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# Informatics Education Europe III

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# Preface

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**This volume contains the papers of the International Informatics Education Europe Conference being held in Venice, Italy, on 4<sup>th</sup> and 5<sup>th</sup> December 2008.**

**The purpose of IEE is to provide a forum for researchers interested in higher-education of Informatics. Topics covered by IEE include: Accreditation and assessment, Innovative degree programs, Innovative uses of technology in the classroom, Partnerships with industry, International cooperation, double degrees and mobility, Integrating gender and culture issues into informatics curricula, Debugging tools and programming learning, Expanding the audience for informatics, Funding opportunities for curriculum development and studies, and Collaborative learning.**

**This was the third IEE meeting. Previous meetings were held in Montpellier (2006) and Thessaloniki (2007).**

**The program committee selected 18 papers out of over 30, on the basis of at least three reviews. The principal criteria were relevance and quality. The program of IEEIII includes in addition three invited talks by Jan van Leeuwen, Rustan Leino and Carlo Ghezzi, and two talks by representatives of the industrial partners Ibm and Intel.**

**I would like to thank the program committee members and the reviewers without whose dedicated work the conference would not have been possible. A special mention has to be made to Andrew McGarrick of the ACM Education Board, and Gordon Davies chair of IFIP 3.2. group.**

**Thanks also to Emanuela Boschetto, Andrea Marin, Sonia Barizza and Gian Luca Dei Rossi for their organizing support.**

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# Why mobility is important for European students in computer science: review of 18 years of a Franco-German university training in with a double degree

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For students in computer science mobility abroad is still relatively rare compared to other disciplines. Yet mobility is often a genuine social elevator for students who experienced it, especially after having obtained a Franco-German degree in computer science. This is what our empirical study based on several surveys of French and German alumni after the bi-national training of ISFATES (Franco-German Institute of Technology, Economics and Sciences) and after obtaining a dual French and German degree proves. This study also demonstrates the importance of "soft skills" and especially intercultural skills. Indeed we show that those students who had followed in their overall training up to 20% less computer science courses than in national education programs nevertheless generally have far better careers in computer science than the latter.

## Keywords

Double degree, CS Curriculum, Engineering, France, Germany, Intercultural, Learning, Professional skills, Surveys, University cooperation.

## 1. Introduction

In most professions, it is now necessary to master new skills such as autonomy, the ability to communicate (in different languages), flexibility, language and culture, mobility and innovation. To prepare future graduates for these changes, the education system should introduce students to these new skills and knowledge, often grouped under the name "new skills" [11]. But in computer science, since the job market has always been in favourable, the stress has always been focused on technical subjects. And in most departments of computer science "soft skills" were and still are, regarded as secondary.

In this article we want to demonstrate that these soft skills and in particular, knowledge in languages and intercultural skills are very important and offer far better career-advancement opportunities for students in computer science. We rely on our experience of nearly 30 years of double degree (18 years for computer science). There is not or hardly any research that has been done on evaluating the mobility of students abroad despite the fact that it is one of the vital challenges of university education in the coming years (in Europe in particular). The intercultural domain is treated by scientists in regards to acculturation [13] culture shock [2, 3], work (or how to avoid failures during an assignment abroad - Training for Intercultural Competence: Avoiding Failures in International Assignments) [15], the differences between cultures [9], learning styles [12] or skills [1, 5, 8]. But measuring the effects of student mobility and intercultural learning in computer science has rarely been an object of study.

In Europe, Socrates / Erasmus programmes promote student mobility: it concerns semesters of study or internships in another European country. The project Valera "Value of ERASMUS Mobility" of the EU [14] aims to establish the impact of mobility within the sub-ERASMUS programme of SOCRATES on the mobile students' and teachers' careers. With respect to student mobility, professional "success" was measured primarily in terms of general and international competences, transition to work, first and subsequent employment and work, and international aspects of employment and work. According to the most recent survey (four fields of study were selected: Chemistry, Sociology, Mechanical Engineering and Business studies), the impact of ERASMUS is very good for the students if we compare this with those students without international experience (higher status, higher earnings as well as a better chance of reaching a position appropriate to their level of education, better career opportunities, higher competences).

