as the percentage of the population with university qualifications increases, and as models of employment and career become more flexible, the current tendency to intersperse academic study and work may increase. Moreover, the emphasis on continuing professional development, involving all parts of universities and virtually every subject area, will become increasingly significant. The changing demands of the educational market-place make it appropriate to consider how continuing professional development, in the context of lifelong learning, can be accommodated within an on-going qualification framework. A system of credits for such study and achievement, which can be widely recognised in a mobile labour force and eventually lead to recognised qualifications will be demanded. ECTS provides a vehicle which, as indicated elsewhere in this paper, is already widely understood and accepted and which will prove adaptable to the new needs as well.

6.4.3. The Role of Credits

ECTS

During the period 1989-1995 the European Commission developed the *European Credit Transfer System (ECTS)*, in close collaboration with some 145 higher education institutions. The intention of this system was to come up with a tool that would make it possible to compare periods of academic studies of different universities in different countries. Such an instrument was thought necessary to improve the recognition of studies completed abroad. ECTS was intended to be a transfer system, to connect the different higher education systems and structures of the countries in Europe. As a transfer system, based on general assumptions concerning workload and information and on a philosophy of mutual trust and confidence, it worked well.

Indeed the strength and attraction of ECTS is and was:

- its simplicity;
- its overarching capability of bridging educational systems on a national as well as on an international basis.

It was agreed, from the very start, that study periods completed successfully at other institutions should only be recognised on the basis of prior agreements between academic staff about *level, content* and *load* of course units.

Relative and absolute value of credits

In the information material which was distributed about the European Credit Transfer System (ECTS), it is stated that *credits allocated to courses are relative values reflecting the quantity of work each course demands in relation to the total quantity of work required to complete a full year of academic study at a given institution*. The question of whether this approach is not too simple must now be raised. Especially the expression ‘relative value’ related to ‘a full year of academic study’ requires more attention. During the development phase it was not possible to define credits univocally as relative value in all situations. This seemed due to a large extent to the fact that a number of countries were not acquainted with credit systems. At that time Italy and Germany were identified as the two countries with most difficulties in applying the system. Germany, because it did not have a clearly described study programme for many disciplines, and Italy because there did not seem to be a real relation between the official and actual length of study programmes. Therefore the term ‘relative value’ was given a different meaning in different countries and circumstances. Sometimes credit allocation was based on the official length of the programme and sometimes on the unofficial length, that is the average amount of time necessary to finish the programme successfully in practice. In the countries where a credit system based on the idea of workload already existed, the official length was taken as a starting point for the allocation of credits. In these cases ‘relative value’ actually became ‘absolute value’ in each context.

It is foreseen that in the near future most European countries, and institutions in those countries, will introduce credit systems based on the notion of workload as in ECTS. By doing so credits will be given an ‘absolute value’ in these countries too. This does not mean that the number of hours of workload of a credit will be exactly the same on a national or an international level. The actual lengths of study periods in an academic year differ from institution to institution and from country to country. This poses no problems as long as the differences are kept within certain limits. We will come back to this issue later.

Types of programmes

Sometimes a distinction is made between regular programmes and extra challenging programmes. The latter programmes are intended for very bright students[46]. In both cases the prescribed study programme should be based on the assumption that an academic regular year counts a total number of 60 credits. This makes clear that although credits **always** represent workload and are only given on the basis of successful assessment, the **standard** of the work, i.e. the performance achieved by the student in order to gain them, may be different. This follows from the fact that there are not only different types of education (i.e. teaching and learning methods/traditions), but also different learning performances within the same type of education. In other words, as far as the credits are concerned, the actual recognised qualification defines how many credits (as a whole) and how many single increments or "bits" of credits (through the "modules" or teaching/learning blocks) a student receives. Credits per se have only **one** dimension: workload, but -- in the Diploma supplement, Transcripts of Records, etc. -- they accompany and are accompanied by **other** indications, such as (host) institution, degree programme, level, contents, quality of performance (i.e. grading), etc. For the sake of clarity, the focus of this paper is on the <u>typical</u> student who takes a <u>regular</u> degree programme.

ECTS as an accumulation system

As stated, credits are **not** an entity in themselves, but always describe work completed which is part of a curriculum. If we refer to a credit accumulation system, we mean a system in which credits are accumulated in a coherent programme of studies. In this respect a credit is a *unit* which reflects a certain amount of work successfully done at a certain level for a recognised qualification. Therefore, <u>credits are not interchangeable automatically from one context to another</u>. Admission officers *always* have to evaluate work done (credits awarded) at a different educational institution, whether abroad or not, before it can be included in their own degree programme. ECTS as an accumulation system <u>facilitates</u> the recognition of such credits. By evaluating, the total of course work done should be taken into account to avoid course to course comparison. This method of academic recognition of work taken elsewhere has been established as a basic rule in the past decade within the ECTS framework. ECTS is suitable as an accumulation system because it is based on this concept of context-related credits and recognition by the institution which ultimately awards the degree.

As said, until now the transfer aspect of ECTS has been stressed, but in the future certainly the focus will shift to the accumulation aspect of ECTS. It will constitute one of the mechanisms necessary to deal with the developments in higher education and the labour market.

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[46] Three different meanings seem fit to the words *'extra challenging programmes'*. They are:

1) normal programs can be squeezed by brilliant students who can then gain more than 60 credits in a single academic year (see also §6.2 below);

2) In some places, i.e. at Oxford and Cambridge, Ecole Normale in Paris, Scuola Normale in Pisa, the students have to attend extra-curricular lectures/activities/etc.

3) A student can substitute in his study curriculum some less challenging credits with other (equal in number) credits which are more challenging: a student can reach a higher level in the same period of time, without getting more ECTS credits (e.g. in programmes that skip details that would appear in a normal programme). Level is not determined by the number of credits.

In this perspective it is in the interest of the higher education sector to develop ECTS into a reliable accumulation system for academic studies. In the first decade of its existence the right conditions for such a step were lacking. However, especially in the last three years, changes have taken place in European higher education policies which have created the possibilities and underlined the necessity for a European accumulation system. The *Sorbonne Declaration* (1998), the *Bologna Declaration* (1999) and the *Prague Communiqué* (2001) on the one hand and the reforms taking place in a number of countries on the other, are clear expressions of this. They follow the idea of a European framework of an open market, free exchanges of persons and goods and one economic area. Therefore, an accumulation system is now considered to be one of the preconditions for the tuning of educational structures in Europe.

