

# VOLUME 2

\* WORKING PAPER N 2\*

## **Teachers' labwork Practice, An Analysis Based on Questionnaires**

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## **Volume 2**

# **Teachers' labwork practice, an analysis based on questionnaires**

A written questionnaire has been elaborated to learn more about teachers' practice in relation to the labwork practice in the upper secondary school and in the university.

Such a questionnaire about the educational practice gives information at an intermediate level. This information is at a more detailed level than that about the structure of the educational systems (Neville Postlethwaite, 1995; European reports, 1993, 94, 95) which do not deal with the type of teacher's activity like the aspects of labwork taken into account in its assessment or the information given to the students. In the same time, it is less detailed than the information usually given by researchers in didactics who often need more specific information about the individual behaviours. We would say that, here, the information is an intermediate granularity level.

The aim of the questionnaire analysis is to give the main tendencies of teachers' practice and not the detailed differences. Five aspects were investigated:

- the types and the organisation of labwork activity including the relation between labwork and lecture (theory In England) and the type of information in the labwork sheet,
- the possible uses of computer during labwork,
- the labwork assessment that is taken into account and the importance of its assessment,
- the demonstrations,
- the teacher's preparation of labwork.
- the material conditions.

The results are presented for each aspect at the two levels, the upper secondary school and the university in order that the main tendencies appear easily.

## 1 Number and types of teachers who filled the questionnaires

The number of teachers who answered the question in each different country is small. Moreover the chosen teachers are rather close to the research groups. Consequently, we do not consider the results as representative of each country. They only give a tendency. They also give information about the relevant questions to ask in the case where a survey would be implemented at a large scale. In the following we discuss the main tendencies of teachers' labwork practices.

### *Upper secondary school level*

As it is presented in the first part, in Denmark, France, Germany, Greece, the duration of the upper secondary school is three years, in Italy it lasts for five years, in England, there are two years corresponding to the two last years of the other countries. Due to these different educational organisations, the questionnaires were given to teachers of upper secondary school:

- in Italy for the last three years;
- in Denmark for the first and third years;
- in England for the two years of the upper secondary school;
- in France, Germany, Greece for the three years.

The Table 1 gives the number of teachers in the different countries. Let us note that in Greece and Italy the questionnaires were given to the teachers who practice labwork; they are not at all representative of their country, since labwork is not a general practice. This is why, in the following, in the tables and figures Greece and Italy are distinguished (they are between parenthesis).

	Denmark	France	Germany	England	[Greece]	[Italy]	Total
Biology	10	36	6	11	5	1	69
Chemistry	8		2	6	10	11	37
Physics	14		13	6	18	10	61
Physics + Chemistry		39					39
Biology + Chemistry			7			5	12
Total	32	75	28	23	33	27	218

Table 1: Number of teachers' answers by country and by discipline at secondary level

The table 1 confirms the way of the subjects disciplines are put together as it was presented in the previous part: in France physics and chemistry are taught by a same teacher and in Germany biology and chemistry.

The teachers were asked for their experience in teaching and for the responsibility of the laboratory in their school. The results are given in Table 2. It appears that, in all countries,

most of the teachers have a long experience (more than 20 years) except in Greece where however a majority still has between 10 and 20 years of experience.

	Denmark	France	Germany	England	Greece	Italy	Total
less than 4 years	6	2	3	5	5	0	21
between 4 and 10 years	4	6	3	1	7	9	30
between 10 and 20 years	7	19	8	7	18	6	65
more than 20 years	15	47	14	10	3	27	101
<b>Total</b>	<b>32</b>	<b>74</b>	<b>28</b>	<b>23</b>	<b>33</b>	<b>27</b>	<b>217</b>

Table 2: Experience years of teachers at secondary level

The responsibility of laboratory is different depending on the country, this is linked to the school organisation (Table 3).

	Denmark	France	Germany	England	[Greece]	[Italy]	Total
N	32	74	25	23	33	27	214
lab. responsibility	32	53	13	7	29	12	146
%	100%	72%	52%	30%	88%	44%	68%

Table 3: Number of teachers who took a responsibility of the laboratory at secondary level

### *University level*

The questionnaires were given to teachers of university in Denmark, England, France, Germany, Greece, Italy. All of the teachers who filled the questionnaires are involved in the first or the second year of university. Depending on the university the teaching organisation can be in module, in semester or in trimester; then we asked the teacher to choose the sequence of teaching and to use it as reference in the whole questionnaire. The number of teachers is given in Table 4.

	Denmark	France	Germany	England	Greece	Italy	Total
Biology	11	11	8	7	8	3	48
Chemistry	7	29	10	5	11		62
Geology		2			2		4
Physics	8	14	11	11	11	8	63
Physics + Chemistry	1						1
Biology + Chemistry						1	1
<b>Total</b>	<b>27</b>	<b>56</b>	<b>29</b>	<b>23</b>	<b>32</b>	<b>12</b>	<b>179</b>

Table 4: Number of teachers' answers by country and by discipline at university level

Concerning the teachers' experience, the results show that even more that at secondary school level, most of the teachers who filled the questionnaires have a long experience (Table 5).

	Denmark	France	Germany	England	Greece	Italy	Total
less than 4 years	6	4	1	1	3		15
between 4 and 10 years	3	13	5	8	2	2	33
between 10 and 20 years	3	7	4	5	13	2	34
more than 20 years	14	32	19	9	14	8	96
Total	26	56	29	23	32	12	178

Table 5: Experience years of teachers at university level

## 2 The types and the organisation of labwork activity

Three questions were dealing with this aspect. One is at a general level on the type of labwork (Q8), the second concerns the links between lectures and labwork, and the last concerns the type of information given to guide students for their labwork.

### 2.1 Types of labwork

The following question allows to know if the labwork sessions are what we call "typical", that is organised in small groups with experiments carried out according to teacher's instruction asking for a complete treatment of the experiments, or if labwork is dealing with a partial task only, or if labwork is open-ended in the sense that students have significant initiative. Another item was introduced to get more information about the practice, it concerns the use of video, CD-ROM or computer simulation

8 - Please estimate, for the last academic year, the amount of time in your labwork sessions which was spent on each of the following types of labwork. Please give this estimate as a percentage of the total time allocated to labwork.

	<i>Estimated % of</i>
<i>total labwork time</i>	
- 'typical' labwork; students working in small groups, interacting with real materials and/or equipment and following detailed instructions given by teacher .....	<input type="text"/>
- Information taken from video, CD-ROM, computer simulation .....	<input type="text"/>
- More open-ended activities (students take some decisions about what to do) .....	<input type="text"/>
- Partial tasks (e.g. planning only, interpretation of given data etc.) .....	<input type="text"/>

#### *Upper secondary school level*

The main result is the importance of the "typical" labwork. For all countries and disciplines the choice is around 60% or more (figure 1).

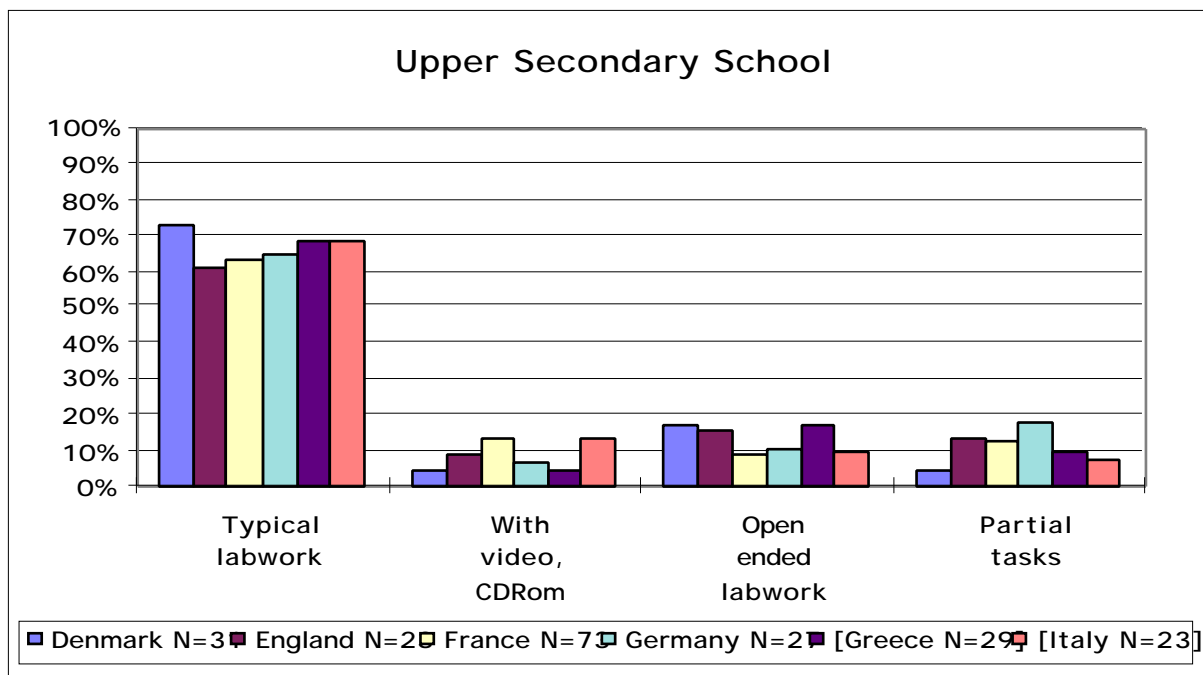


Figure 1: Average of the percentage given for each item by the teachers on the types of labwork

Moreover there is no overlapping between the confidence intervals at 0, 95% (the middle of the confidence interval is calculated by making the average of the percentage given for each item for the choice "typical labwork" and the other types of labwork whatever the country).

The data by discipline show that for England in physics, it appears an overlapping between typical labwork and open ended labwork; this may correspond to the introduction of the practice of project in this country.

Let us note that the item corresponding to the use of video or CD-ROM has a very low percentage in all cases.

### *University level*

The tendency is the same than at the secondary level, the typical labwork is much more frequent (Figure 2), for each country there is no overlapping between the confidence interval corresponding to the answers "typical labwork" and that for the "open ended labwork". However the open ended labwork seems more important than in secondary school in particular for Denmark.

