How well aligned are the views of generic competence development between Electrical and Information Engineering students, their faulty and their employers?

Anthony E. Ward, Jean-Marc Thiriet

How well aligned are the views of generic competence development between Electrical and Information Engineering students, their faulty and their employers?

Anthony E Ward
Department of Electronics
University of York
York, England
Aew6@york.ac.uk

Jean-Marc Thiriet
Université Joseph Fourier, IUT 1,
Dépt. RT, BP 67, 38 402 Saint Martin d'Hères cedex,
France
jean-marc.thiriet@ujf-grenoble.fr

***Abstract*— As faculty members it is part of our job, in conjunction with local and/or National government regulations, our institutional rules, regulations and guidance and our faculty Industry advisory committees, to design and deliver appropriate degree programmes to our students. But what is appropriate and does our thinking align with that of the students we educate? This paper presents a project that set out to investigate the alignment of the perception of the importance (to future careers) and level of development of a large set of generic and specific competences. The target group for the project was Electrical and Information Engineering (EIE) students, faculty and employers across Europe. The body undertaking this project was the European Association for Education in Electrical Engineering as part of the European Union funded EIE-Surveyor project. In total, 3,275 completed questionnaires were analyzed and analyses have been carried out by gender, academic study level, country and by competence both individually and in groups they for through the application of standard statistical data reduction techniques. This paper introduces the project and its background and explains the research methodology and analyses employed. It shows key results and their impact and provides a set of recommendations for future related work.**

***Keywords*—competence, electrical engineering, information engineering, survey**

I. INTRODUCTION

The Electrical and Information Engineering (EIE) discipline area has been the focus of attention for the European Association for Education in Electrical and Information Engineering (EAEEIE) [1] since its inception 20 years ago. As an Association, it dedicates itself to all matters relating to education at the Higher Education level, in the EIE area. Since 1996 it has successfully won a series of European Union Thematic Network projects to investigate aspects of EIE education and to share and disseminate findings and best practice.

This paper presents findings from part of the EU funded EIE-Surveyor project [2], the third project undertaken by the EAEEIE. The project was a review included a survey of the perceptions of the generic competences that higher education degree qualifications develop in students. In particular it reviewed the perception of importance and level of development of 32 generic competences for the key stakeholders, faculty, employers and the students themselves. This paper introduces the project and its background, the research methodology and analyses employed.

By way of introduction, this section starts with a brief introduction to the EAEEIE, the EIE-Surveyor project and the survey activity and to the Tuning Methodology [3], which underpins the methodology used in this project.

A. EIE-Surveyor Project

The EIE-Surveyor Project was a Thematic Network project funded by the EU between 2006 and 2008. The project had more than 110 HE partners from across Europe. The main objectives of the project are

1. Reflection on generic competences and subject- specific competences in Electrical and Engineering (EIE) Information
2. Implementation assessment educational available in EIE of quality on some resources
3. Reflection and proposition of a methodology for accreditation, in order to enhance comparability and common certification procedures
4. Proposition of a census of the existing curricula in EIE in Europe, the multinational degrees, and the situation of the implementation of the Bologna-process in our fields, at the bachelor, master and PhD levels.

As indicated above one of the EIE- Surveyor main activities is the application of the TUNING methodology to EIE with the objective of improving understanding of the generic and subject-specific competences in the EIE discipline area.

B. Tuning Methodology

The Tuning project was generally concerned with the implementation of the Bologna Process at university level. It proposed output-oriented programmes based on learning outcomes expressed in terms of generic and subject-generic competences as well as on ECTS workload-based credits.

The name of the project "Tuning" was chosen to express the idea that universities are not attempting the harmonization of their degree programmes or planning to implement any sort of unified, prescriptive or definitive European curricula. They are more interested in establishing reference points and encouraging convergence and common understanding.

According to the Tuning methodology attention is devoted to the concept of profile that should be based on a process of consultation with the most significant stakeholders for the degree programme. These stakeholders are academics, students, employers and professional organizations. The latter three groups represent an important link to the needs of society. Formal university bodies as well as the academic faculty involved must ultimately be responsible for the realization of each programme.