In practice, the transfer of credits and the accumulation of credits are two sides of the same coin. During recent years it has often been suggested that the abbreviation 'ECTS' be changed to include the accumulation aspect. It has been decided not to do so in order to avoid confusion. ECTS has become a well-known trademark during the last decade in Higher Education, which reflects a unique methodology of academic recognition. This methodology includes both transfer and accumulation. After all, ECTS requires that credits be allocated to all courses in all programmes. The basic idea of ECTS is that recognition is not realised on the basis of course to course comparison, but by recognising periods of studies at a comparable level and content in a more flexible way.

Credits and the length of a degree programme

Since the *Sorbonne Declaration* (1998) and the *Bologna Declaration* (1999) the discussion about credits has received a new impulse. Not only have more countries decided to introduce a national credit system – which in nearly all cases coincides with ECTS – but also a debate has been initiated about the structure in cycles of the higher education sequence and about the desired length of the study programmes. A consensus appears to have developed in Europe about the following general structure:

- First cycle or undergraduate: 180 - 240 credits (see the conclusions of the Helsinki conference 2001, where a general consensus was achieved on this range of lengths, later on confirmed by the Salamanca Convention)
- Second cycle or (post)graduate (the required length is subject of discussion)
- Third cycle or doctoral (180 to 240 credits)

6.4.4. Allocation of Credits to Courses

Student workload

ECTS was designed as a credit system based on student workload. This was in accordance with developments in the 1980s in a number of EU countries like in Scandinavia, the Netherlands and the United Kingdom. In those countries the (national) credit systems were set up as accumulation systems. ECTS could therefore be easily implemented. In other countries, which had based their teaching systems on the number of contact or teaching hours, implementation proved to be much more complicated. Initially, in these countries the following approach was mostly used: Allocation of credits to courses was based on the number of teaching hours for each course unit. This approach is based on the assumption that the number of teaching hours reflects more or less the workload involved for the student. However, in practice this is not always the case. Experiences in Italy and Spain, for example, show that in the long run this approach is not satisfactory. The same teaching load may correspond to different student workloads. In a number of countries the situation is complicated by the fact that the contents of the curricula to a large extent are decided at central government level: there is a fixed list of subjects which has to be taught. This approach leads to rather rigid course structures and a fair allocation of credits becomes problematic.

Some countries, which have taken workload - in terms of the quantity of student work rather than teaching hours - as the basis for allocation, have met other kinds of problems. In a number of cases misunderstanding~~s~~ occurred about the relation between the importance of a topic and the number of credits to be allocated to a course unit. It proves difficult**,** in practice, to make clear that the complexity or importance of a topic *as such* is **not** the basis for credit allocation. Credits depend only on the amount of time it takes to learn the subject matter and to complete the course unit successfully.

Student-oriented versus teacher-oriented programmes of studies

Discussions of this nature reflect a different emphasis on teaching and learning. Educational systems can be described as being more teacher-oriented or more student-oriented. The teacher-oriented approach is generally time independent, based on the assumption that the proper object of study is what the individual professor thinks the student should learn in his or her course. The student-oriented approach gives greater weight to the design of the overall curriculum and focuses especially on the usefulness of study programmes for a future position of the graduate in society. With respect to this latter approach a correct allocation of credits as well as a sensible definition of learning outcomes play a decisive role.

Until recently most systems in use were teacher oriented. There is now a tendency however to give greater attention to the obstacles encountered by a *typical* student in finishing his or her studies in time. Student workload is acknowledged to be a crucial factor and educators recognise that there is a tension between what a student **should learn** and **is able to learn** in a given period of time. In particular, when determining the number of credits required for a particular set of learning outcomes and degree programme specifications, allowance must be made for differing prior knowledge, skills and competences, acquired before entering university. Different assumptions about these prior factors are made in different countries because of differences in the architecture of secondary school education.

6.4.5. Overall Curriculum Design

Role of desired learning outcomes

In the quantitative framework assured by the use of credits, it would seem beneficial to develop course programmes on the basis of desired learning outcomes. Learning outcomes can be defined as statements of what a learner is expected to know, understand and/or be able to demonstrate after completion of a learning programme.[47] Experience with this approach has been recently built up by the *Quality Assurance Agency (QAA)* in the United Kingdom and the method is also known but less widely used in most other European countries.

[47] Compare the report *Credit and HE Qualifications. Credit Guidelines for HE Qualifications in England, Wales and Northern Ireland,* published in November 2001 by CQFW, NICATS, NUCCAT and SEEC.

By designing programmes in this way, more transparency and coherence can be achieved. This approach makes it possible to develop cumulative programmes, with specific entrance requirements for each of the cycles, the study years and levels as well as the course units.

The learning outcomes foreseen for the first cycle and the second cycle must be clearly distinguished. Although the final outcomes and the competences to be acquired should be discipline/programme related, more general objectives can be formulated also. In practice two types of learning outcomes can be distinguished:

- General competences (transferable skills)
- Subject specific competences (theoretical, practical and/or experimental knowledge and subject related skills)

Both should have a recognisable place in the course programme and should be verifiable at the end.

Generic and subject-specific competences (skills and knowledge)

When we speak of **general competences** we refer to such things as capacity for analysis and synthesis, general knowledge, awareness of the European and international dimension, capacity for independent learning, co-operation and communication, tenacity, capacity for leadership, organisational and planning abilities. In other words, we are speaking of qualities which are of use in many situations, not only those related to the specific subject area. Furthermore, most of them can be developed, nourished or destroyed by appropriate or inappropriate learning/teaching methodologies and formats.

In addition to these more general competences -- which hopefully will be developed in all study programmes -- each course of study will certainly seek to foster more **specific subject competences** (skills and knowledge). The subject related skills are the relevant methods and techniques pertaining to the various discipline areas, e.g. analysis of ancient scripts, chemical analyses, sampling techniques and so forth, according to the subject area.

The **subject related theoretical and practical and/or experimental knowledge** includes the actual contents, that is specific factual knowledge relating to the discipline, ways in which problems are approached and solved, knowledge of the history of the subject and of current developments within it and so forth. Here too, careful analysis must be made, in terms of definition of priorities and required levels for each kind of subject related knowledge, in order to design a satisfactory curriculum.