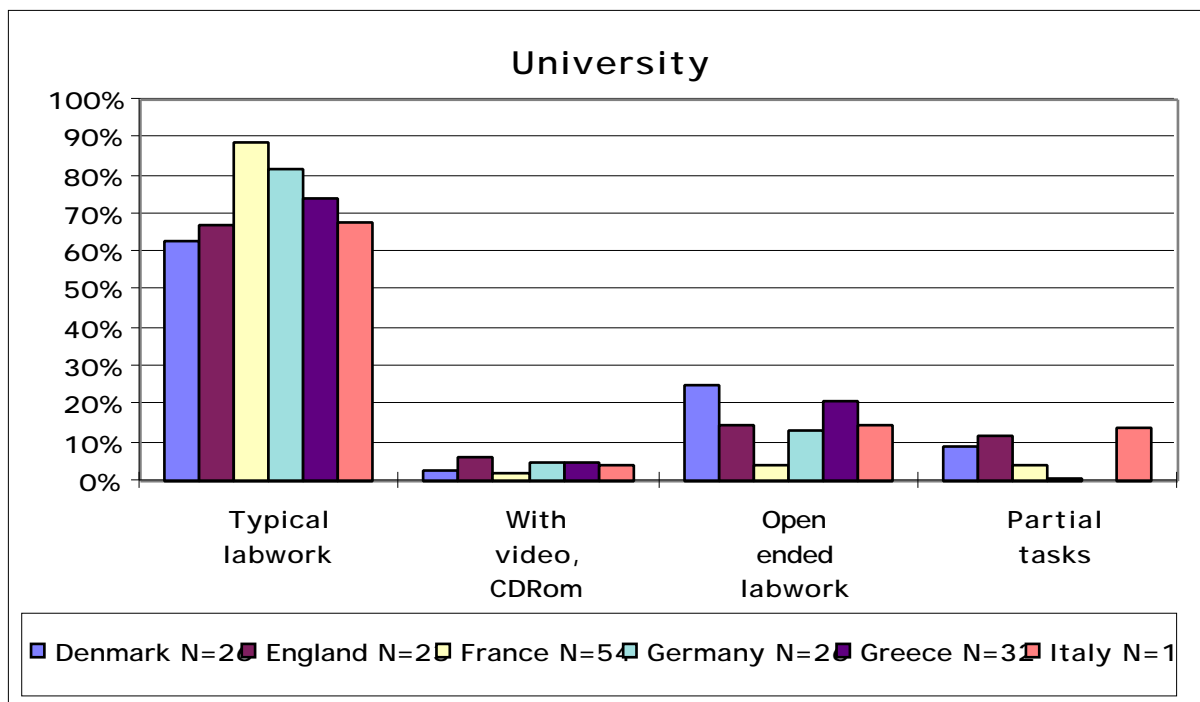


Figure 2: Types of labwork for all subjects with the confidence interval at 95% (the middle of the confidence interval is calculated by making the average of the percentage given for each item by the teachers of a given country).

## 2.2 Relation between labwork and lectures

A single question (Q 9) deals with the link between labwork and lecture. It shows a very majority tendency : a strong relation between labwork and lecture.

9 What is the relationship between theory (*lectures for the French case*) and labwork ?

From the alternatives below please choose the one which best describes this module:

- There is a close relationship between theory and labwork .....
- There is a close relationship between theory and labwork, but for organisational reasons there is often a time gap between these two aspects of a course .....
- There is no close relationship between theory and labwork - either in content or time.....

*Upper secondary school level*

As it is shown in the Figure 3, the link between lectures and labwork is very strong. The results show that Greece and Italy has a similar behaviour that the other countries.

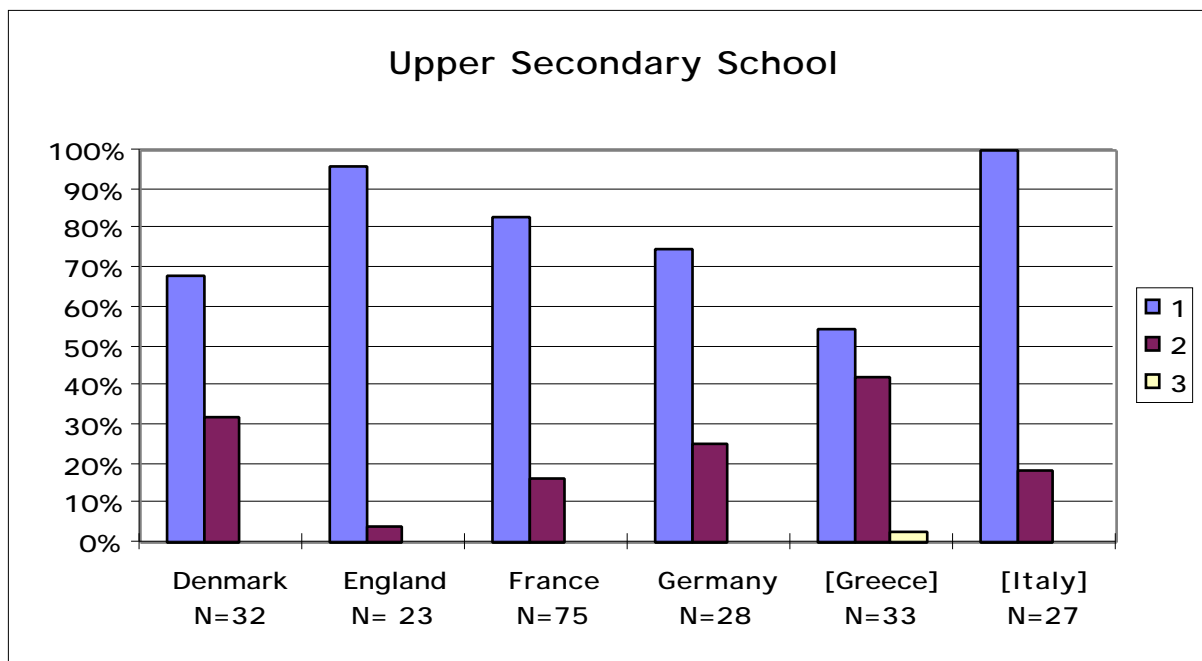


Figure 3: Relation between lectures (theory) and labwork

### University level

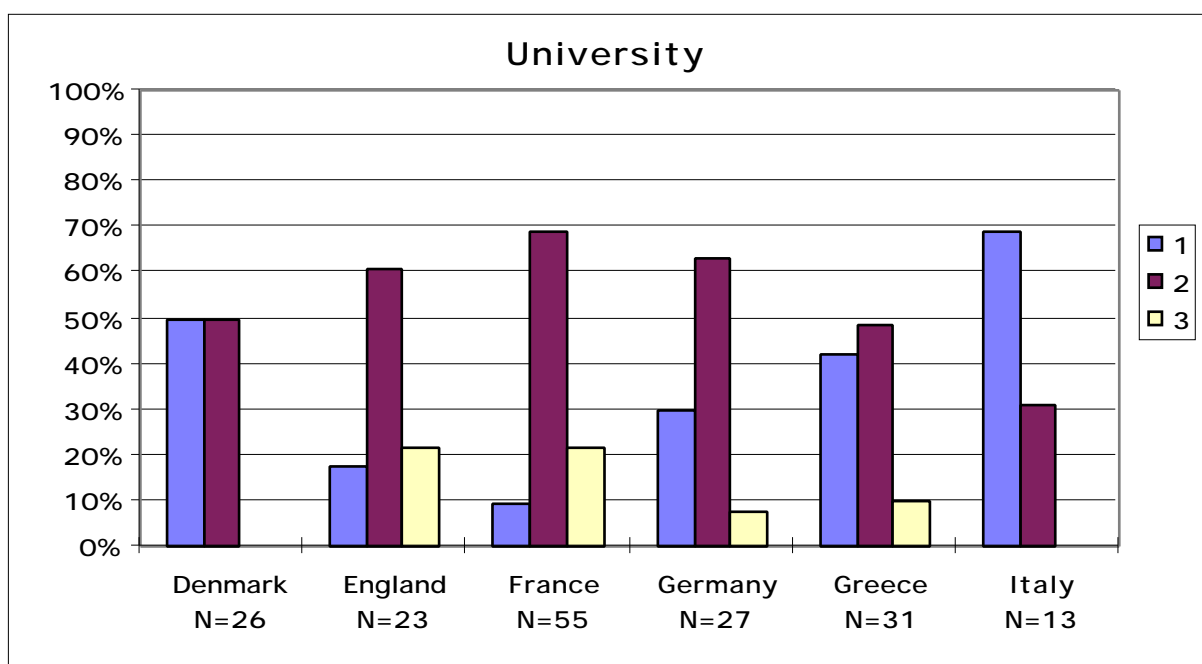


Figure 4: Links between labwork and lecture (theory) at university level

1 : close relationship

2: close relationship but time gap for organisational reasons

3: no close relationship

A big difference appears between countries : in Denmark and Greece there is a strong relationship both in terms of content and in terms of time, whereas in France, Germany and England the links are much weaker, even in some case it appears that there is no close



relationship (Figure 4). This situation almost never appears at the upper secondary school level. This difference between these levels will be discussed in the next paragraph since it is analysed with the same way, on the organisational point of view.

The difference between the secondary and the university levels, link between lectures (theory) and labwork can be interpreted by general organisational aspects. At the secondary level the same teacher has systematically in charge lecture and labwork, then s/he can manage her/his teaching sequence and then the link between lecture and labwork. This situation does not happen at university, it is rather frequent that the teachers in charge of lectures is not the same for all labwork session; then the organisation of sequence is depending of numerous conditions.

### 2.3 Type of information given to students for labwork

The type of information provided to the students is an indication of the degree of autonomy on experiment, data processing and presentation and discussion of results.

16 - Students are usually given both verbal and written information to guide them in their labwork. This information has a variety of different functions. Some of these are listed below.

Please indicate the relative weight given to each type of information within your named module. Please do this by estimating what percentage of the total information provided, both verbal and written, fits into each category.

	<i>Please tick one box for each source</i>		
	frequently	occasionally	never
Provides the theoretical background.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
States the question(s) to be investigated .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Gives instructions for performing the experiment(s) .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Gives guidance on data processing .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Gives guidance on the presentation and discussion of results	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

The importance of "typical labwork" is reinforced by the results to this question.

#### *Upper secondary school level*

The results to this question show a similar behaviour both for the disciplines and for the countries. The majority behaviour corresponds to a labwork sheet giving (Figure 5) most of the time the questions which has to be studied and very frequently the steps to follow to carry out the experiments. They also give how to process data and how to present and discuss the results even if it is in a less extent.

The theoretical context seems the aspect which is the most variable. It is given frequently in chemistry and most rarely in biology. In the case of France where physics and chemistry are taught by the same teacher it is rather rarely given.