The Tuning project established a methodology designed to understand curricula and to make them comparable. It comprises five lines of approach:

- Generic (general academic) competences
- Subject-specific competences
- The role of ECTS as an accumulation system
- Approaches to learning, teaching, and assessment and
- The role of quality enhancement in the educational process (emphasizing systems based on internal institutional quality culture).

The first application of the Tuning Methodology was in Business, Chemistry, Earth Sciences, Education, European Studies, History, Mathematics, Nursing and Physics.

C. Survey Activity

The EIE-Surveyor project focused on the first three lines of this methodology and this paper focuses very specifically on the first line, generic competences. The objective of the application of the Tuning Methodology to the EIE discipline area was to explore the alignment of the competences of EIE graduate with employers as the users of the end product of study programmes; of academics who are instrumental in the design of the curricula; and students as 'customers' of the programmes. A more detailed description of approach taken in given in the methodology section. Before this it is perhaps important to clarify what degree titles are included in the EIE discipline area, as this is not clearly bounded.

D. The EIE Discipline area

The titles Electrical and Information Engineering are broad and somewhat 'fuzzy' terms. As was found in the creation of the EIE-Surveyor first cycle degree programme monograph [4], there are many different academic programmes that clearly fall within common understanding of the terms and many that lie at its boundary. For the purposes of this project the definition of EIE has been aligned with the EIE Surveyor monograph definition that is encapsulated in a set of degree programme titles. These embrace Electrical and Electronic Engineering as would be expected. They embrace Information Engineering where it is of an electronic or computer science nature, and Computer Science. Excluded would be information engineering where it is directly and predominantly orientated towards information in the media (news, television, etc.)

Subjects such as Media Technology, Communications (again where electronic in nature), Control, Aerospace, Mechatronics, and so on are included where the electrical or electronic technical content predominates. Subjects such as Business Management are included where it is a minor component (typically 25% or less) of a technical degree.

The broadness of the discipline introduces the potential problems of comparing engineering subjects with more science (e.g. Computer Science) orientated subjects. This aspect is not included in this report but could be the subject of a more focussed study on the overall dataset in the future.

II. METHODOLOGY

The objective of the study was to quantify the importance of a set of generic competences to the respondent's future and the level to which they feel the competence is being developed, make comparisons and draw conclusions from the responses obtained.

The general process followed was to produce an initial set of questions, create a set of pilot questionnaires, carry out a small pilot study, make appropriate modifications and then launch the full survey. This section describes this process in more detail and explains the rationale to the approach at each stage.

From the Tuning Methodology report it was clear that a set of the generic competences had been developed and used consistently across the studies carried out prior to the Surveyor project. The set of generic competences (32 in total) was discussed for applicability to the EIE area by the task team and it was agreed they should be used unchanged. Space was, however, added for additional competences respondents view as important as respondents complete the questionnaire.

The Tuning Methodology approach of using a 4-point Likert scale for the importance and level of development of each competence was retained.

To illustrate, the first generic competence is "Capacity for analysis and synthesis". Respondents were asked to rate how important this is to them on a 4-point scale where 1 represents "none', 2 "weak", 3 "considerable" and 4 "strong". They were then asked to indicate how well they feel "Capacity for analysis and synthesis" is being developed in their degree programme, also on a 1 to 4 scale with exactly the same meaning for each response number. The responses could only be 1, 2, 3 or 4.

As an introduction to the questionnaire a set of general questions were asked of all respondents to capture their gender, age band, position in the organisation, country, etc.

Different questionnaires were created, one for students, one for academics, and one for employers. The wording in each questionnaire was adjusted to make the whole questionnaire appropriate to the 'stakeholder' and to capture the important general information about them. Information not relevant to a particular stakeholder was removed to avoid confusion.

The initial questionnaires were pilot tested in a small number of institutions on a small sample to test the logic, instructions and wording and to assess the completion time. Following the pilot study changes were made to the wording to improve clarity and ease of completion.

A number of questionnaire delivery mechanisms were proposed. An online website was created for direct electronic entry. Electronic versions of the questionnaire were created for sending to potential respondents by email and finally paper versions were made available.