The same learning objectives and competences can be reached by using different types of teaching and learning methods, techniques and formats. Examples of these are attending lectures, the performing of specific assignments[48], practising technical skills, writing papers of increasing difficulty, reading papers, learning how to give constructive criticism on the work of others, chairing meetings (of seminar groups, for example), working under time pressure, co-producing papers, presenting papers, making précis or summarising, doing laboratory or practical exercises, fieldwork, personal study.

At first glance, it seems reasonable that the more general learning outcomes should be pursued in the first cycle. Some previous experience shows however that the "general" learning outcomes are to an extent subject dependent. It is suggested here that, in general, at completion of the first cycle, the student should be able to:

[48] I.e. finding out about a specific topic and writing a report or an essay

- show familiarity with the foundation and history of his/her major (discipline);
- communicate obtained basic knowledge in a coherent way;
- place new information and interpretation in its context;
- show understanding of the overall structure of the discipline and the connection between its sub disciplines;
- show understanding and implement the methods of critical analyses and development of theories;
- implement discipline related methods and techniques accurately;
- show understanding of the quality of discipline related research;
- show understanding of experimental and observational testing of scientific theories.

The completion of the first cycle functions as entry requirement for the second cycle. The second cycle usually is the phase of specialisation. The student who graduates must be able to execute independent (applied) research. It seems that, with regard to the learning outcomes of the second cycle the student should:

- have a good command of a specialised field within the discipline at an advanced level. This means in practice being acquainted with the newest theories, interpretations, methods and techniques;
- be able to follow critically and interpret the newest development in theory and practice;
- have sufficient competence in the techniques of independent research and to be able to interpret the results at an advanced level;
- be able to make an original, albeit limited, contribution within the canons of the discipline, e.g. final thesis;
- show originality and creativity with regard to the handling of the discipline;
- have developed competence at a professional level.

Not all the mentioned learning outcomes or level indicators are of the same relevance for each discipline.

Modular and non-modular systems

For some the introduction of a credit system automatically implies the introduction of a modular system, that is, course "units" or modules, to which are allocated a "limited/reasonable number" of credits in more or less standard multiples. In practice there are many existing options and the "*multiple standard"* is not often taken into consideration. The modular system has obvious advantages, because in some countries it might prevent too much fragmentation and therefore avoids too many examinations. It also makes the transfer of credits easier. A modular system is not a precondition for overall curriculum designing, although in practice it facilitates the process. The negative aspect of a modular system is that it decreases the teaching freedom, when the amount of contact hours within the module is limited, but the positive aspect is that it increases the flexibility insofar as it becomes possible to build different curricula having points of contact between them. While in a non-modular system (i.e. when a large amount of credits is given to a course unit taught by a single teacher) the choice of the material is given priority, in a modular system it is the structure of the over-all curriculum which will constitute the primary consideration.

In any kind of system, modular or non-modular, the question of the allocation of credits can be approached from two sides: from the bottom and the top. In a bottom-up approach the course unit or building brick is the central point of attention. In that situation the position of the specific course unit within the overall curriculum is not clear. The risk involved in this approach is that teachers overestimate (or underestimate) the role of the course units they teach. This is reflected in the amount of work that a student is asked to do for a course. For students this might mean that they will not be able to use their time in the most profitable way because their total workload is too heavy (or too light).

In a top-down approach the starting point in this process is to describe the intended learning outcomes at four levels:

- the degree programme of the second cycle (MA/MSc-level);
- the degree programme of the first cycle (BA/BSc-level)
- each year/level of the study programme, e.g. first, second, third and fourth and fifth;
- each course unit (or module or teaching learning activity).

Distribution of credits

When we talk about desired learning outcomes or competences, we refer to factual knowledge, analytical skills, practical skills, etc. Special attention should be put in avoiding the inclusion of inappropriate learning outcomes (e.g. too much detailed coverage of a given topic). After the desired learning outcomes have been formulated, the next step is to decide how much time is required to reach each of these learning outcomes. This calculation is based on the estimate of what a typical student can do in a certain amount of time. In effect, this calculation and the total amount of time available[49] will probably not match. That is the moment to make compromises with regard to the level of knowledge and skills as formulated in the desired learning outcomes and the available amount of time. It will probably mean that the learning outcomes have to be adjusted. If this exercise is executed correctly, it will show how much time is available for each teaching/learning activity in the course programme (e.g. teaching block or module or course unit, thesis work, fieldwork, placement, comprehensive examination, etc). The credits allow calculation of the necessary workload and impose a realistic limit on what can actually be put in the whole course or in each academic year.

The total number of credits needed to complete a degree or a single academic year can be divided in various ways, in order to facilitate the definition of courses of study and of the degree of flexibility allowed. For example, the necessary credits needed to complete a degree could be divided into different categories: e.g. those pertaining to mandatory 'core' courses, auxiliary courses or complementary course units or the like.

Such a distribution into categories of course will vary quite a bit from institution to institution. Indeed institutions differ greatly as to the available teaching resources and as to the preparation of their students at entrance, and hence will need to distribute credits in an appropriate way in order to optimise the use of resources and the efficacy of the teaching learning activities.

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[49] Available e.g. on the basis of the teaching/learning tradition in the given “institution + country”.

6.4.6. Credits and Level

While there is no suggestion within ECTS that credits measure level, it is apparent that, when credits are used within an accumulation system, the rules relating to the award of a qualification generally specify not only the number of credits required for the specific qualification but also a set of sub-rules in relation to the level at which those credits must be obtained as well as the type of courses.

This project has not endeavoured to tackle this issue basis but it is evidently one which all those institutions implementing a credit accumulation system will need to address and which, if credits are to be transferable between institutions and between member states, will need to be addressed in a European perspective. Currently, such issues are resolved on an ad hoc basis, sometimes utilising the NARIC network, but if larger scale use of a European credit accumulation system is to be successful, there will need to be a European understanding - or even a European-wide system of level indicators. A system of course type descriptors will be required as well. Moreover, developing these further indications in conjunction with credits will be a critical factor in a system of accrediting prior learning or prior experience so that all concerned will understand, in a transparent way, the level at which the credits are being awarded. Similarly, as the pace of continuing professional development accelerates, the level at which credits are being allocated will need to be made clear.