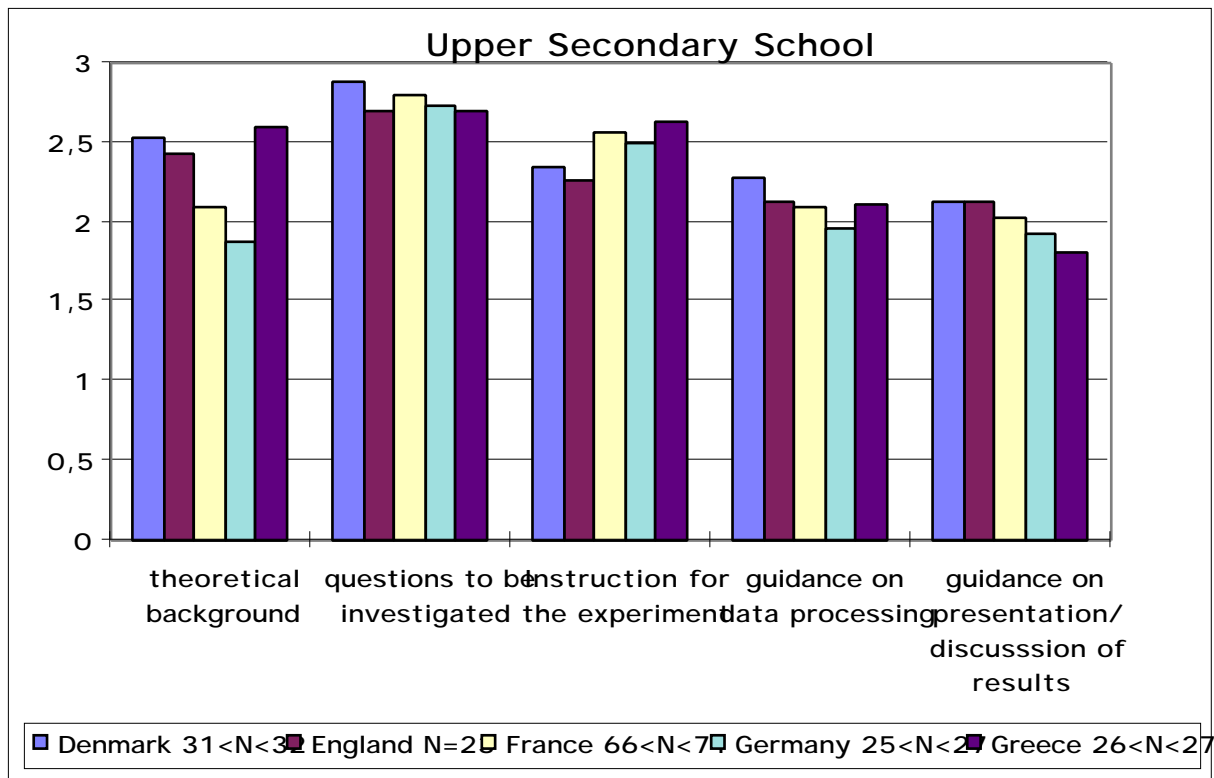


Figure 5: Type of information more or less frequently given by the teacher for labwork at secondary school level. The mean was calculated on the numbers corresponding to each item; frequently has been coded 3, occasionally : 2; never : 1. Each item can be understood by the teacher as an independent question. The number of answer (N) could thus be different depending on the item. For each country, we give the interval in which N is comprised<sup>1</sup>.

### University level

The results obtained at the upper secondary school level and at university level are rather similar. The information given to the students is connected to all types even if guidance on data processing and presentation or discussion of results are a little less important.

<sup>1</sup> Italy does not appear in the histogram because all the answers are similar: the only item "always" is chosen for all items

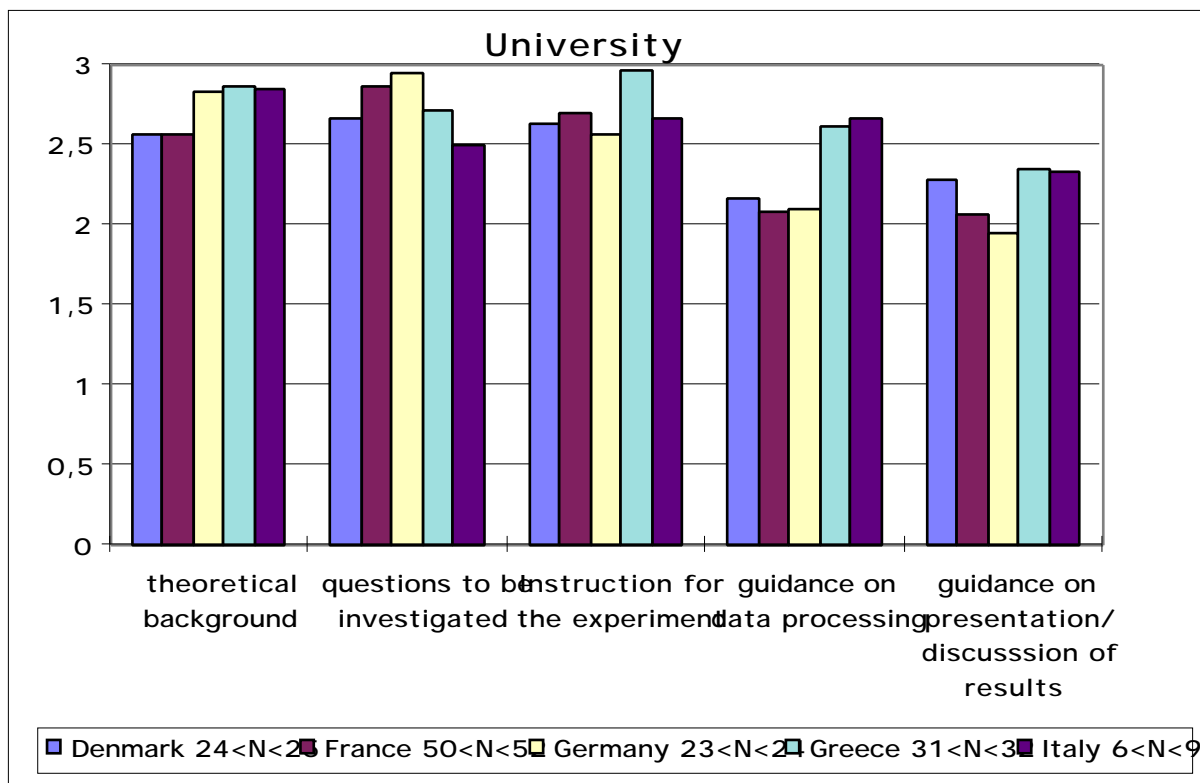


Figure 6: Type of information more or less frequently given by the teacher or the labwork sheet for labwork. The mean was calculated on the numbers corresponding to each item; frequently has been coded 3, occasionally : 2; never : 1. Each item can be understood by the teacher as an independent question. The number of answer (N) could thus be different depending on the item. For each country, we give the interval in which N is comprised.

### 3 Uses of the computer

Computer can be used very differently, mainly with an interface with the experiment to acquire data and then process them, or in a more autonomous way to simulate. These two main uses are not exclusive. To reduce the number of questions, we put the type of interface and these uses together in a single question, however the results will be treated separately.

11 - During labwork, how frequently do you expect your students to use computers?

A number of different ways of using computers in labwork are shown below. Please estimate, for the previous academic year, the percentage of your labwork sessions which included each of these uses of computers. For any one use, 100% means that it was used during all labwork sessions during the whole year. The total for all uses may exceed 100% if computers are used in several different ways within one labwork session.

	% of labwork sessions
- computer interfaced to the experiment and set up by you .....	<input style="width: 80px; height: 20px;" type="text"/>
- computer included in manufactured equipment .....	<input style="width: 80px; height: 20px;" type="text"/>
- computer to aid data processing .....	<input style="width: 80px; height: 20px;" type="text"/>
- simulated experiments .....	<input style="width: 80px; height: 20px;" type="text"/>
- other use of a computer (please specify) .....	<input style="width: 80px; height: 20px;" type="text"/>

Two different aspects relative to the use of computers are investigated in this question (11): the type of interfaces and the use of computer to process data or to simulate experiments. We present these two aspects separately.

### 3.1 Type of interfaces

#### *Upper secondary school*

Table 6 shows the teachers' choices according to the countries for all disciplines both for the type of interfaces and the type of uses.

	Denmark	England	France	Germany	[Greece]	[Italy]	Total
N	32	23	75	28	33	27	218
personal interface	53%	52%	23%	29%	3%	0%	25%
commercial interface	34%	22%	79%	18%	6%	0%	38%
data processing	91%	70%	73%	46%	15%	0%	54%
simulation	41%	48%	72%	50%	6%	0%	43%
other	13%	17%	12%	18%	12%	0%	12%

Table 6: Percentage of teachers by country at the upper secondary school level concerning different uses of computers. (Several items can be chosen by a same teacher, the total percentage is more than 100%).

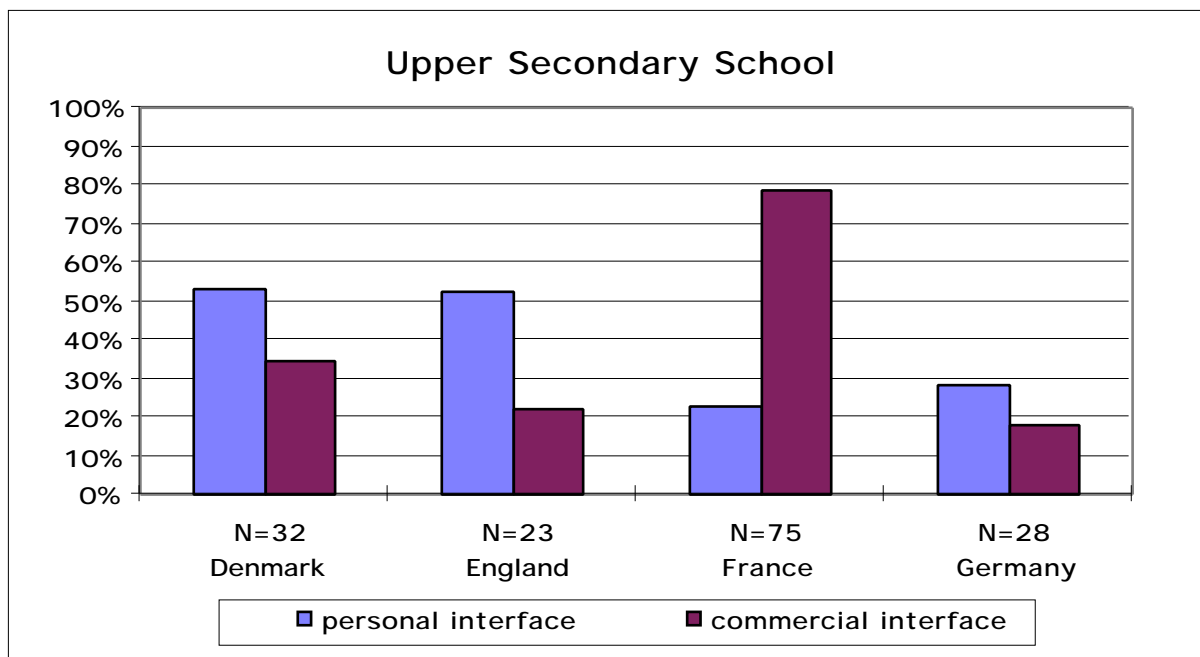


Figure 7: Use of the interfaces at secondary school level (Table 6)

In the use of commercial or personal interface, it appears differences in the practice according to the countries, in France the commercial interface seems much more popular than in the other countries (Figure 7). In Germany, the number of teachers using interfaces is rather low. As an example we show in the Figure 8 the difference of teachers' behaviours in two countries where there is regular labwork. Even if there is a difference between disciplines, the difference according to the country is much more important.