It was accepted that there would be a trade off between response rate and the collection method and that a difference method would suit different collection approaches. For maximum flexibility all collections methods were offered.

In the final form each questionnaire starts with an introductory page containing a brief overview of the objective of the study and the questionnaire and who the supporting body is. It then makes a statement about confidentiality and data protection and gave a name and contact details for more information. Finally there is a general instruction on how to complete the questionnaire.

Responses into the online website were collated into a set of Excel compatible spreadsheets. Paper and electronically completed responses were manually entered. All data were merged into a single SPSS data file. The responses for the different stakeholders being identified by a questionnaire code field. Each response was also given a unique reference code.

A code book defining all the variable names and attributes was designed for the data set before the SPSS data file was created and was then updated as the analysis was undertaken.

The primary objective of this study is, in line with the Tuning methodology, to quantitatively assess the alignment of the supply and demand equation in the EIE discipline. Specific within this is the alignment of the generic competences. In addition to these questions two subsidiary research questions were addressed:

- What are the most important competences for each respondent group?
- Do the generic competences group to form meaningful and usable clusters?

The primary research questions and the above subsidiary ones were tested using a combination of descriptive statistical methods, factor analysis and correlation tests.

The EIE-Surveyor project had participants of almost every European Country and all project partners were asked to sample students, faculty and employers in the EIE area.

III. RESULTS

A total of 3,275 completed questionnaires were returned. Of these 81.1% were from students, 3.4% employers, and 5.7% academics. Responses were received from 26 different European countries although many returned small numbers that are insufficient to allow country based analyses. 9 countries returned over 200 responses.

2,691 student questionnaires were returned of which 2,641 stated their gender. Of these 14.5% were female and 85.5% male. 74.3% of the students were studying First Cycle degrees, 24.8% Masters level and 0.9% were at the Doctoral/PhD level. As might be expected 99.0% were from individuals in the 'conventional' (under 30) age range for students.

A. The student view of generic competences

Table 1 shows, in descending order of magnitude, the mean importance of the top and bottom 5 generic competences for all students. In the mean column 4 is the highest score (indicating "strong"). Note that the lowest ranked competence still has a mean of 2.52, midway between "weak" and "considerable" – hence no generic competence is really considered very low in importance.

Table 1 shows that "Problem Solving" is rated as the most important competence by students and that "Understanding of cultures and customs of other countries" is rated least important. A look at the order of the means by gender does not show any material differences (all differences are small and not statistically significant). Further, a look at the order between Bachelor and Master level students also shows few differences.

Overall the position of some of the generic competences merits comment:

- The competences usually associated with enterprise/entrepreneurship ("Initiative and entrepreneurial spirit" and "Patents and Intellectual Property Rights") tend to lie to the bottom of the list

TABLE I. ALL STUDENT RATING OF THE LEVEL OF DEVELOPMENT OF THE GENERIC COMPETENCES

Rank	***Generic competence***	***Mean***
1	Problem solving	3.48
2	Elementary computing skills	3.44
3	Capacity for applying knowledge in practice	3.41
4	Teamworking	3.41
5	Will to succeed	3.36
…		
28	International Relations and Collaborations	2.92
29	Patents and Intellectual Property Rights	2.79
30	Appreciation of ethical issues	2.72
31	Appreciation of diversity and multiculturality	2.71
32	Understanding of cultures and customs of other countries	2.52

with only "Capacity for generating new ideas (creativity)" being ranked important (7th in the list).

- All competences associated with internationalism ("Ability to work in an international context", "International Relations and Collaborations", "Appreciation of diversity and multiculturality", and "Understanding of cultures and customs of other countries") all score low. "Knowledge of a second language" lies midway in the list. Overall this placement should be a concern for mobility generally.
- "Research skills" is rated low in the list, a concern for those institutions with aspirations towards developing their students into future research careers. That said there may be many reasons for this particular placement, current year of study possibly being one.

Table 2 shows, in descending order of magnitude, the mean level of development of the top and bottom 5 generic competences for all students. Here again 4 is the highest score (indicating "strong").

Note that the lowest ranked competence has a mean of 2.03, or "weak". Students clearly feel that the level of development of, in particular "Understanding of cultures and customs of other countries" is weak on average across Europe.