A possible path forward could be to introduce extra descriptors, which go along with ECTS as an accumulation and transfer system. A pre-condition for such a European wide system is that it should be transparent and easy to understand and to implement. The consequence is that credits will be distributed over levels and type of courses. If we talk about levels we can distinguish the following ones:

- **B**asic level course (meant to give an introduction in a subject);
- **I**ntermediate level course (intended to deepen basic knowledge);
- **A**dvanced level course (intended to further strengthening of expertise);
- **S**pecialised level course (meant to build up knowledge and experience in a special field or discipline).

With regard to the type of courses the following ones can be distinguished:

- **C**ore course (part of the core of a major programme of studies);
- **R**elated course (supporting course for the core);
- **M**inor course (optional course or subsidiary course).

The levels and types of courses offer us additional crucial descriptors. In order to make clear and immediately evident what learning experience the credits represent one can imagine that a simple code system could be introduced. This system would include not only the amount of work done by the student in terms of credits, but also descriptors which give an indication of the level and the type of course unit. To give an example: The code 5-I-R might tell us that the unit has a load of 5 credits, is offered on an intermediate level and is related to the core.[50] For courses taken outside the framework of a programme, for example in terms of lifelong learning, the last code letter would be superfluous.

[50] This code system is based on a proposal of the EUPEN network.

6.4.7. Calculation of Credits in Terms of Workload

The definition of credits

The actual calculation of credits in terms of workload has proven to be a difficult issue. First of all it should be clear what is meant by credits. The following definitions seem to be workable:

Credit is a measure of student workload based on the time necessary to complete a given teaching/learning unit.

In ECTS terms:

60 ECTS credits measures the workload of a typical student during one academic year.

The number of hours of student work (that is, of the typical student) required to achieve a given set of learning outcomes (on a given level) depends on student ability, teaching and learning methods, teaching and learning resources, curriculum design. These can differ between universities in a given country and between countries.

Since credits, whether relative or absolute are, hence, only a measure of workload within a curriculum, credits can only be used as a planning or monitoring tool when the curriculum itself has been defined. In order to create, modify or evaluate a curriculum, general and specific learning outcomes must be agreed upon.

Estimating average workload and performance

It is often argued that the *typical* student does not exist. How to determine the average standard of brightness? There is a consensus though, that it takes time and a certain standard of preparation/background to acquire certain knowledge and skills. Therefore, time employed and personal background are the two elements that can be identified as variables in learning achievement with respect to a particular course or study programme. In this context, pre-requisite knowledge when entering a given recognised qualification is a basic element. Its actual level/amount may measurably influence the workload of the student during the course programme. Teaching staff normally has a rough idea of what it can ask a student to do in a certain amount of time in a certain programme. Furthermore, teaching staff has a clear notion about quality standards. However, it is commonly accepted that if a *typical* student puts in more effort into preparing an examination the grade will probably be somewhat higher. Similarly, if a good student spends the expected amount of time to prepare an examination, he or she will be rewarded with a good grade. If less time is spent, the grade will probably be lower. In other words, there is a relationship between the effort and the results of a student. Accepting the fact that the actual time that any particular student needs to spend in order to achieve the learning outcomes will vary according the capacities of the individual student and be influenced by the degree of prior learning and to the mode of learning, the so-called <u>notional learning time</u> can be defined. The notional learning time is the number of hours which it is expected a student (at a particular level) will need, on average, to achieve the specified learning outcomes at that level.[51]

Methods of calculating workload

In practice different approaches are used to calculate the student workload. Although there are differences due to the subject, common denominators can be identified also.

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[51] *Credit and HE Qualifications. Credit Guidelines for HE Qualifications in England, Wales and Northern Ireland, p 4.*

In the calculation of workload the following items play a role:

- The total number of contact hours for the course unit (number of hours per week x number of weeks);
- Preparation before and finalising of notes after the attendance of the lecture / seminar;
- The amount of further independent work required to finish the course successfully.

The last item is the most difficult one to calculate and depends largely on the discipline concerned and the complexity of the topic. Independent work can contain the following items:

- The collection and selection of relevant material
- Reading and study of that material
- Preparation of an oral or written examination
- Writing of a paper or dissertation
- Independent work in a lab

It should be obvious that the calculation of workload in terms of credits is not an automatic process. The professor has to decide on the level of complexity of the material to be studied per course unit. It goes without saying that prior experience of the staff plays an essential role. One of the main contributions of the process of credit allocation is that it leads to more reflection on curriculum design and teaching methods on the part of the teaching staff.

In order to check regularly whether students are able to perform their tasks in the prescribed period of time, it has proven to be very useful to utilise questionnaires. In those questionnaires students are asked not only about how they experienced the workload, but also about their motivation and the time reserved for the course.

6.4.8. Length of the Academic Year in Europe

Results of Tuning surveys

Just as with defining the typical student, it does not seem easy to cope with the variety of the lengths of the actual study period per academic year within Europe. As stated before, the length of the academic year, i.e. the number of working hours of an academic year, is one of the factors in determining how many student working hours one ECTS credit contains. In Europe the length of the academic year at first glance seems to differ from country to country and in some cases within a country from institution to institution. Although time in itself is clearly an insufficient measure, the Tuning project has done a survey to obtain a better picture of the actual situation. From the acquired information a number of general conclusions can be drawn. The first one is that a distinction has to be made between the actual number of teaching weeks, the number of (independent) study weeks and fieldwork, the preparation time for examinations and the number of examination weeks. The total of these gives the actual length of the teaching period and offers therefore comparable information per discipline, institution and/or country. The second conclusion is that, when programmes are broken down, the <u>differences</u> in length prove to be <u>much smaller</u> than one would expect at first glance.

This last conclusion is in line with the information that has been collected about the *official* length of the academic year of institutions and countries, e.g. the beginning and the end of an academic year. This calculation takes into account vacation periods during which it is normal for students to be expected to continue to work, prepare assessments, projects, dissertations. In the latter case nearly all countries fit in the range of 34 to 40 weeks per year. If it is accepted that a week contains 40 to 42 hours, the actual number of "official hours" in which a student is expected to work during an academic year runs from 1400 to 1680 (1800[52]). Even in the cases of systems where the formal specification of hours is lower, it is evident that, in practice, because of work undertaken in vacation periods, the actual number of hours corresponds with the general norm. The point average seems to lie around 1520 hours per year. Given the fact that an academic year contains 60 ECTS credits, one credit represents then approximately 25 to 30 hours of student workload. This range of difference seems to be acceptable. The average point lies around 25 to 26 hours per credit.