International experience notably seems to reinforce adaptability, initiative, the ability to plan and assertiveness, higher socio-communicative skills as well as better ways of problem-solving and leadership). More than half of the formerly mobile students assess their knowledge and understanding of international differences in cultures and societies, and almost half their knowledge of other countries is as important for their job tasks. These proportions are mostly somewhat higher than in previous years. But the impact of ERASMUS is smaller than before according to surveys of previous generations for graduates in obtaining a first job, getting a higher income and taking over job tasks for which visible international competences are needed. This is most likely caused by a growing internationalisation in general that leads to a gradual decline of the uniqueness of the ERASMUS experience. But now the value of experience abroad as such is declining in the wake of the general internationalisation of the environment.

But the number of mobile students is still small compared to the general student population and depends both on the country, on scientific fields and also... on the parents income. In France students who are mobile are still mostly students who major in business and management, who graduated from reputable business and engineer schools and who take advantage of this mobility that has been imposed on them. Parents and / or banks are the financial support of these students whose future was in any case very favourable from the outset.

At the other end of the hierarchy of higher education are the general universities, whose students come mainly from popular classes. For them mobility is very difficult because neither is it organized (no information, little or no cooperation agreements, no mobility grants, ...) nor recognized (no validation of units acquired abroad), without mentioning the cost of mobility. Such mobility is particularly low in the computer science fields (for example in 2005, only 0.3% of French students in mathematics and computer science experienced Erasmus). Yet for these students, this mobility is possible and would be extremely beneficial particularly in the context of a more competitive Europe. That's what we try to show on the basis of our experience. To do this we will first present this institute, its history and its functioning, then the results of several surveys that we conducted with former students. Then we try to analyze what made these students successful, how we can develop their intercultural skills and how we have integrated them into our curriculum.

## **2. Presentation of the Institut**

### ***2.1 History***

After the Second World War, the construction of the European union was a means of avoiding the conflicts of the past. It was necessary to build a political, a cultural and an industrial Europe as well as an academic Europe. Ifates was created in this will in order to

pose the first stepping stones of a European education. The institute was created on September 15th, 1978 during a meeting at the Franco-German summit of Aix-la-Chapelle: its statutes come from a convention signed by the German Chancellor Helmut Schmidt and President Giscard D' Estaing. This operation was the first of its kind on the European university level. This Franco-German university institute was created to develop economic ties between France and Germany by training a personnel qualified for the light industries that are rising in this epoch (the mechanics of precision, electronics...) and by training technical and commercial specialists that are really bilingual.

The fact that the institute was created in the towns of Metz (in France) and Saarbrücken (in Germany) is not by chance as the two cities are only 70 kilometres away from each other which makes it possible for the students to move easily from one city to the other throughout their training. The choice of these two cities was symbolic. Robert Schuman originated from Metz and the two cities also share a common story: in a little more than a century they continued to pass from the hands of one country to the other.

Since its creation this institute has not ceased to develop and adapt. Today, nearly 2,200 French and German students follow the bi-national training of ISFATES and obtain a both a French and German university diploma. The institute is at the very least unique and original since it had allowed, until 1999, students having succeeded their first 2 years of higher education in their country of origin, to then continue their studies for the next two years in alternation between Saarland (one of the German "lands") and the University of Metz.

ISFATES has made it possible, from the beginning, to obtain a French "licence" and a German engineer diploma in three fields: electrical engineering, mechanical engineering and company management and economics. The computer science department was created in 1990, and other departments such as the civil engineering and logistics department were soon to follow. Since 1993, students can obtain a masters degree at the University of Metz in the field of their choice (as well as the German engineer diploma). And since 1999 students have been able to enter ISFATES directly after the baccalaureat (highschool diploma), its duration having been extended to four years. This new structure thus offers students a course comparable with the national university programmes.

The ISFATES-DFHI has been used as a model for many trainings that have been set up since 1988 under the aegis of the Franco-German College for higher education, then, since 1997 under the aegis of the Franco-German University / Deutsch-französische Hochschule (UFA/DFH), created at the time of the Franco-German summit of Weimar. The purpose of this institution is to bring together all of the cooperations integrated between higher French and German educational establishments. Currently gathering 150 establishments, 5000 students were registered with the UFA for the academic year of 2007/2008. The ISFATES-DFHI, with its 400 registered students, remains today the most significant Franco-German training delivering at the same time French and German diplomas.