Table 2 shows that "Elementary computing skills" is rated as the best developed competence by students. This is perhaps, for some, a disappointment as the development of elementary computing skills is not a learning objective in all higher education institutions and is probably a competence assumed in the student body.

Second in the list is "Problem Solving", a competence that probably does appear in the learning objectives of academic programmes in the EIE discipline and is top of the list of rated importance by students – so there is an immediate and clear indicator of good alignment between student rating of importance and their view on how well it is developed in them.

TABLE II. ALL STUDENT RATING OF THE LEVEL OF DEVELOPMENT OF THE GENERIC COMPETENCES

Rank	*Generic competence*	*Mean*
1	Elementary computing skills	3.20
2	Problem solving	2.97
3	Capacity to learn	2.96
4	Teamworking	2.94
5	Basic general technical knowledge of the profession of your work area	2.91
…		
28	Leadership	2.30
29	International Relations and Collaborations	2.30
30	Appreciation of ethical issues	2.29
31	Patents and Intellectual Property Rights	2.27
32	Understanding of cultures and customs of other countries	2.03

A look at the order of the means by gender does not show any material differences (all differences are small and not statistically significant). Further, a look at the order between Bachelor and Master level students also shows few differences.

"Problem Solving" is rated most important and second most well developed of all the generic competences, suggesting a small 'gap' in how students need is being met. This notion of 'gap' can be quantified by looking at the numerical difference between the rated importance and level of development for each generic competence. The algorithm used is:

Difference = Rated importance – Level of development

Given that both rated importance and level of development are in the range 1..4, the valid range of the difference is -3..+3 and a positive difference indicates that the rated importance is greater than the level of development – or students need is greater than what they are receiving.

Table 3 shows the 'gap' for all students and for males and females separately for the top and bottom 5 generic competences.

Across all students "Knowledge of a second language" is top of the 'gap' list. This indicates that academic institutions (at least those involved in this survey) are, on average, not delivering this competence to the level the students rate it as important. The next few at the top of the list are "Ability to work in an international context", "Capacity for generating new ideas (creativity)" , "Leadership", "International Relations and Collaborations", and "Initiative and entrepreneurial spirit". These generally group to entrepreneurialism and internationalism and the results suggest academic institutions could be doing more in these two areas. Overall the differences between the genders is small and not statistically significant however there are important differences between levels of study.

TABLE III. ALL STUDENT RATING OF THE 'GAP' IN THE GENERIC COMPETENCES

Rank	*Generic competence*	*Mean*	
		FCD	SCD
1	***Knowledge of a second language***	***0.76***	***0.88***
2	Capacity for generating new ideas (creativity)	0.76	0.72
3	Ability to work in an international context	0.75	0.83
4	Leadership	0.69	0.66
5	***Ability to work in an interdisciplinary team***	***0.64***	***0.49***
…			
28	Capacity for analysis and synthesis	0.41	0.38
29	***Research skills***	***0.40***	***0.28***
30	Basic general technical knowledge of the profession of your work area	0.37	0.29
31	Grounding in basic knowledge of the profession of your work area	0.28	0.27
32	***Elementary computing skills***	***0.28***	***0.20***

In Table 3 the competences shown in bold italics are where there is a statistically significant difference between the Bachelor and Master level responses. The direction of the difference can be understood by looking at the value of the means.

There are some significant differences between the study levels. “Knowledge of a second language” is top at both levels. At Master level students consider “International Relations and Collaborations” in the top 5 along with “Capacity for applying knowledge in practice”. This suggests that at Masters level capacity of applying knowledge in practice, for example, with a larger gap, is either being taken for granted at this level or is not being developed as much as the pure theoretical aspects of the discipline. Students clearly perceive the need for knowing how to apply this knowledge in practice.

There are some differences between countries with, for example, the difference in “International Relations and Collaborations” being 1.1 in France, 0.81 in Poland, 0.63 in Greece, 0.58 in the Slovak Republic and 0.39 in Hungary. This shows that there is diversity across Europe in either the perception of importance of the competence or the amount to which is it developed in each country. It also suggests a lack of homogeneity in the results – a more serious consequence as is considered more in the discussion section.