Some special cases

If a regular study programme is 34 to 40 weeks, there is limited time left to obtain more ECTS credits than the set standard number of 60 within an academic year. If the assumption is accepted that a normal study programme should contain 36 to 40 working weeks, there remains a maximum of 10 weeks in which extra course work can be done. This observation is relevant for second cycle programmes, which are based on a *full calendar year* of study instead of 9 study months. These programmes are on offer for example in the UK and Ireland. If a programme lasts 12 months, which are approximately 46 to 50 weeks, it should have an allocation of 75 ECTS credits. A structure in which an academic year contains more credits than that number is undesirable. If we summarise:

- a normal course programme has an official load of 60 ECTS credits per academic year;
- a second cycle programme or so-called "intensive programme" of a *full calendar year* (e.g. a 12 months programme) can have a maximum load of 75 credits (which equals 46 to 50 weeks);
- a second cycle programme or Master programme of 90 ECTS credits is based on a lengths of 14 study months (which equals 54 to 60 study weeks).

For all programmes which demand more than 1500/1600 hours (36/40 weeks) per year, to be able to award more than 60 credits, evidence of the workload should be given.

It has also to be recognised that many students study part-time nowadays. If for example, a part-time study programme holds 45 ECTS credits a year, four years of study equals three years of full-time study. Credits give a fair way to organise part-time learning programmes.

6.4.9. Workload, Teaching Methods and Learning Outcomes

Workload, teaching methods and learning outcomes are clearly related to each other. However, there are other relevant elements. In achieving the desired learning outcomes a large number of interrelated factors play a role. These are not limited to the number of working hours, workload and brightness of the student. Also methods of teaching and learning have to be taken into account. It might make quite a difference whether teaching is organised in large groups or more individually: in other words, whether the majority of course units a student has to take are lectures or seminars, exercise courses and practical exercises. Furthermore the number of students in a working group might have its effect on the result of teaching, as probably the use

[52] In a number of countries it has been stated in law that an academic year for students has a workload of 1500 to 1800 hours.

of a tutorial system has. Also the kind of assessment will play a role, as will the design and coherence of the curriculum (is it focused on gradual progression in performance or does it make excessive or insufficient demands in some phases?) as well as the quality of the organisation and the availability of advanced teaching aids like computers. Furthermore, national and regional traditions have to be taken into consideration. For example, in some countries most students will live at home and need time to travel, while in others they live on their own and have to look after themselves. In others again they will be housed on campuses. All these factors bear, in some measure, on the results of the teaching/learning experience as measured in time (in terms of credits) and in performance (in terms of level of achievement). In an ideal situation the aims and objectives set will be fully reached in the notional learning time. As said before, notional learning time is not the actual time that any particular learner needs to spend in order to achieve the learning outcomes. The actual time will differ from student to student. In many cases the ideal situation will not exist.

To summarise, we may consider the relevant elements which play a role under the following headings:

- Diversity of traditions
- Curriculum design and context
- Coherence of curriculum
- Teaching and learning methods
- Methods of assessment and performance
- Organisation of teaching
- Ability and diligence of the student
- Financial support by public or private funds

The above mentioned factors make clear that it is not only impossible, but also undesirable, to identify one way of achieving desired learning outcomes. Given the internal and external circumstances and conditions the right balance for every course programme has to be found in terms of the above mentioned factors, of which time is one. This mix will vary from institution to institution and from country to country. Thus it becomes clear that different pathways can lead to comparable learning outcomes. In this way the existing diversity in Europe can be fully maintained.

Study programmes require continuing monitoring, adjustment and evaluation. This guarantees that the required learning outcomes can still be obtained when the circumstances and/or conditions, i.e. one or more of mentioned factors, change. Monitoring, adjusting and evaluating are very important internal processes for which staff and students are responsible equally.

The most important external way to check whether the applied mix is the ideal one is by regular quality assurance and accreditation. We will come back to this issue in a separate paper. What can be said here is that quality evaluation schemes are developed to check whether the actual learning outcomes are of the intended level and whether they are actually met by the content of the programme. At present, these are mainly organised on a national level, but it may be expected that quality assurance and accreditation will be internationalised in the near future.

6.4.10. Conclusion

This paper makes clear that many factors play a role in the teaching and learning process. It also makes clear that credits as such are not a sufficient indication for the (level of) learning achievements. The only reliable way to compare pieces of learning and study programmes offered by (higher) education institutions is to look at learning outcomes/competences. By defining the right learning outcomes, standards can be set with regard to the required level of discipline related theoretical and/or experimental knowledge and content, academic and discipline related skills and general academic or transferable skills. With the exception of the last one these will differ from discipline to discipline. To make programmes more transparent and comparable on a European level, it is necessary to develop learning outcomes/competences for each recognised qualification. These learning outcomes should be identifiable and assessable in the programme that opts for such a qualification. Learning outcome should not only be defined on the level of formal qualifications such as degrees but also on the level of modules or courses. The inclusion of learning outcomes in the pieces and the total of a curriculum stimulate its consistency. They make explicit what a student should learn. It is obvious that credit accumulation and transfer is facilitated by clear learning outcomes. These will make it possible to indicate with precision the achievements for which credits are and have been awarded.

The definition of learning outcomes/competences is a responsibility of the teaching staff. Only specialists of the same field will be able to formulate useful learning outcomes, although, it is useful to consult other stakeholders in society. The fact that the higher education sector has been internationalised and that institutions and disciplines compete on a global level nowadays, makes it necessary that the more general learning outcomes for each discipline or field are designed on a supranational level. By defining learning outcomes in this way universal standards are developed, which should be the bases for internal, national and international quality assurance and assessment. One of the major tasks of the project Tuning Educational Structures in Europe is the development of the required methodology for defining learning outcomes/competences. This methodology should offer the mechanism to cope with recent developments like the internationalisation of labour and education, the interruption of academic studies as an effect of the introduction of a two-cycle system and lifelong learning. In this paper we have tried to clarify the definition of credits to use these effectively in planning courses designed to achieve the agreed learning outcomes/competences.