## ***2.2 Operation of the Institut***

Currently Isfates has 6 branches : Computer Science, Logistics, Management Sciences, Civil Engineering and Infrastructures, Mechanical Engineering and Industrialized Manufacturing and Engineering Systems. For each branch, a group of 15 to 30 French and German students " will travel " together each year from one university to the other. During these 4 years alternatively divided between the University of Metz (France) and the HTW Saarland (Germany), the French and German students attend all of the courses jointly (of the national host branch of reception), which allows a permanent and enriching contact with the other culture. The students from the six branches of a given year also have some "inter-branch" courses in order to maintain a certain cohesion. The course of study is as follows:

- 1st and 2nd semester in Metz,
- 3rd and 4th semester in Saarbrücken,

- 5th and 6th semester in Metz,  
- 7th semester in Saarbrücken,  
- 8th semester period training course in a company outside the linguistic area of origin.  
This training leads to a Bac + 4 in each of the branches leading to the following qualifications:

- An engineer diploma (Abschluss DER HTW Saarbrücken).
- A master's degree (maitrise) at the University of Metz.

The teaching staff is in itself bicultural and meets regularly and alternatively in the 2 countries.

### 3. Alumni surveys

We present here the two surveys which were carried out with all students from all sectors: the results of the computer science sector were not significantly different from those of the other sectors. These results are thus also valid for the computer science specialists.

#### 3.1 First Survey (1995)

This survey was sent to 800 alumni of the old structure: 317 questionnaires were returned. It concerned alumni who graduated from the institute between 1980 and 1994. They had completed the Isfates curriculum in Bac+3 and Bac+4 and had obtained the French "licence" and German Engineer Diploma.

Out of the 500 questionnaires that had apparently reached their destination, 317 returned completed within one month after sending them (which constitutes a very strong and significant return rate). Of the 317 questionnaires at our disposal, only 299 were usable. Out of the 299 responses, 127 came from former German students, 172 from former French students. 196 engineers responded (1/3 German, 2/3 French) and 103 managers (47% German, 53% French). The average age of the subjects concerned in this survey was 29 years old and they had had 5 years of professional experience on average.

We will describe only a part of the results of this survey: certain aspects, such as their motivation for coming to Isfates, pedagogy, marks, contact with teachers, the quality of teaching offered at the two sites, the autonomy granted to students, how their first job was found, and the size of their company will not be revealed in this article. But these data were used to cope with the various reforms of recent years.

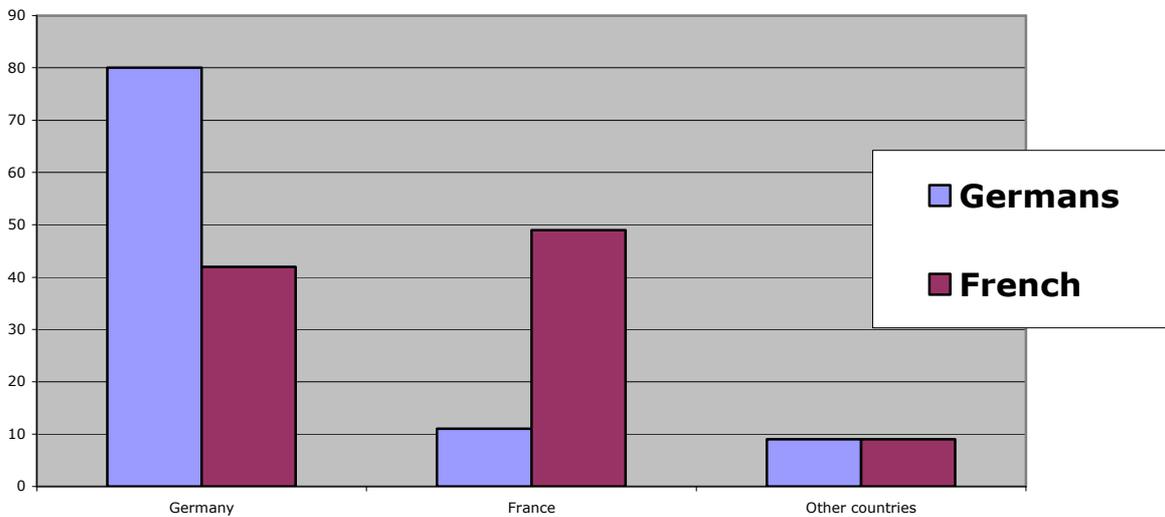
We will here describe the responses to the following questions: who they were before joining the institute, in which countries they found a job, what the nationality of their first employer was when they were expatriates, how much they earned, what were the essential skills offered by this training for their professional life and would they repeat the same training.