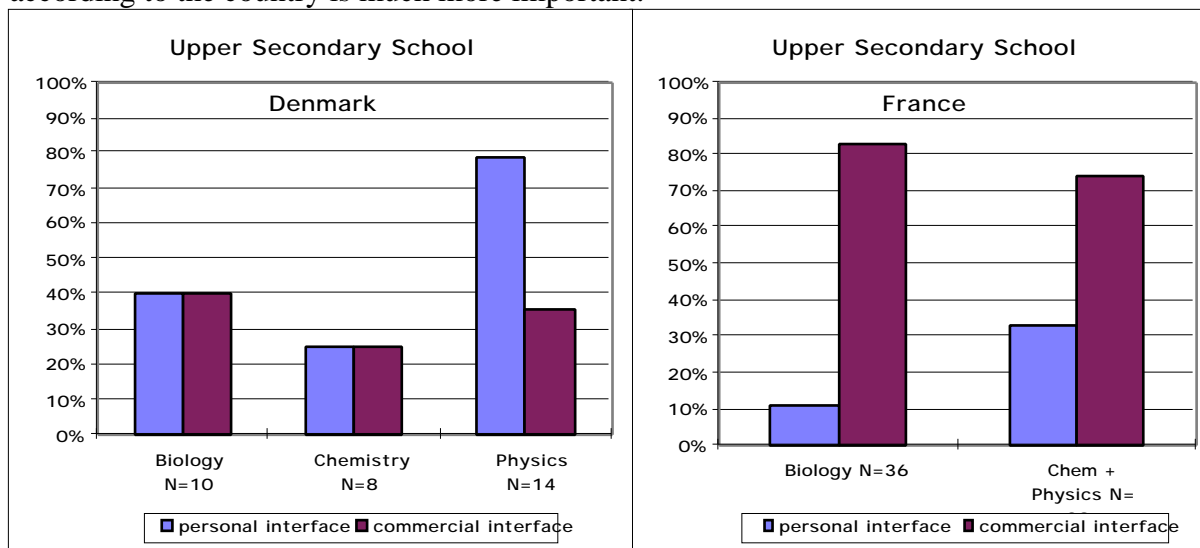


Figure 8: Example of tendencies of teachers' behaviours relative to the different types of using the computer during labwork at the upper secondary school level

### University level

Concerning the personal or commercial interface, the difference of teachers practice according to the country almost disappears. There is a balance between both, and more generally the

number of answers is much less important than at secondary school level (Figure 9, Figure 10).

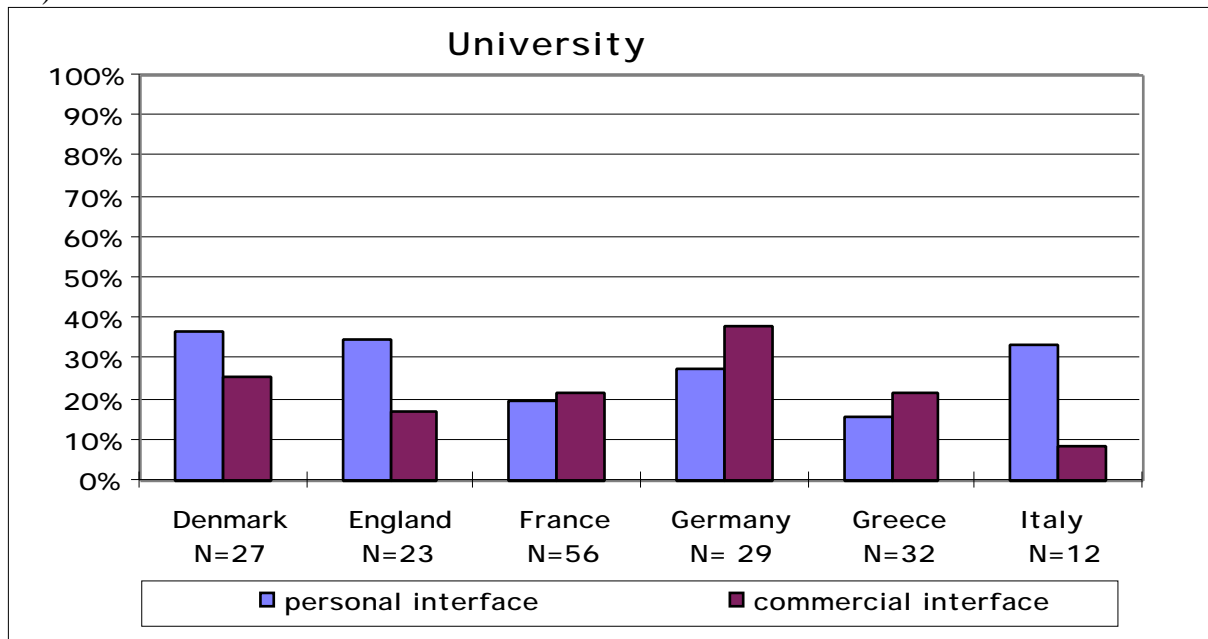


Figure 9: Use of interfaces at university level

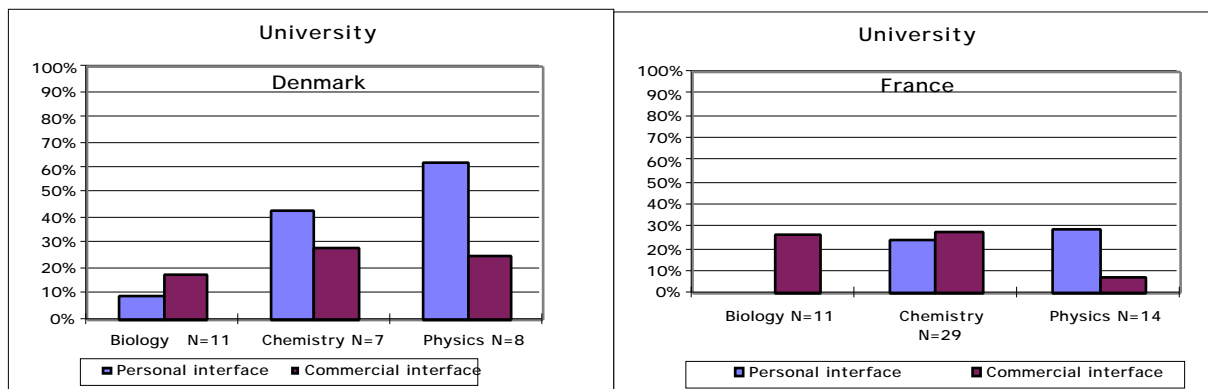


Figure 10: Example of tendencies of teachers' behaviours relative to the different types of using the computer during labwork at the university

### 3.2 Computer use as data processing and simulation

#### Secondary school level

Table 7 shows the teachers' choices according to the countries for all disciplines for the type of uses.

	Denmark	England	France	Germany	Greece	Italy	Total
N	32	23	75	28	33	27	218
data processing	91%	70%	73%	46%	15%	0%	54%
simulation	41%	48%	72%	50%	6%	0%	43%
other	13%	17%	12%	18%	12%	0%	12%

Table 7: Percentage of teachers by country at the upper secondary school level concerning different uses of computers. (Several items can be chosen by a same teacher, the total percentage is more than 100%).

The analysis of the data shows no specific practice by discipline. Moreover, the difference between countries is much less important than for the type of interface (Figure 11, Figure 12).