B. The acadmic view of generic competences

The 189 completed questionnaires returned by academics show they rate all but 8 of the generic competences to be of “considerable” importance or stronger. The most important is “Elementary computing skills” with “Capacity for applying knowledge in practice” and “Problem solving” very close behind in joint second place. It is interesting to note that these top three are also the top three for all students. The least important competence is “Understanding of cultures and customs of other countries” again in agreement with the views of all students.

There are statistically significant differences between the rated importance of 5 generic competences between the First and Second Cycle Degrees. In all 5 cases the mean at the Bachelor level is higher than that at the Master level indicating academics feel the competences are more important for study at the Bachelor level. The difference in “Leadership” and “Appreciation of diversity and multiculturality” are both of medium effect size [3], the other three, “Decision making”, “Interpersonal skills” and “Understanding of cultures and customs of other countries” are small.

Table 4 shows the rating of level of development of the generic competences for all academics. There is an important difference between the ratings of level of development between academics and their students. The academics consider technical aspects of their programmes to be being developed more than the general ones of “Problem solving”, “Capacity to learn” and “Teamworking”.

Table 5 shows the gap between rated importance and level of development.

TABLE IV. ALL ACADEMIC RATING OF THE LEVEL OF DEVELOPMENT OF THE GENERIC COMPETENCES

Rank	***Generic competence***	***Mean***
1	Elementary computing skills	3.39
2	Basic general technical knowledge of the profession of your work area	3.21
3	Capacity for analysis and synthesis	3.14
4	Grounding in basic knowledge of the profession of your area	3.08
5	Capacity for applying knowledge in practice	3.06
…		
28	Appreciation of ethical issues	2.36
29	International Relations and Collaborations	2.33
30	Leadership	2.31
31	Understanding of cultures and customs of other countries	2.15
32	Patents and Intellectual Property Rights	2.09

Academics consider knowledge of a second language to be the competence with the highest mismatch between rated importance and level of development. Interestingly this is the same as for students. Next is ability to work in an interdisciplinary team. This competence is ranked 17th of all the generic competences with a mean of 3.22 – above “considerable”. Academics clearly recognize the value of this competence in their students but perhaps do not have the opportunity to develop it within their own institutions. Initiative and entrepreneurial spirit are next highest in ‘gap’ followed by “planning and time management” and “capacity to adapt to new situations”. Planning and time management is not ranked very high in the overall importance ranking (19th out of 32) yet is an important general student study skill.

TABLE V. ALL ACADEMIC RATING OF THE ‘GAP’ IN THE GENERIC COMPETENCES

Rank	***Generic competence***	***Mean***	
		FCD	SCD
1	Knowledge of a second language	0.71	0.68
2	Ability to work in an interdisciplinary team	0.66	0.72
3	Initiative and entrepreneurial spirit	0.69	0.65
4	Planning and time management	0.65	0.62
5	Capacity to adapt to new situations	0.65	0.58
…			
28	Understanding of cultures and customs of other countries	0.41	0.23
29	Basic general technical knowledge of the profession of your work area	0.40	0.45
30	Appreciation of diversity and multiculturality	0.37	0.14
31	Grounding in basic knowledge of the profession of your work area	0.28	0.32
32	Elementary computing skills	0.28	0.14

The competences at the bottom of the list indicate the smallest gap between importance and level of development indicating that their development is closely matched to need. Interestingly all gaps are positive indicating rated importance is higher than level of development (on the same rating scale) in all cases.

There is some variation in the ranking of the 'gap' across Europe. For example, in Bulgaria the top 5 ranked gaps are:

1. "Planning and time management"
2. "Ability to work in an interdisciplinary team"
3. "Knowledge of a second language"
4. "Initiative and entrepreneurial spirit"
5. "Oral and written communications in your native language"

For French academics Capacity for generating new ideas (creativity)" is top with "Knowledge of a second language" second. Irish academics rank "Capacity to adapt to new situations" top.