- Profession of father: 70% of French and 52% of German alumni belonged to the most disadvantaged social-professional classes : workers (miners often for the French), employees, farmers, civil servants of a basic category.
- In which country did you find your first job (in %)?

The survey concludes that there is a strong mobility for the first employment, especially for the French (42% in Germany, 9% in another country against 49% in France). Thus a little over half of French students expatriated after their degree (especially to Germany) in contrast to 21% of German students (12% + 9%).

For the French, attractive higher salaries abroad (in Germany in particular), is certainly the essential explanation of this mobility.

**Figure 1 Mobility** country of your first employment.



- Nationality of the company for expatriates at the time of their first employment. The aim was to assess the number of French and German alumni who left their country of origin for their first job.

Most expatriates worked in companies in partner countries. (for example the French worked primarily in Germany in a German company, only 10% of French expatriates worked in a French company).

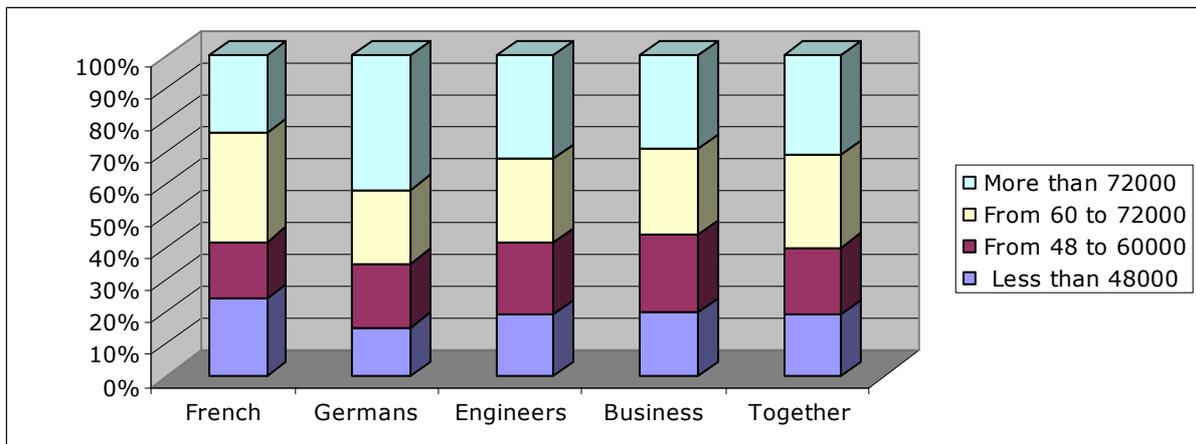
Nearly 30% of the French alumni worked in a company in a third country. This phenomenon was even more significant for German expatriates. This can be explained by the attractiveness of an international curriculum, even if this curriculum does not directly integrate knowledge about this third country. This enforces the assumption that already in 1995, intercultural skills were acknowledged and recognized by international companies.

The results show that relatively few expatriates abroad worked in companies from their country (keeping in mind that in 1995 the number of the French companies operating abroad was much lower than today).

- What is your gross annual salary in DM?