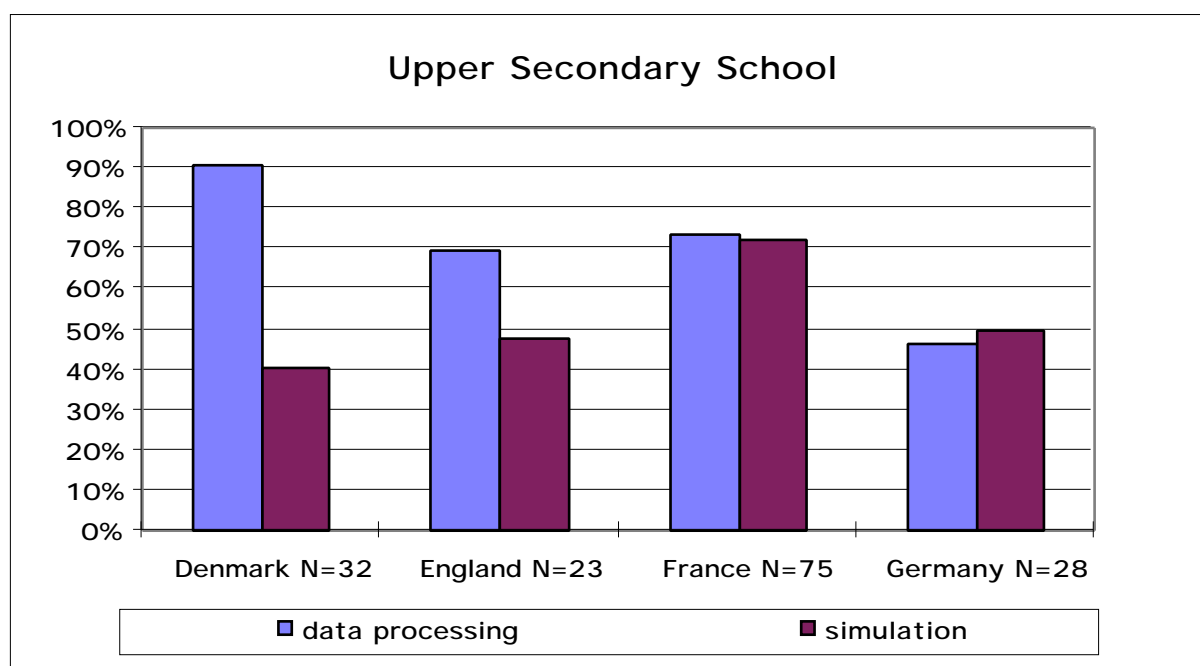


Figure 11: Types of uses of computer

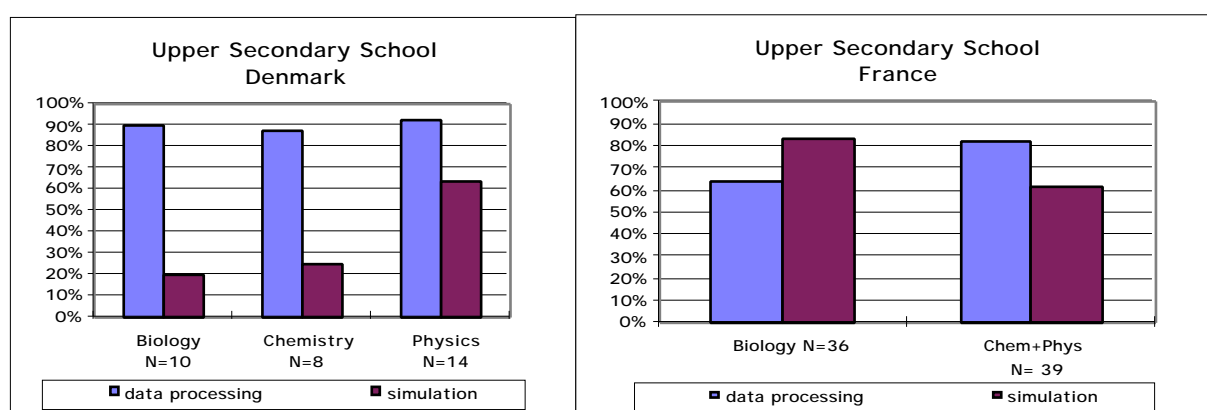


Figure 12 : uses of computer at secondary school level for two countries

It also appears that in Denmark, France and England, when teachers use a computer, data processing is very often involved (between 91% and 70%).

### University level

Concerning the use of computer, data processing is much frequently used than simulation. Moreover, simulation seems a less frequent use at university level than at secondary level (Figure 13, Figure 14).

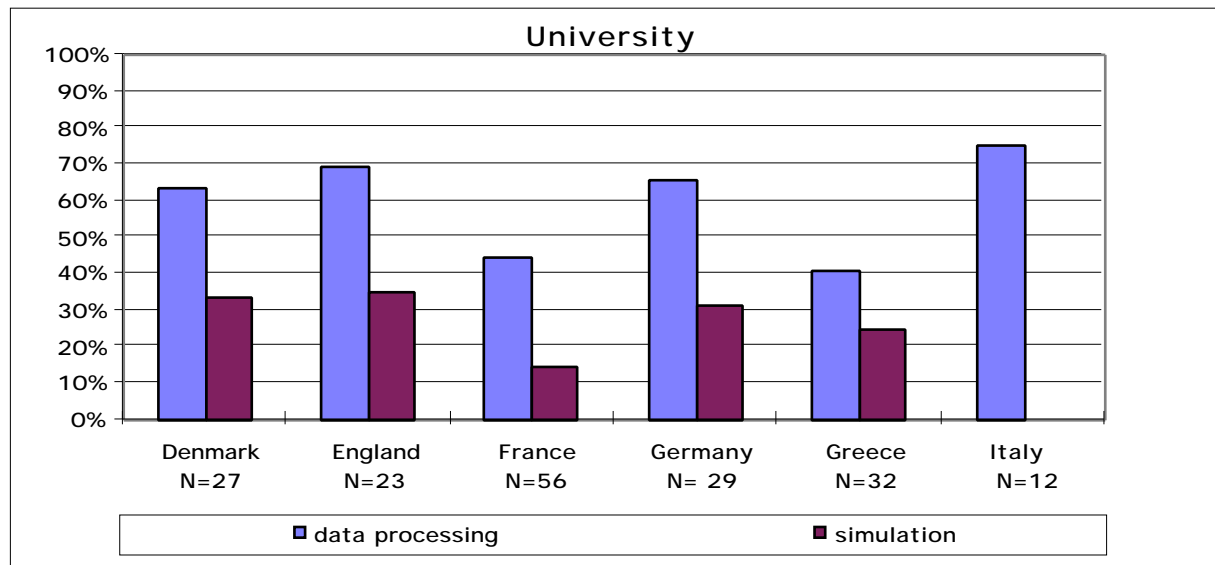


Figure 13: Uses of computer at university level

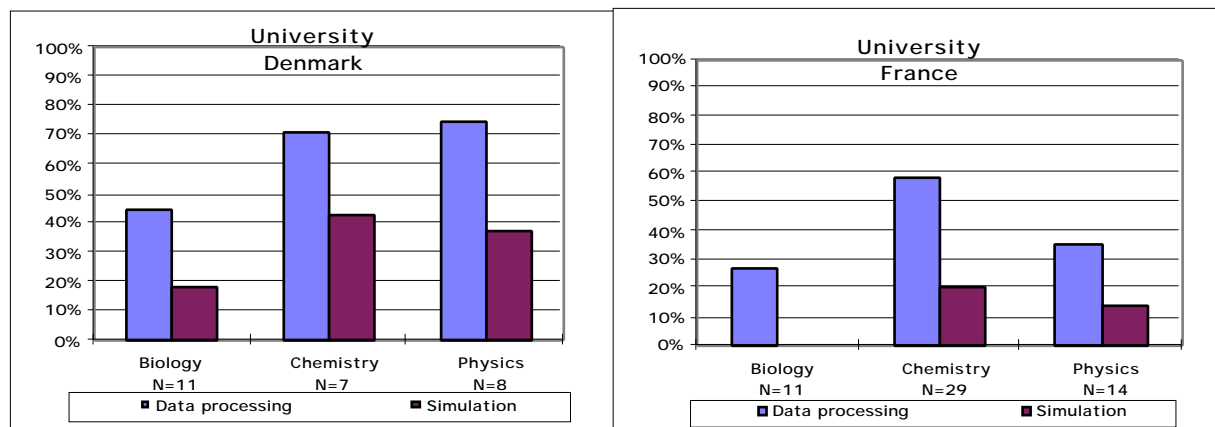


Figure 14: uses of computer at university level



### Comparison between secondary and university levels

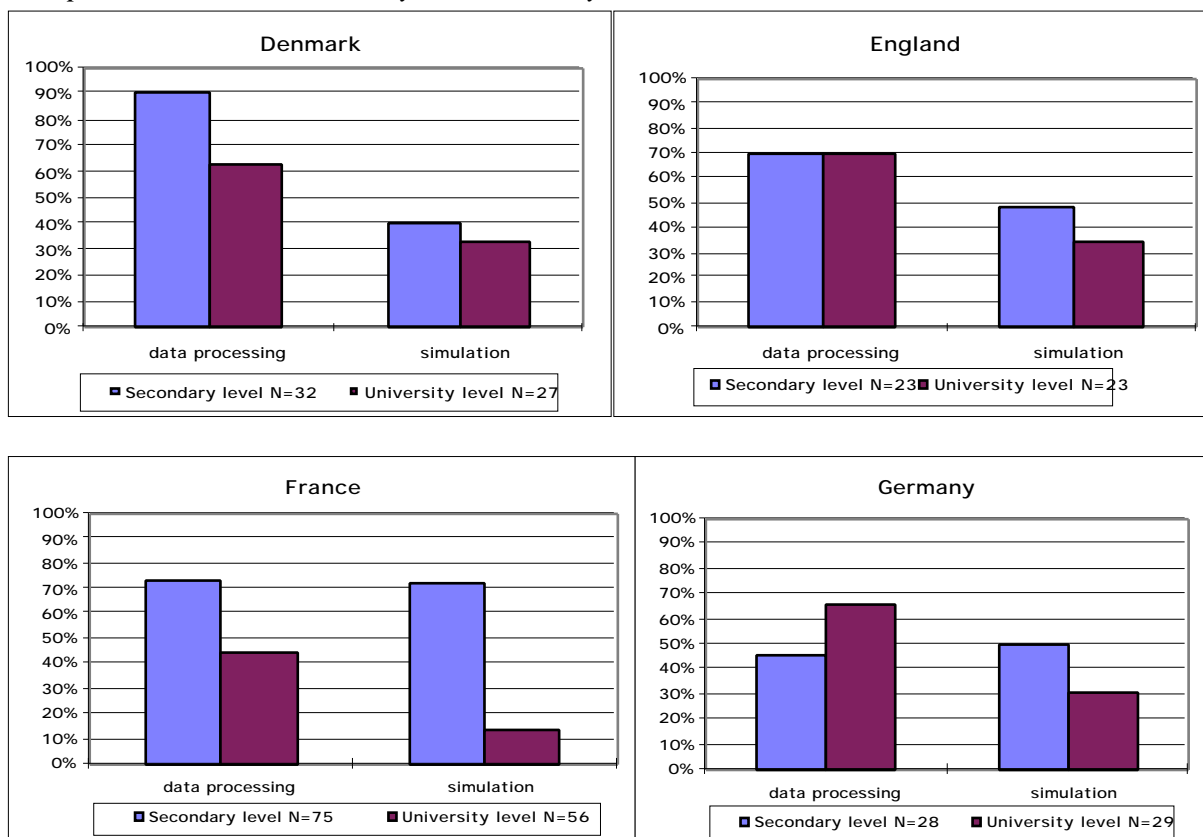


Figure 15: comparison between secondary and university levels of the computer use for data processing and simulation

The Figure 15 shows that at both levels, the computer is used more often for data processing than for simulation. And a same tendency in all countries appears for simulation: it is less used at university than at secondary school.

## 4 Labwork assessment

Five questions were dealing with the assessment.

### 4.1 Existence of assessment

A first question (Q12) was about the existence of an assessment during the labwork. At the upper secondary school level, the behaviour of Denmark, France, England and Germany seems very similar, labwork is assessed by more than 75 % except for Denmark at the first year of the upper secondary school. In Greece and Italy, the assessment seems a little less done particularly at the last year, this again is in coherence with the other results, since labwork is done only in specific schools or with teachers working with research groups.

At university level the question (Q12) was :

- For your named module, is the students' performance during labwork assessed?      Yes      No

Results are similar to those at secondary level , labwork is usually assessed (Table 8).

	N	Yes
Denmark	27	63%
France	56	73%
Germany	28	64%
England	20	90%
Greece	32	97%
Italy	11	82%

Table 8 : students' assessment during labwork

## 4.2 Aspects taken into account in the assessment

Two questions deals with these aspects

A question (Q13) asks for the aspects which are particularly taken into account by the teacher to assess the students.

13 If you assess your students, what proportion of the labwork assessment is based on each of the categories listed below? Please give your response as an estimated percentage.