C. *The employer view of generic competences*

The 112 completed questionnaires returned by employers show a slightly different view to students and academics. In the top 5 ranking of importance of the generic competences are "Problem Solving", "Team working" and "Capacity for applying knowledge in practice" in common with students and academics but also "Concern for quality" and "Capacity to learn". Both understandable from an industrial perspective.

Employers, like students rated "Elementary computing skills" first in terms of level of development followed by "Capacity to learn", an encouraging result for HEIs. "Oral and written communications in your native language" came third followed by "Will to succeed" and "Basic general technical knowledge of the profession of your work area". Surprisingly "Planning and time management" can in the bottom 5 – this should be a concern for HEIs as most of us expect good demonstration of this competence in examination preparation, individual and group projects and general assignment work.

Table 6 shows the employers rating of the 'gap' in the generic competences.

Top of the list overall is "Concern for quality". This is dominated by a clear difference at the Masters level. At the Bachelor level the greatest gap is in "Teamworking". "Planning and time management" is second overall, again principally because of the Master level responses, it is ranked 6th for Bachelor students. It is clear from the top few in the list where employers feel the academic programmes their graduate recruits have taken are falling short of their "need" in the generic competences.

TABLE VI. ALL EMPLOYER RATING OF THE 'GAP' IN THE GENERIC COMPETENCES

Rank	***Generic competence***	***Mean***
1	Concern for quality	0.79
2	Planning and time management	0.75
3	Capacity for applying knowledge in practice	0.74
4	Problem solving	0.72
5	Team working	0.72
…		
28	Research skills	0.33
29	Grounding in basic knowledge of the profession of your area	0.26
30	Appreciation of diversity and multiculturality	0.26
31	Understanding of cultures and customs of other countries	0.14
32	Elementary computing skills	0.09

Encouragingly at the bottom of the list there appears to be no issue with Elementary computing skills although the academics who feel that this is not a core component of their degree programme will gain little comfort from this outcome. The other competences at the bottom of the Table 6 are generic competences employers feel are being developed in line with their rating of its importance.

There is variation in the way employers in different countries rate the gap between importance and level of development of the generic competences. The top ranked gap is:

- Bulgaria: "Capacity for applying knowledge in practice", "Decision making", "Leadership" (equal top)
- France: "Capacity to adapt to new situations", "Teamworking" (equal top)
- Germany: "Planning and time management"
- Ireland: "Teamworking"
- Poland: "Planning and time management"
- Slovak Republic: "Ability to work autonomously"

IV. HOW THE GENERIC COMPETENCES GROUP

Factorial analysis was used to 'group' the generic competences. Across all the responses the 32 generic competences factored into 5 groups:

1. "*Internationalisation*": "Understanding of cultures and customs of other countries." "Appreciation of ethical issues." "Appreciation of diversity and multiculturality", "International relations and collaborations", "Ability to work in an international context"
2. "*Entrepreneurship*": "Patents and IPR", "Creativity" "Initiative and entrepreneurial spirit"
3. "*Professional skills*": "Grounding in basic knowledge of the profession", "Basic general technical knowledge",

"Capacity for analysis and synthesis", "Research skills", "Capacity to learn"

4. "*Interpersonal skills*": "Leadership", "Interpersonal skills", "Ability to communicate with non-experts", "Oral and written communications in native language", "Critical and self-critical capability", "Teamworking"
5. "*Personal skills*": "Ability to work autonomously", "Problem solving", "Capacity to adapt to new situations", "Knowledge of a second language", "Concern for quality", "Will to succeed", "Elementary computing skills", "Capacity for applying knowledge in practice", "Decision making", "Project design and management", "Information management skills"

Table 7 shows the mean importance of each group of competences by stakeholder group for the First Cycle Degree respondents. For the employers the personal skills are the most importance group followed by professional skills and interpersonal skills. The table confirms that employers rank internationalisation and entrepreneurship lowest. Academics agree with the order of the competence groups but rate all of them more strongly important than employers. Students also rank the competence groups in the same order but rate internationalisation slightly higher than employers and entrepreneurship very slightly lower.