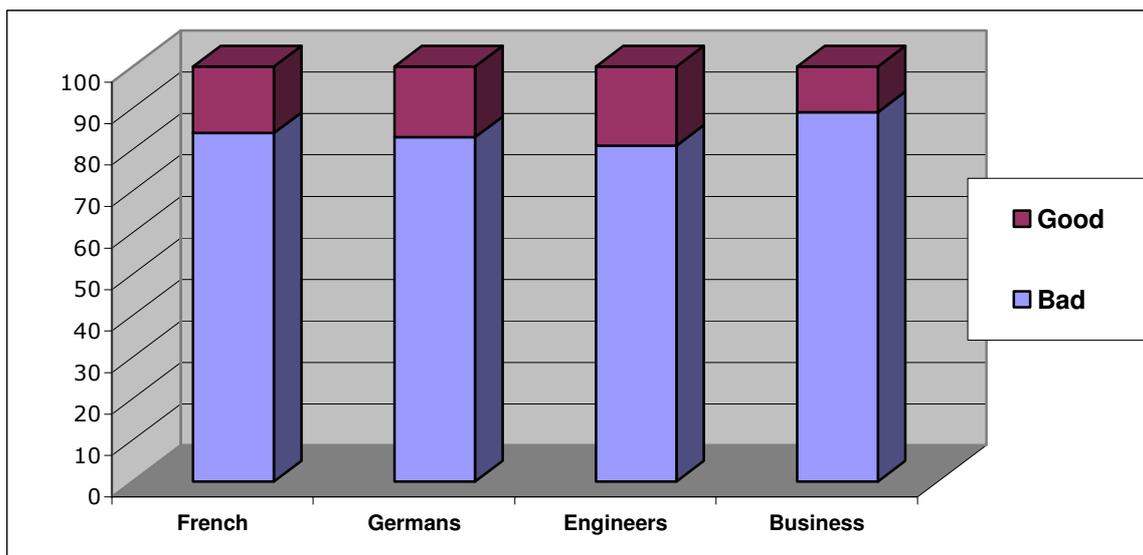
The result of this question showed an annual average gross salary of 65000 DM for the average 29 years old age group and 5 years of professional experience. In 1995, this corresponded to the wages of engineers from reputable schools in France and to that of engineers of good technological universities in Germany. Note that these wages were obtained by students after four years of training (instead of five in the well-known schools), in university establishments that are not the most reputable (Metz and Saarbrücken) and coming from, in the majority of cases, from the underprivileged social classes. Whereas in the renowned schools around 7% of the pupils came from the "disadvantaged" classes. At Isfates nearly 70% at that time were from the "disadvantaged" classes.

**Figure 2 Annual Wages in DM**



- How you see your professional future (in %)

**Figure 3 Your professional future**



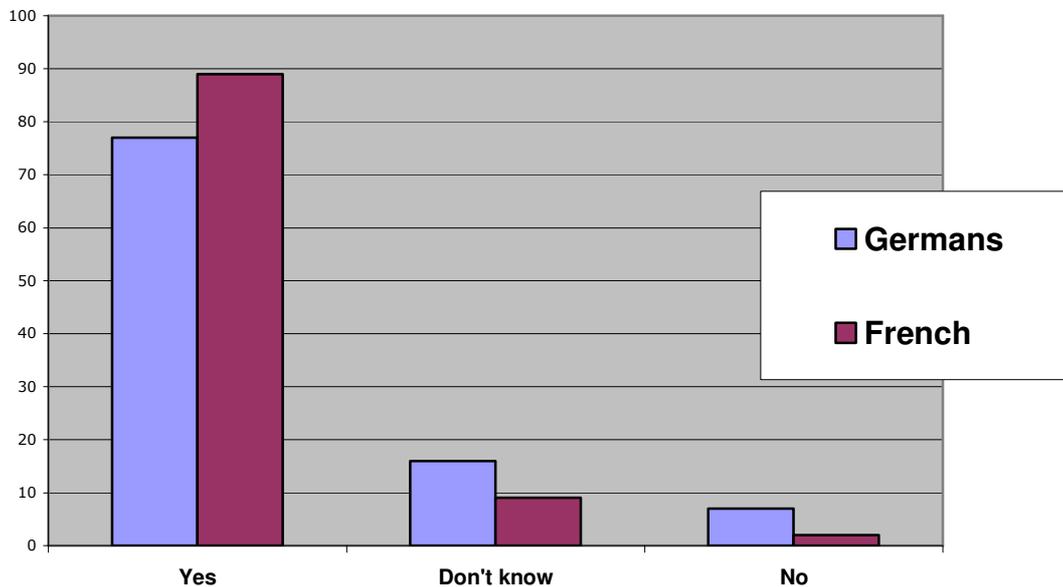
Here again, we can see a certain optimism whatever the sectors or nationalities : 84% of French felt good about these prospects! Considering that the French culture is known for its pessimism in regard to the future, this is an excellent result.

- If you had the choice, would you reattend Isfates?

Overall 89% of French alumni (9% did not know and 2% would not recommence this training) and nearly 80% of German alumni would agree to repeat this training (a little more the technicians than the managers). This is an excellent result, and very significant, because among the 9% of the French alumni who did not know, or who would not repeat this training, it is necessary to also include those who were aware of having chosen the wrong field. The Germans were probably a little less enthusiastic because the social elevator was a little less significant for them (the social-professional levels of their parents being a little higher) and the net worth wages which they earned thanks to the diploma was a little less significant for

them than for the French. If one asked the question " If I had to start again? " to a 100 managers of an average age of 29 years and working for approximately 5 years on average, how many would say they do not regret their choice of training?