- |  | <i>% of assessment</i> |
|--|------------------------|
| - From the observation of students during the labwork session..... | <input type="text"/>   |
| - From the experimental results obtained by the students .....     | <input type="text"/>   |
| - From reports written by the students.....                        | <input type="text"/>   |
| - other<br>(please specify .....                                   | <input type="text"/>   |

Another question (Q 14) informs about the aspects taken into account in the mark given to the reports.

14 This question is about different criteria for assessment.

a) When you grade a students report, is this report usually:

- |                        | <i>please tick one box</i> |
|------------------------|----------------------------|
| An oral report .....   | <input type="checkbox"/>   |
| A written report ..... | <input type="checkbox"/>   |
| Both .....             | <input type="checkbox"/>   |

b) When you grade a student's lab report, how do you weight the following criteria?  
Please classify in order of importance; 1 being the most important.

	<i>Please rank</i>
A precise description of the way the investigation was performed.....	[ ]
Correct data acquisition .....	[ ]
Creative/original ideas (e.g. in modifying the question or the apparatus).....	[ ]
Detailed discussion of the quality of data (e.g. errors) .....	[ ]
Effective group work .....	[ ]
Thorough interpretation of the experimental results .....	[ ]
Other (very) important aspects..... Please Specify:	[ ]

*Upper secondary school level*

For all levels and disciplines, in Denmark, France, England and Germany the reports written by the students play a major role in the assessment. The observation of students activity is much less important. This item could be ambiguous because it could mean teacher's observation or the quality of students' observation. The first proposal was the intended meaning. The results for each year of the upper secondary school are very similar. We give in Figure 16 the case of the last year. This figure shows that in the countries where labwork is a general practice the written report is the base of assessment. Only for Greece the written report is less important than the observation of students.

Teachers were asked to give a percentage weighting for each of the proposed assessment criteria. To give a more general idea of teachers answers, we chose to re-code the answers given by teachers as following. The mean values given by the diagram are calculated from the re-coded variables.

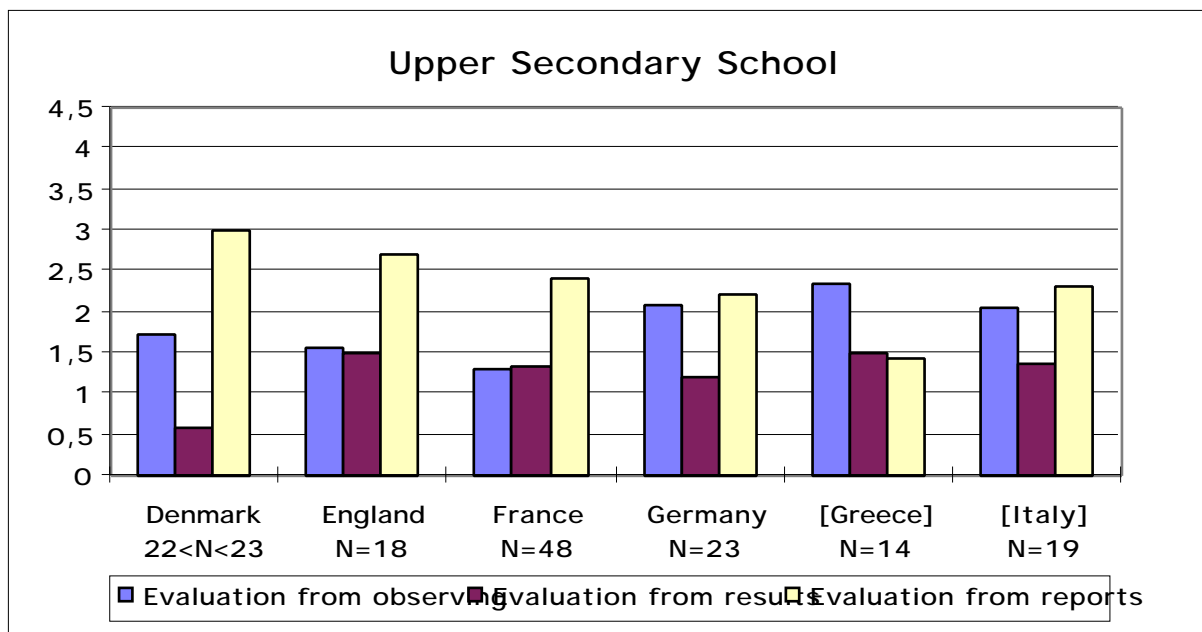


Figure 16 : Teachers' choice on the elements on which their evaluation is based for the last year of the upper secondary school for all disciplines

The mean is calculated from the re-coded values :

Initial value given by the teacher	→ re-coded value
0 %	0
1 to 20 %	1
20 to 40 %	2
40 to 60 %	3
60 to 80 %	4
80 to 100 %	5

The results concerning the importance of the oral or written report are similar for all disciplines. Concerning the countries a difference appears particularly for Germany and also for Greece, the teachers grade from an oral and written report whereas for Denmark, France, England, Italy it is only for a written report.

## Upper secondary school level



N= Denmark :32; France: 75; Germany: 28; England: 23; Greece: 33; Italy: 27.

Figure 17: Teachers' choices for five criteria of labwork assessment at the last level of secondary school (Q14): the first and second choices, the third, fourth, five choices and the sixth and seven choices were put together (seven items had to be ordered).

The percentage are calculated on the number of questionnaires by country

Concerning the criteria used for labwork assessment (part b of the question), Figure 17 shows the results. In Denmark, France, England "thorough interpretation of experimental results" is an important aspect. In Germany it is less important and in Greece and Italy much less. The effective work group seems not important at all in the assessment, and the creative ideas seems important only for some teachers in Denmark, Germany, England and Greece, and for much fewer number of teachers in France. *Consequently "thorough interpretation of the experimental results" is the main aspect considered by teachers in the evaluation in most of the countries and for most of the disciplines.* This strong common tendency is associated to differences between countries. In particular, in England, for physics the evaluation of the correct data acquisition is more taken into account than the other items. Creative or original ideas does not play a major role in the assessment, particularly in France (about no first or

second choice), however particularly in Denmark but also in Germany and England, creative ideas can have the first role.

### University level

At this level also, labwork is mainly assessed from written report, in all countries (Figure 18).

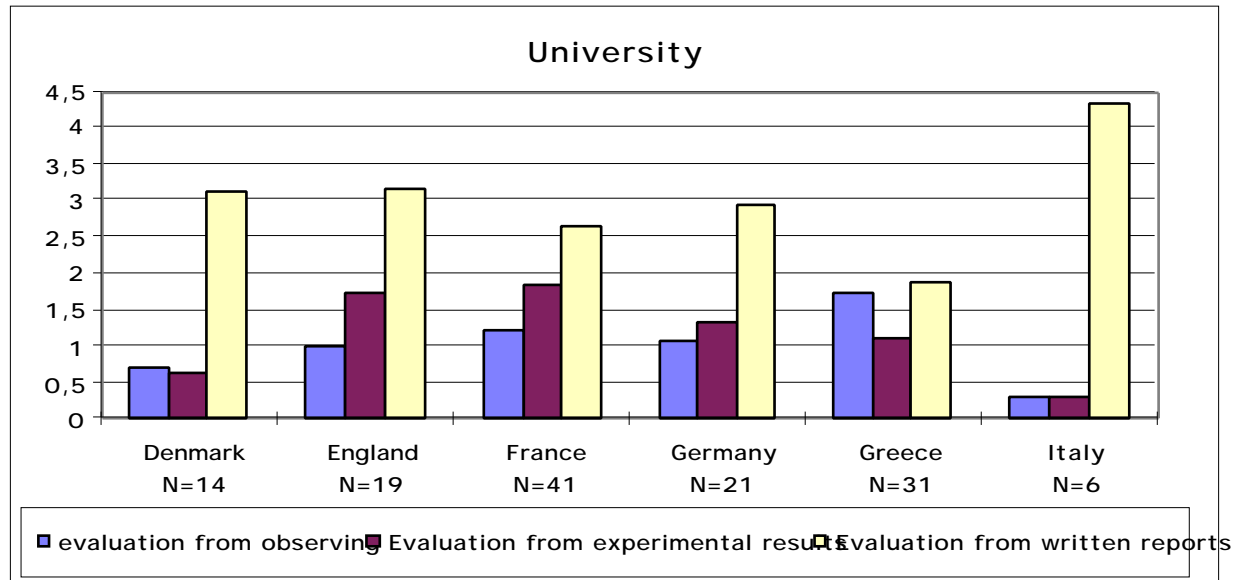


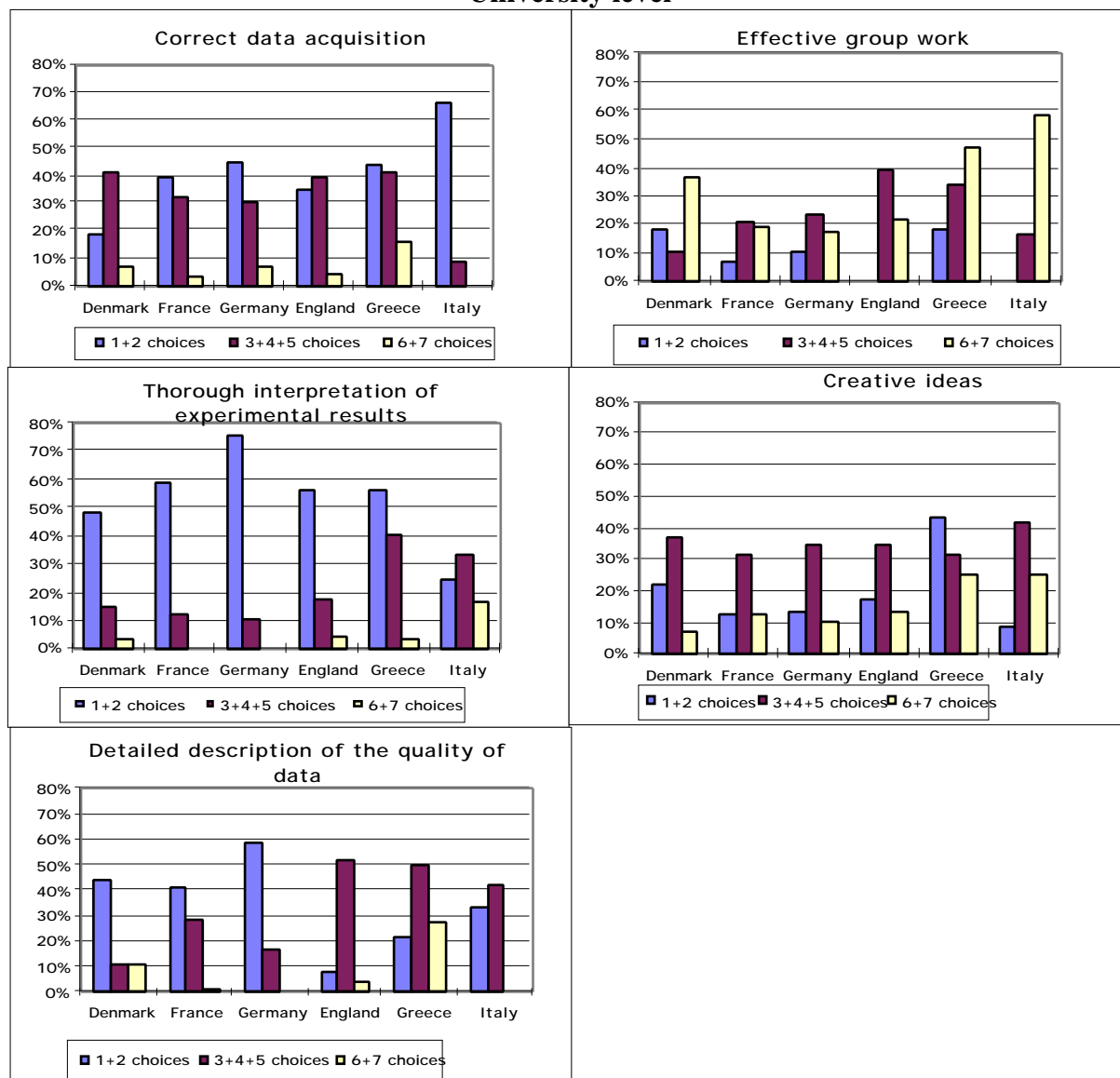
Figure 18 : Teachers' choice on the elements on which their evaluation is based for all disciplines (N is the maximum number of answers)