The objective of the paper has been to show the relationship between educational structures, learning outcomes, workload and the calculation of credits in particular within the context of the Bologna Process. This relationship is very relevant in the world of today where traditional teaching is partly replaced by new types of teaching and learning and where traditional higher education institutions experience more and more competition with comparable institutions and with non-traditional institutions which offer novel, attractive opportunities for learners. It is in the interest of society as a whole that learners find their way in a global educational market-place. Transparency is not only the keyword for that market-place but also for degree programmes. Quality assurance and accreditation is an integrate part of this picture. Competitiveness requires the definition of learning outcomes / competences to be transparent and requires a credit system which allows comparison. In this respect the ECTS methodology and tools (learning agreement, transcript of records and – in future – level and course descriptors), relevant for both mobile and non-mobile students, are of crucial importance. The same is true for the Diploma Supplement. Employability in both a national and an international setting is critical for today's student. It implies that the student will shop for study programmes that fit best to his or her abilities. Comparison requires not only comparable systems of higher education on a European level but also comparable structures and content of studies. The definition of learning outcomes/competences and the use of ECTS as a transfer and an accumulation system can accommodate these objectives.

7. Line 4: Approaches to Teaching and Learning, Assessment and Performance, and Quality

7.1. Introduction

The underlying reasons for undertaking a project such as Tuning, and indeed, the strong impulse behind the Bologna-Prague process is the realisation that the young people of Europe must be culturally and intellectually equipped in new ways in order to construct meaningful satisfying lives, personally and collectively.

1. In our view, in practice, all institutions of higher education in general, and the Universities in particular have a key role in developing appropriate strategies to accomplish this and in implementing them. This is not a theoretical judgement. It is a practical fact. The Universities have primary responsibility for using their knowledge, their tradition and their capacity for innovation in order to prepare the future of Europe. Universities, if they use it, have the capacity to act as protagonists **in preparing students for a productive working career and for citizenship.**

Tuning shows some very interesting things. Universities are experts in transferring disciplinary knowledge. Employers, graduates and academics agree on this. Equally, however, it is clear that the requirements of a mobile, rapidly changing society, are such that students, whatever their age need to develop general capabilities: along with their knowledge they need to have personal qualities which will allow them during their lifetimes to learn further, to teach or communicate what they know and to use their knowledge in many ways we can only dimly imagine today.

If the aims of Universities come to include, as we recommend, the encouragement or the enhancement of qualities which are not subject specific, or even of subject specific qualities which are of use in a more general context of employability and citizenship, they must use the full potentialities of the Bologna-Prague process for promoting quality in teaching/learning and appropriate learning outcomes, hence dedicating careful attention to their approaches to teaching and learning.

2. Mapping the teaching/learning approaches in use at present in different national systems or individual Universities, it is clear that each has developed a mix of techniques and kinds of learning environments. When these are discussed in international fora, confusion is often created because the same name is given to different methods (e.g. 'seminar', 'lecture', 'tutorial') or, conversely, different names correspond to similar activities. For this reason**, to achieve transparency at a European level**, a new or **an agreed terminology must be developed**. If we go behind the words, we find that in each country and in each tradition, universities and their teaching staff have -- spontaneously, so to speak -- developed a variety of strategies to achieve the desired results. Hence each system has today a degree of inner coherence which cannot simply be discarded, in favour of one or more new 'models'.

3. 'Tuning' results make clear that Universities must not only transfer consolidated or developing knowledge, their traditional sphere of expertise, but also a variety of 'general' abilities. This implies that they must explicitly develop a novel mix of approaches to teaching and learning in order to encourage, or allow to develop, valuable qualities such as capacity for analysis and synthesis, independence of judgement, curiosity, teamwork, and ability to communicate.

4. Changing teaching and learning approaches and objectives implies corresponding changes in assessment methods and criteria for evaluating performance. These should consider not only knowledge and contents but also general skills and competences. Each student should experience a variety of approaches and have access to different kinds of learning environments,

whatever his/her areas of study may be. Of course, transparency and comparability of assessment methods and criteria for evaluating performance are essential if quality assurance in a European context is to be developed.

7.2. Conclusions

1. To utilise to the full extent the potentialities inherent in the Bologna-Prague process for promoting quality in teaching/learning and appropriate learning outcomes, it is essential that Universities dedicate careful attention to their approaches to teaching and learning.

2. Mapping the methods in use at present in different national systems or individual Universities, it is clear that each has developed a mix of techniques and kinds of learning environments . Often confusion ensues because the same name is given to different methods (e.g. 'seminar', 'lecture', 'tutorial') or, conversely, different names correspond to similar activities. To achieve transparency at a European level, a new or an agreed terminology must be developed.

3. 'Tuning' results make clear that Universities must not only transfer consolidated or developing knowledge -- their traditional sphere of expertise -- but also a variety of 'general' abilities. This implies that they must explicitly develop a novel mix of approaches to teaching and learning in order to encourage -- or allow to develop -- valuable qualities, such as capacity for analysis and synthesis, independence of judgement, curiosity, teamwork, and ability to communicate.

4. Changing teaching and learning approaches and objectives implies corresponding changes in assessment methods and criteria for evaluating performance. These should consider not only knowledge and contents but also general skills and competences. Each student should experience a variety of approaches and have access to different kinds of learning environments, whatever his/her areas of study may be.

The members of each subject area are reflecting on the implications of Line 4 on their discipline. Here we include, as a case study, the reflections of the Mathematics group.

7.3. Case study: Mathematics subject area

The mathematics group could not devote much time in the duration of the programme to the methods of teaching and learning.

However, on the basis of the work done in other lines and of the discussions they generated, the group agreed on some observations, which apply to many mathematics programmes in European universities.

The teaching and learning process includes, and should include:

1. Lecture courses
This is a very time-efficient way for students to learn part of the large material involved in the corpus of mathematics. A student would lose much useful time if he was asked to fish out this material from the literature.

2. Exercise sessions
These could be either in group with supervision, or individually with subsequent supervision of the results.
The aim of the exercises is two-fold: understanding of the theoretical material through examples and applications to problems.
These sessions are essential in mathematics, where understanding is acquired by practice, not memorisation.

3. Projects
These could be done individually or by small groups, and would imply putting together material from different sub-fields to solve more complicated problems.
Doing them in small groups could help to develop the ability to do teamwork (identified as an important transferable skill)
Through out, accent must be put on understanding the mathematics and its interpretation. This means learning progressively to pass from a problem to its mathematical model, solve the mathematical problem then interpret the solution in terms of the original problem.