**Figure 4** And if were to be redone?



### 3.2 Second alumni survey ( 2002 )

This survey was carried out in July and August 2002 in the perspective of a renewal of Isfates. At that time the essential problem was to make the courses more attractive, in particular in the scientific field affected by both the decline in the vocations in the field of engineering (still of more an advantage in Germany than in France), and the drop in the number of high-school pupils having learned German in France and French in Germany. Whereas the first survey raised the question: " What have you become and what do you think of us? ", this second survey was primarily focused in responding to recent concerns such as:

- taking into account the current situation, " what type of courses should be offered in order to make the institute more attractive? "

- " is the masters degree necessary and which LMD should be put into place? "

Meanwhile we had also taken the questions of the first survey again in order to determine whether we would still have the same results: career, mobility, wages, vision of their future professional life and satisfaction with their training are the questions which we repeated. We will reveal in this part only this last data.

Overall the sample was comparable to that of the survey of 1995: the same proportion of managers (39%) and engineers (51%), a type of professional situation slightly more favourable than the father. The average age of the subjects covered by this survey was 30 years old and they had had 5 years of professional experience on average. 70% of them had obtained their diploma from Isfates after 1995, and thus had not been consulted at the time of the first survey: they were primarily recent graduates.

The answers to these various questions confirmed the 1995 survey: there was still a majority of students that came from more disadvantaged social-professional levels, a mobility as significant for the first job, annual wages still high in taking into account their level of studies (comparable with those of students leaving good engineering and business schools). Although the survey was conducted during a period of economic recession in France as well as in Germany during the summer of 2002, the old optimism remained. Their professional future was seen as " good or very good " for 69% of the alumni, " not good " for 11%, while 20% did not know. Finally the very significant indicator of satisfaction with this training when asked " If I had to start again, would I? " : 83% answered yes, 7% no and 10% did not know.

### **3.3 Some other indicators**

Since the creation of the computer science department of Isfates in 1990, one could note very visible differences between the students who followed this curriculum compared to the students of the national education French and German sectors. Most of these differences were also observed in other sectors, but we will focus on computer science students. In the computer science subjects these students obtained similar results to those obtained by students from the national education sectors. There was no significant difference in the average mark of a group of computer science students from Isfates with the average mark of students from the national group (even if the students from Isfates had completed, in overall, less computer science courses throughout their training compared to other students). On the other hand the difference was extremely favourable for Isfates when it was a question of finding a training course or an employment, in the average duration of research, the type of missions given or salaries earned. These Franco-German students found their first training course or their first job much more quickly, had a very interesting position, and had higher paid salaries. And this variation was even more visible during the years of the computer science crisis. Indeed the students from Isfates were hardly affected in these years of crisis. Let us notice that in a period of full employment in computer science, the number of candidates in the computer science department of Isfates fell because mobility was not necessary to find a job. And of course as soon as the job market in computer science weakened, one could note an increase in the number of candidates again.

Therefore the students of Isfates have always interested employers, as much as the well-known engineer schools and universities. Thus, those wishing to continue their studies after their fourth year had their student files very easily accepted (much easier than those from the national education) even in the most renowned establishments in France. We have thus been able to set up an agreement with the Polytechnique School of Montreal, known to be a very selective establishment for European computer science specialists and which only accepts students from the most reputable schools in France and those of the best German technological universities. Today, Polytechnique, noting the adaptability and excellent results of Isfates, is opening its doors more widely to the students of Isfates and is continuing to accept an increasing number of our students (whereas the number of candidates for this school has not decreased).

A last indicator is the number of prizes obtained for the best training courses carried out by the students of the two countries. In Isfates, and in the computer science sector in particular, students regularly receive prizes of having carried out the best training course, whereas students from the national education (having a much more significant manpower: from 4 to 7 times more depending on the year and locations) only obtain prizes very exceptionally.

## **4. Discussion**

#### **4.1 The cultural skills that pay**

The results of the studies we have undertaken show that this type of training offers students interesting career-advancement opportunities. The high level of satisfaction of former students who would be willing to repeat the same career choice (89% and 83% according to the survey) can be explained in the following way: even if the direction they had chosen at the age of 18 or 20 years was not necessarily the best compared to their tastes today, the position they currently occupy, and also the professional opportunities encountered enabled them to have a job that pleases them. The awareness of the effect of a social elevator (remembering that over 50% of students had grants) is certainly another reason not to regret their choice.