The mean is calculated from the re-coded values :

Initial value given by the teacher	→ re-coded value
0 %	0
1 to 20 %	1
20 to 40 %	2
40 to 60 %	3
60 to 80 %	4
80 to 100 %	5

Figure 19 shows that very similar results to those at secondary level. "Thorough interpretation of data" is the most important aspect for the assessment in all countries except for Italy where correct data acquisition is taken into account and also a detailed description of the quality of data even if it is in a less extent.

## University level



N= Denmark: 27, France: 56; Germany: 29; England: 23; Greece: 32; Italy: 12

Figure 19: Teachers' choices for five criteria of labwork assessment at university level (seven items had to be ordered)

Then at both levels, *the thorough interpretation of the experimental results is the main aspect* the teachers say that they take it into account in the evaluation, in most of the countries and for most of the disciplines. Also, the *effective group work* does not appear as very important, it is the only item which is chosen the more frequently as the last choice in several countries. Differences appear concerning the correct data acquisition and the detailed description of the quality of data. These aspects correspond either to a first choice or to an intermediate choice but very rarely as the last choice. This result is confirmed by the analysis of the labwork sheets concerning the teachers' objectives. The creative ideas are most of the time taken as a second choice, but the importance in the assessment vary according to the country.

### 4.3 Role of labwork assessment toward the final mark

It is well known that the aspects of the taught discipline which contribute to the final mark strongly influence the teaching content all along the year. This is why a question was specifically dealing with this point.

15 Does assessed labwork count towards the final mark/grade?

	year 1	year 2	year 3
Yes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
No	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

*Upper secondary school level*

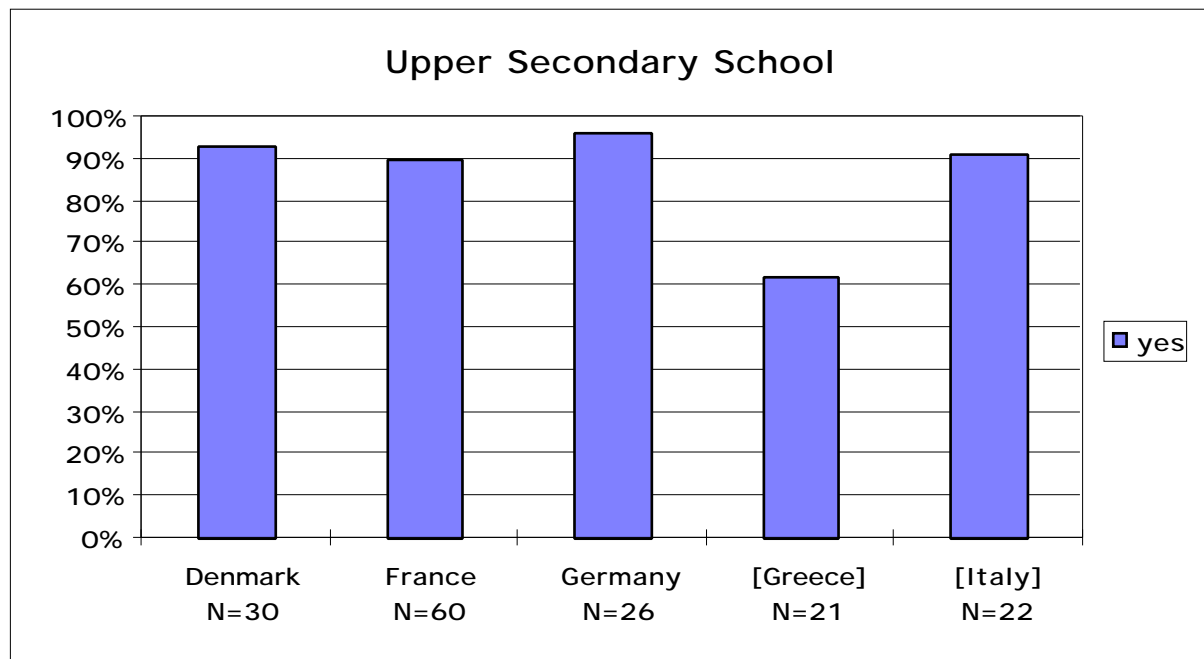


Figure 20: Importance of labwork assessment in the final mark at the last year of the upper secondary school (the question for England was different)

This result confirms the importance given by the teachers who filled the questionnaire to labwork even if, except in England, the regular labwork assessment is not officially involved in the final evaluation.

*University level*

The situation is more contrasted at university level (Figure 21); Denmark and Germany seem having different practices: labwork assessment is much less important than in England, France, Greece, and Italy.



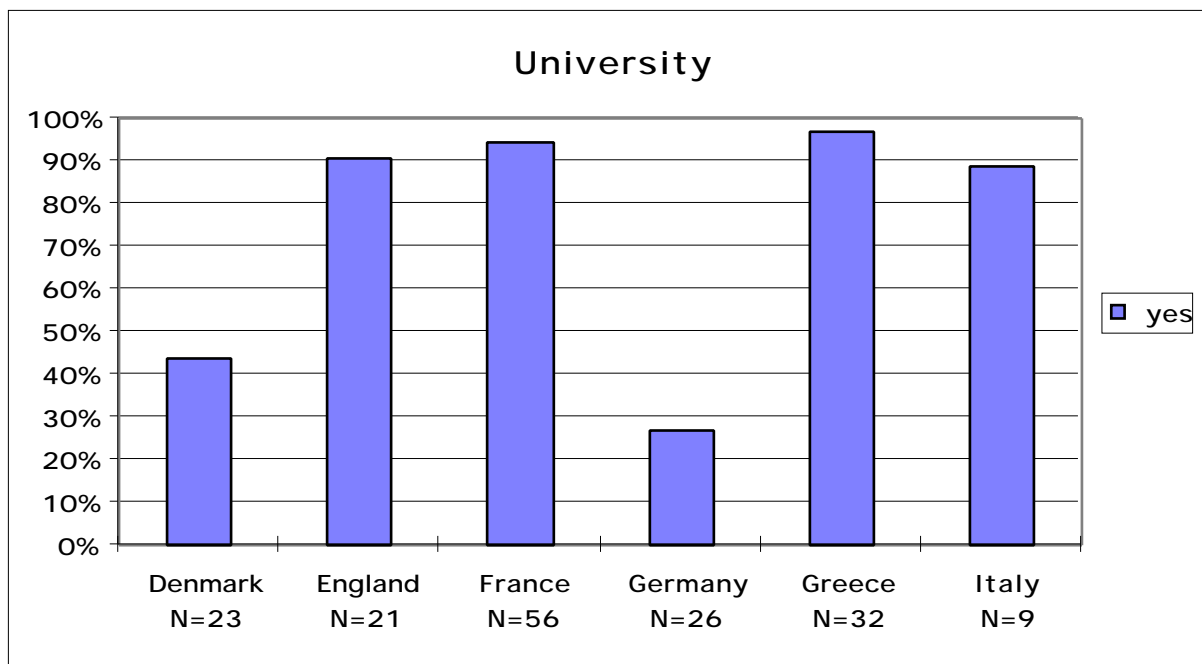


Figure 21: Importance of labwork assessment in the final mark/grade

## 5 Importance of demonstrations

Demonstrations are a facet of the experimental aspect of science teaching and can have a complementary role to that of labwork.

5 How often did you use demonstrations in your teaching?

*Please tick one box per year for your general subject area*

*	1st year			2nd year		
	ph	ch	bi	ph	ch	bi
- every session	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
- every other session	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
- every fourth session	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
- less than every fourth session	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
- not at all	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

### *Upper secondary school level*

For this question it appears a difference between countries. In Denmark few teachers practice demonstration even in biology some use them every four sessions. Germany is in opposite situation, demonstration seem to be a more common practice. Moreover there are difference between disciplines, in biology the demonstration would be less used than in physics mainly in Germany (Figure 22). In physics the demonstrations are practised mainly every two session even more by some teachers. Then demonstration is not a replacement for labwork, for example in England and France where labwork is very regular, demonstrations are also frequently used.