4. Written and oral expression
Written and oral communications are seen as a problem in higher education. Although these skills should really be developed much earlier, one has to acknowledge the fact that for a number of students at university, much progress must be made in these transferable skills. Therefore, time should be allowed for written and oral presentations, as soon as possible, not necessarily in all branches so as not to overload the schedule.

5. Search of bibliography
Both in libraries and on Internet, efficient ways to find the relevant information must be acquired. A special effort could be made on textbooks at the European level. These are extremely useful for students, because they provide a consistent exposition of a whole subject.
However, it can be seen from existing textbooks that different countries have different approaches to mathematics, so that a consistent and unified approach does not exist presently.

6. Use of the computer
The efficient and advanced use of a computer (mixing familiarity with existing mathematical or statistical software's and the ability to adapt them by some programming) naturally leads to a different kind of learning, when individual or small group work with the computer is central.

7. Dissertation or final project
In a Masters programme, a substantial individual piece of work should be accomplished in the last year, as a final step towards independent practice of mathematics. It could take different forms depending on the sub-field, but would be characterised by its importance in workload.

Conclusion

All kinds of teaching/learning above must be combined in a mathematics programme, in a way depending on the sub-fields

In many universities, time limitation in the studies and lack of funding have pushed the balance towards time and cost efficient methods , mostly lectures and tutorials, except in the last year with a dissertation.

The implementation of the Bologna declaration should be the opportunity to restore more individual work for the students, without having to cut in efficient teaching.

The mathematics group regrets the somewhat chaotic way in which some of the governments implement this declaration, thereby reducing much of its efficiency.

Note finally that all comments above concern university education. The group was not competent to analyse other programmes of higher education, but stresses once again the social and job related necessity of offering a good variety of offers in higher education, to accommodate students with various level of motivation, gift and previous preparation.

8. General Conclusions and Recommendations

INITIAL CONCLUSIONS

- Universities have taken their responsibility in the Bologna process by initiating the Tuning Project.
- Tuning shows that groups of academic experts working in a European context can establish reference points for the two cycles in their subject areas
- Common reference points can be identified using an approach based on subject related and generic competences.
- The application of Tuning techniques can be vital for the creation of the European higher education area.
- A process of adjusting to Bologna indications is under way: Tuning gives a co-ordinated context for collaboration.

INITIAL RECOMMENDATIONS

- European higher education institutions should agree on a common terminology and develop a set of methodologies for convergence at the disciplinary and interdisciplinary level.
- Competences (both subject-related and generic) should be central when designing educational programmes.
- A framework based on a common understanding of the European credit system should be adopted.
- A common approach to the length of studies within the Bologna two-cycle system is essential.
- The results of Tuning should be discussed broadly and if possible elaborated and extended by all stakeholders.

9. Glossary

ASSESSMENT

The total range of written, oral and practical tests, as well as projects and portfolios, used to decide on the student's progress in the COURSE UNIT OR MODULE. These measures may be mainly used by the students to assess their own progress (formative assessment) or by the University to judge whether the course unit or module has been completed satisfactorily against the LEARNING OUTCOMES of the unit or module (summative assessment)

ASSESSMENT CRITERIA

Descriptions of what the learner is expected to do, in order to demonstrate that a LEARNING OUTCOME has been achieved.

CLASS
The group of students in the same year of a given PROGRAMME OF STUDY.

COMPETENCES
In the Tuning Project competences represent a dynamic combination of attributes - with respect to knowledge and its application, to attitudes and responsibilities - that describe the LEARNING OUTCOMES of an educational programme, or how learners are able to perform at the end of an educational process. In particular, the Project focuses on subject-area related competences (specific to a field of study) and generic competences (common to any degree course).

COMPREHENSIVE EXAM
ASSESSMENT of the overall LEARNING OUTCOMES achieved over the past/previous years.

CONTACT HOUR
A period of 45-60 minutes teaching contact/cooperation between a staff member and a student or group of students.

CONTINUOUS ASSESSMENT
Tests taken within the normal teaching period as part of an annual or the final ASSESSMENT.

CONVERGENCE
Voluntary adoption of suitable policies for the achievement of a common goal. Convergence in the architecture of national educational systems is pursued in the Bologna process.

COURSE UNIT or MODULE
A self-contained, formally structured learning experience with a coherent and explicit set of LEARNING OUTCOMES and ASSESSMENT CRITERIA.

COURSEWORK
Taught COURSE UNITS , TUTORIALS etc., which are a preparation for further independent work.

CREDIT
The ‘currency’ used to measure student WORKLOAD in terms of the NOTIONAL LEARNING TIME required to achieve specified LEARNING OUTCOMES.

CREDIT ACCUMULATION
In a credit accumulation system LEARNING OUTCOMES totalling a specified number of CREDITS must be achieved in order to successfully complete a semester, academic year or a full PROGRAMME OF STUDY, according to the requirements of the programme. Credits are awarded and accumulated if the achievement of the required learning outcomes is proved by ASSESSMENT.

CREDIT FRAMEWORK
A system that facilitates the measurement and comparison of LEARNING OUTCOMES achieved in the context of different qualifications, PROGRAMMES OF STUDY and learning environments.

CREDIT LEVEL
An indicator of the relative demand of learning and of learner autonomy. It can be based on the year of study and/or on course content (e.g., Basic/Advanced/Specialised).

CREDIT TYPE
An indicator of the status of course units in the PROGRAMME OF STUDY. It can be described as Core (major course unit), Related (unit providing instrument/support) and Minor (optional course unit).

CYCLE
A course of study leading to an academic DEGREE. One of the objectives indicated in the Bologna Declaration is the "adoption of a system based on two main cycles, undergraduate and graduate." DOCTORAL STUDIES are generally referred to as the third cycle.

DEGREE
Qualification awarded by a higher education institution after successful completion of a prescribed PROGRAMME OF STUDY. In a CREDIT ACCUMULATION system the programme is completed through the accumulation of a specified number of credits awarded for the achievement of a specific set of LEARNING OUTCOMES.