If we compare our surveys with the results of the Valera study on Erasmus, one finds that the benefits of mobility is much more favourable for students from Isfates. This can be explained by the following reasons:

- The duration of mobility: the students from Isfates carried out either two semesters (in the old system), or four semesters (in the intermediate system), or five semesters (in the current system) abroad. Erasmus does only one or two semesters abroad.
- Integration: even when the semester takes place in the country of origin, the student is in a bicultural group. Moreover, the programmes of the different semesters are synchronized. This is not the case for Erasmus.
- Diploma: Isfates students receive the diploma from both countries which is not the case for Erasmus. The importance of a double degree no longer needs to be proven: for example, most German companies in computer science technology do not know the French diplomas. For a French person, having the German diploma allows him easy access to the German labour market.
- Economic ties are very developed between the two countries. The Erasmus survey covered four specialities of which two are general (sociology and general chemistry) and where mobility seems, a priori, to be not so great. For Isfates, its six specialties are in great demand in the international market.

We also asked the alumni in these questionnaires, and in many interviews, to classify three skills (specific knowledge in the field, knowledge of the language and intercultural skills) that they considered to have contributed to the success of their careers. Intercultural skills were in majority considered to be the first, followed by language skills and finally academic knowledge. Obviously a good academic level is indispensable, but intercultural skills are increasingly needed in the job market, and appear to make a difference. It is the reason why we have taken advantage of the various reforms of the institute by integrating, each time a little more, these skills into our educational programmes.

#### **4.2 Taking into account the results of the survey: intercultural skill development in the curriculum**

In the computer science department, as well as in all other departments, each group is made up of 50% Germans and 50% French. So even when French students spend their academic year in France, they study each day with German students and have a certain number of German teachers. All projects in computer science must be bicultural meaning a group working on the project must necessarily have both French and German students. We gradually introduced specific courses aimed at developing language and intercultural skills. These courses consist of presentations on the cultures of each country, conferences, projects to be realized by the students, company visits, etc.... Moreover, the importance we grant these courses is illustrated by the specific number of dedicated hours and their weight in the marking system. Thus intercultural and language lessons account for 30% of the

number of students' hours. To illustrate these choices, here is the content of the courses taken by first year students in the computer science department.

First Semester: (4 Units: Each Unit consists of subjects each representing 48 hours or 24 hours per semester)

- M1 Languages and intercultural education
  - German / French 48 h.
  - English 48 h.
  - Intercultural 24 h.
  - Knowledge of companies 24 h.
- M2 Core Subjects
  - Mathematics 48 h.
  - Computer Science 48 h.
- M3 Programming
  - Algorithmic 48 h.
- M4 Management
  - General Economy 48 h.
  - Commercial law 48 h.

2nd Semester (4 Units)

- M1 languages and intercultural education
  - German / French 48 h.
  - English 24 h.
  - Intercultural 2 24 h.
- M2 Core Subjects
  - Mathematics 48 h.
  - Computer Science 48 h.
- M3 Programming
  - Databases 48 h.
  - Algorithmic 48 h.
- M4 Networks
  - Internet 48 h.

The “languages and intercultural learning” units and the “management” course units are taught in all of the departments : it allows computer science students to not remain only among themselves and to have ongoing contacts with students from other departments. In the first semester, rather than starting immediately on specific computer science subjects we have decided to offer many non-IT units. Here are the reasons:

- To allow German students, who often have an average knowledge of the French language on their arrival in the first year in France, to improve their level of French so as to not fall behind in the technical courses (which really begin in the 2nd semester)
- To reduce the dropout rate (frequent in the 1st year at universities) by giving a chance to students who come from high schools to gradually adapt to the pace of university life and to adapt to the country.

For the following three years the programme consists of close to 30% of language and intercultural education. We recognize the difficulty confronted in setting up these type of lessons as it is a new field, is little recognized and is often poorly accepted by the students. Explaining the choice of “sacrificing teaching hours to something other than computer science” has not been easy with both students and among teachers. Indeed in the computer science department (as in other departments) the same resistance and remarks were made: computer skills are essential, and any other subject (sometimes even languages) were not a priority, the academic level of the students at the end of the training would be too low, other

































































































































































































































































































































































































