Analysis of the level of development of the competenceas shows that there is good agreement that Professional skills are the best developed of the skill groups followed by Personal skills and Interpersonal skills. As with importance the Entrepreneurship and Internationalisation skill groups are developed the least. There is clearly a difference between the rated importance and level of development of these groups in that the Personal skills group is rated most important but the Professional skills group is developed the most. Other than that the general structure of the supply demand balance of the generic competences is quite well aligned.

V. CONCLUSIONS AND RECOMMENDATIONS

The objective of this study was to apply the Tuning Methodology to the EIE discipline set to test the alignment between the views of the importance and level of development of sets of competences between students, academics and employers. The results of this study show that the Tuning Methodology is a useful tool for assessing alignment in these subjects.

TABLE VII. MEAN IMPORTANCE OF EACH GROUP BY STAKEHOLDER

Competence Group	*Academic*	*Employer*	*Student*
Internationalization	2.86	2.63	2.79
Entrepreneurship	3.07	3.05	3.02
Interpersonal skills	3.23	3.09	3.06
Professional skills	3.36	3.29	3.13
Personal skills	3.44	3.30	3.29

In total 3,275 questionnaires have been collected from the stakeholder groups from a range of European countries. The number of responses from each country is variable and a full by country analysis is not possible with the responses currently available, that said a range of analyses have been carried out.

Tests of the homogeneity of the responses across all countries show that there are country differences in some analyses and some of these are explored, others merit further investigation. Many of the analyses presented in this paper are aggregated results and therefore potentially suffer clustering problems. This too is a topic of further investigation.

The following is a summary of the key conclusions drawn from the analyses presented.

Consistent top of importance of the generic competences for all stakeholders is "Problem solving". Second in the ranking for students is "Elementary computing skills". Comparatively students under rate the importance of this skill, perhaps it is taken for granted in students than in academics and employers. The results show employers value it more than students and this message could be communicated to students.

A number of gaps exist between the importance and level of development between the stakeholders. The largest gap is "Knowledge of a second language" and the evidence from the languages section suggests this view is strongly aimed at English.

The generic competences group into 5 sets with "Personal skills" rated consistently as the most important set. This is followed, in descending order of importance, by "Professional skills", "Interpersonal skills", "Internationalisation" and "Entrepreneurship". The smallest mean "Internationalisation" is just over midway between "weak" and "considerable". Given the European Union's desire to see greater student and employee mobility across Europe, it is clear there is scope for scope for improvement in the value placed in this skill set by curriculum designers.

Curriculum designers and academics can take comfort in the finding that "Professional skills" are the best developed of the skill groups followed by "Personal skills" and "Interpersonal skills". This not only aligns with the views of employers but aligns with anecdotal evidence on the real purpose of EIE education programmes. That said there is a trend in a number of countries across Europe away from large firm employment towards a Small to Medium Sized Enterprise culture. Curriculum designers may wish to reflect on the fact that entrepreneurial skills are very low in the list and perhaps merit more attention and emphasis in the curricula.

In general the different stakeholders rate the importance and level of development on average differently. This difference has been taken into account in the conclusions drawn. The general unevenness in ranking reflects different perspectives and is, in itself not considered a major issue, of concern are the relative positions of competences and the relative gaps. In general and even allowing for this employers and academics tend to rate competences higher in importance than students and graduates a number of specific instances of differences are drawn out in section 8.

After the text edit has been completed, the paper is ready for the template. Duplicate the template file by using the Save As command, and use the naming convention prescribed by your conference for the name of your paper. In this newly created file, highlight all of the contents and import your prepared text file. You are now ready to style your paper; use the scroll down window on the left of the MS Word Formatting toolbar.

ACKNOWLEDGMENT

The authors acknowledge the funding provided by the European Union for this project and to the members of the project team for help in collecting questionnaires.

REFERENCES

[1] European Association for Education in Electrical and Information Enginering, http://www.eaeeie.org/

[2] EIE-Surveyor project, http://www.eie-surveyor.org/

[3] Tuning Report, http://tuning.unideusto.org/tuningeu/index.php?option=content&task=view&id=172&Itemid=205

[4] "Overview of the Bologna Process – Implementation in Europe in Electrical and Informaiton Engineetring", ISBN 2-9516740-3-1, pp 542.