DIPLOMA SUPPLEMENT
The Diploma Supplement is an annex to the original qualification designed to provide a description of the nature, level, context, content and status of the studies that were pursued and successfully completed by the holder of the qualification. It is based on the model developed by the European Commission, Council of Europe and UNESCO/CEPES. It improves the international transparency and the academic/professional recognition of qualifications

DOCTORAL STUDENT
See RESEARCH STUDENT

DOCTORAL STUDIES or DOCTORAL PROGRAMME
Course of study leading to a DOCTORATE.

DOCTORATE or DOCTORAL DEGREE
A high level qualification which is internationally recognised as qualifying someone for research or academic work. It will include a substantial amount of original research work which is presented in a THESIS. It is generally referred to as the degree awarded after completion of third cycle studies.

ECTS (European Credit Transfer System)
A system for increasing the transparency of educational systems and facilitating the mobility of students across Europe through credit transfer. It is based on the general assumption that the global workload of an academic year of study is equal to 60 credits. The 60 credits are then allocated to course units to describe the proportion of the student workload required to achieve the related LEARNING OUTCOMES. Credit transfer is guaranteed by explicit agreements among the home institution, the host institution and the mobile student.

ELECTIVE COURSE
A course to be chosen from a predetermined list.

EXAM
Normally formal written and/or oral test taken at the end of a course unit or later in the academic year. Other assessment methods are also in use. Tests within the course unit are classed as CONTINUOUS ASSESSMENT.

FIRST DEGREE
First HIGHER EDUCATION qualification taken by the student. It is awarded after the successful completion of first CYCLE studies which, according to the Bologna Declaration, should normally last a minimum of three years or 180 ECTS credits.

GRADE
A final evaluation based on the overall performance in the PROGRAMME OF STUDY

GRADUATE or POSTGRADUATE STUDIES
A course of study following a FIRST DEGREE and leading to a SECOND DEGREE

GRANT or SCHOLARSHIP or FELLOWSHIP
Payment made to some or all students to cover fees and/or living expenses. It may come from national/local governments or charitable foundations or private companies.

GROUP PROJECT
A piece of work given to a group of students which needs co-operative work for completion. This work may be assessed either individually or as a group.

HIGHER EDUCATION
PROGRAMMES OF STUDY which may be entered by students holding either a qualified school leaving certificate of an upper secondary school after a minimum of twelve years of schooling or other relevant professional qualifications. Providers may be universities, universities of professional studies, higher education institutions or colleges.

INDEPENDENT PROJECT
A piece of work given to a single student or a group of students for completion. This work will be assessed either individually or as a group.

ICT TEACHING
Teaching/studying/learning making use of information and communication technology. It usually takes place in e-learning environments.

INTENSIVE COURSE
A short full time course of one to four weeks concentrating on a particular topic. It may take place at another institution or in a summer school.

LEARNING OUTCOMES
Statements of what a learner is expected to know, understand and/or be able to demonstrate after completion of a process of learning. Learning outcomes are distinct from the aims of learning, in that they are concerned with the achievements of the learner rather than the overall intentions of the teacher. Learning outcomes must be accompanied by appropriate ASSESSMENT CRITERIA which can be used to judge that the expected learning outcomes have been achieved. Learning outcomes, together with assessment criteria, specify the minimum requirements for the award of CREDIT, while marking is based on attainment above or below the minimum requirements for the award of credit. Credit accumulation and transfer is facilitated if clear learning outcomes are available to indicate with precision the achievements for which the credit will be awarded

LECTURE
Provision of content by presentation and explanation (possibly including demonstration) by a lecturer.

MARK
Any numerical or qualitative scale used to describe the results of ASSESSMENT in an individual COURSE UNIT or MODULE.

MODULE
See COURSE UNIT

NOTIONAL LEARNING TIME
The average number of hours a student will take to achieve specified LEARNING OUTCOMES and gain CREDITS.

OPTIONAL COURSE
A COURSE UNIT or MODULE which may be taken as part of a PROGRAMME OF STUDY but is not compulsory for all students.

ORAL PRESENTATION
A verbal presentation to a lecturer and possibly other students by an individual student. It may be on a topic researched by the student in the published literature or a summary of project work undertaken.

POSTDOCTORAL RESEARCHER
A recently qualified researcher with a DOCTORATE, who will probably be employed on a short term contract.

POSTER
A written presentation of some work on a display which can be read by a number of people.

PROGRAMME OF STUDY
An approved set of COURSE UNITS or MODULES recognised for the award of a specific DEGREE. A programme of study can also be defined through the set of LEARNING OUTCOMES to be achieved for the award of a specified number of CREDITS.

RESEARCH STUDENT OR DOCTORAL STUDENT
A student seeking to obtain a degree primarily on the basis of research.

RESIT EXAMS
Additional EXAM session offered to students who have not been able to take or pass their exams on the first dates scheduled.

SECOND DEGREE
Second HIGHER EDUCATION QUALIFICATION taken by a student after the FIRST DEGREE. It is awarded after the successful completion of second CYCLE studies and may involve some research work.

SKILLS AND COMPETENCES
The skills and COMPETENCES developed as an outcome of the learning process can be divided into ‘subject-area related’ and ‘generic’.

SEMINAR
A period of instruction based on written or oral contributions by the learners.

SUPERVISOR
Member of academic staff of the University who monitors the progress of a DOCTORAL STUDENT, provides advice and guidance, and may be involved in assessing the THESIS. S/he will normally be a member of the research group where the student is working.

THESIS
A formally presented written report, based on independent research work, which is required for the award of a degree (generally SECOND DEGREE or DOCTORATE).

TUITION FEES/ TUTORIAL FEE
Charges made by university to student for teaching and/or supervision.

TUNING
Developing agreement and harmony by combining single sounds into a common "tune" or pattern of sounds. In the case of the Tuning project, it relates to higher education structures in Europe and recognises the diversity of traditions as a positive factor in the creation of a dynamic common HE area.

TUTORIAL
A period of instruction given by a tutor aimed at revising and discussing materials and topics presented at LECTURES.

UNDERGRADUATE STUDIES
A course of study leading to a FIRST DEGREE.

WORKLOAD
All learning activities required for the achievement of the LEARNING OUTCOMES (i.e., lectures, practical work, information retrieval, private study, etc.).

WORKSHOP
A supervised session where students work on individual tasks and receive assistance and direction when needed.

Conference notes

Tuning

Tuning
Educational Structures
in Europe

Directorate-General for Education and Culture

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