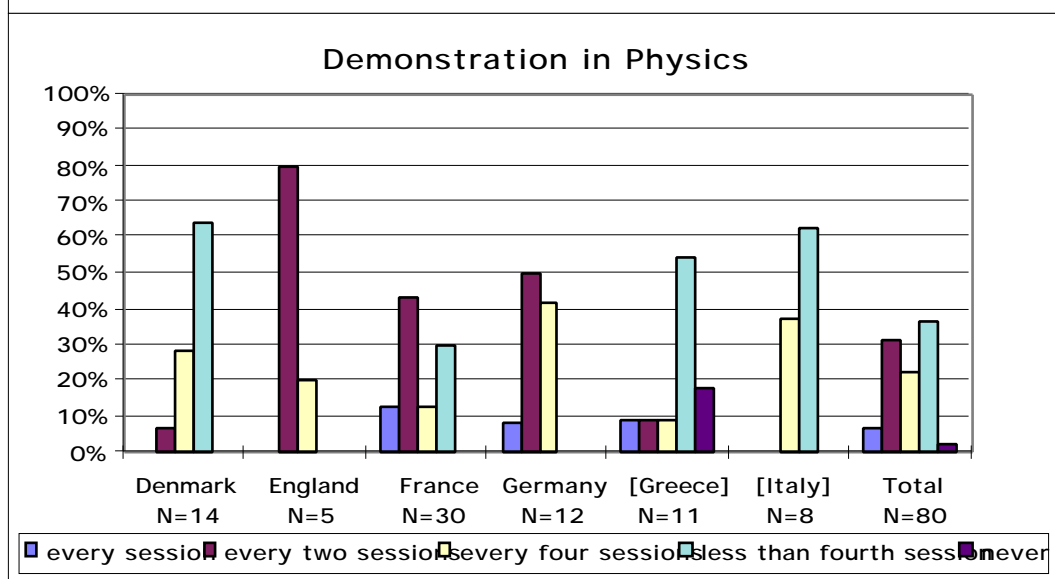
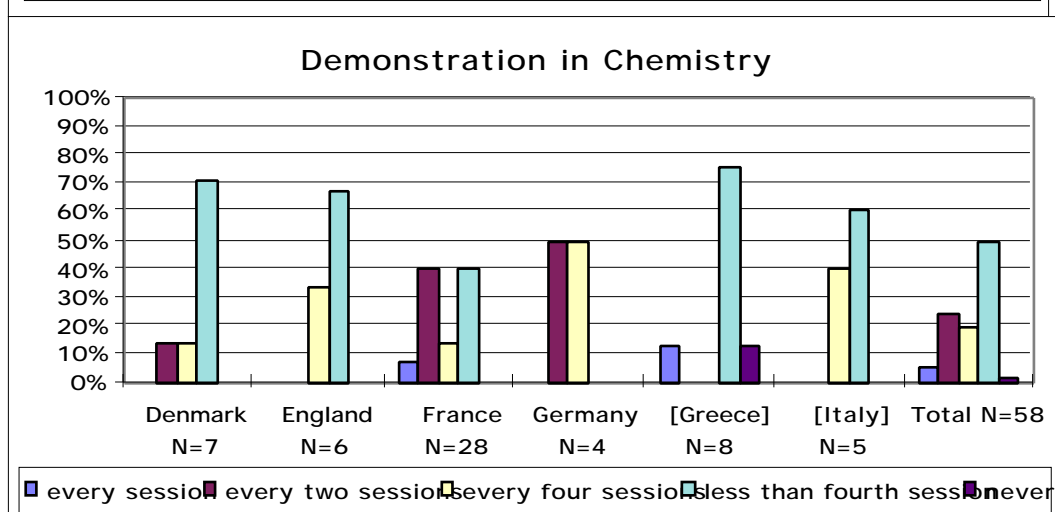
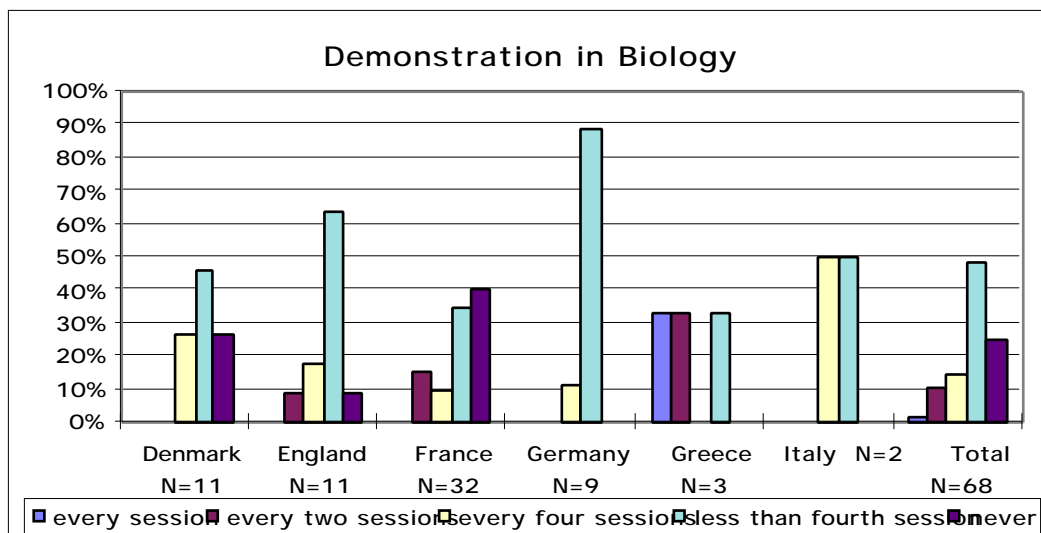


Figure 22 : Frequency of use of demonstration for the last level of upper secondary school

The percentages corresponds to the number of choices on the number of answers by country for each discipline (this number is given on the horizontal axe with the country). For France, physics and chemistry teachers are the same and then same results are presented for Chemistry and for Physics.

*University level*

Concerning the demonstration, that is experiment during lectures, the results to this question (5) do not give a strong tendency, it would seem that the demonstration are not very frequent.

## 6 Teachers' preparation of labwork

A single question (Q 10) dealt with the source of the teachers' labwork design.

10 - *You usually choose experiments for labwork that come from :*

*Please tick one box for each source*

	frequently	occasionally	never
- initial training.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
- your personal teaching experience .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
- your in service training .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
- your own initiative .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
- collectives files held in your department .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
- specialist journals.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
- specialised journals.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
- students textbooks .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
- teachers textbooks .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
- the Internet .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
- other, please specify .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
.....			
..You do not have the possibility to select or design labwork		<input type="checkbox"/>	

*Upper secondary school level*

The main results show :

- A strong tendency, around 80 % or more of the teachers of all countries do not use Internet. However, in England 20% of the teachers who filled the questionnaire use Internet frequently or occasionally, in Denmark 12%, in France 9%.
- A difference between countries concerning the initial training, its role seems more important in France and in Greece. In Denmark and Germany more that 40% of the teachers consider that it never plays a role and around 50% its role is occasionally.
- The role of the personal experience for a majority of teachers in all countries (note that in Germany this item was no proposed).
- The role of teachers' own initiative.

Among the documents, the practice depends on the countries. For example, in England collective documents (57% frequently) seem a more important source than the others and in

Denmark students' textbooks (52% frequently) seems an important source. Except the specialised textbooks which are never used by between 35 and 50% of the Danish, French, and Greek teachers, the diverse documents are used frequently or occasionally.

### *University level*

The number of proposed items was lower than at secondary school level, in particular "the Internet" and " You do not have the possibility to select or design labwork" are not included.

The main results show:

- a majority of teachers choose the labwork from their own initiative or from collective documents. Specialised journals students' and teachers textbooks are used occasionally by about half or the teachers who give an answer. It appears a rather large source of labwork design. There is not strong tendency concerning the difference between countries.

## **7 Conditions of labwork**

Two questions (Q 17 and Q 18) deal with the attitude of teachers on the conditions in which they can perform labwork. Only at upper secondary school level the results are meaningful; at university level, these questions have not been used in all countries and few people answered this question.

17 How would you describe the equipment you use for labwork, in terms of quality and quantity ?

	in biology/geology	in chemistry	in physics
- Very satisfactory	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
- Satisfactory	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
- Not very satisfactory	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
- Not satisfactory	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

It appears a similar result according to the countries where labwork is regularly practised (in Italy and Greece only specific schools' teachers were involved) and to the discipline. Around 60% of the teachers who answered this question were satisfactory, no difference between discipline appears. In other terms it means that around 30% of the teachers are not satisfactory (Figure 23).

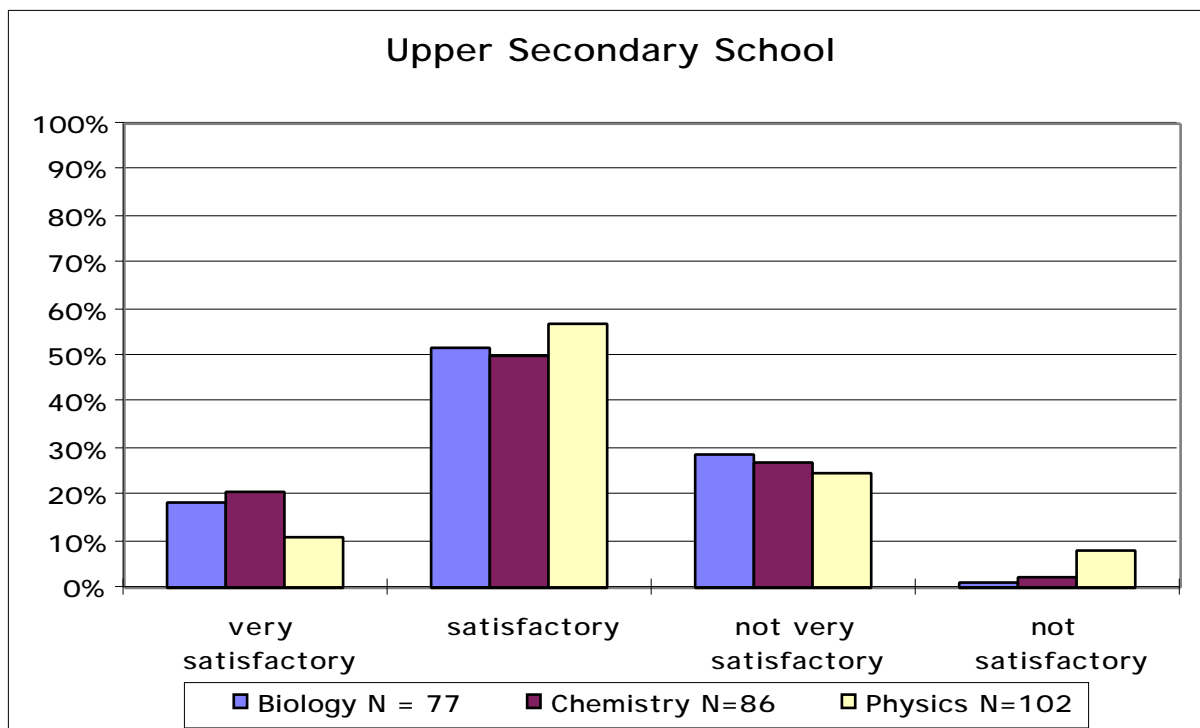


Figure 23: Teachers' judgement about the available equipment

The following question concerns teachers' view about the factors that would discourage to practice labwork. It was only asked at secondary level.

18 Which of the following factors would discourage you from labwork ?

Please classify in order of importance ; 1 being the most significant factor, then 2, then 3...

- Your school is not satisfactorily equipped for labwork
- Experiments need time for preparation
- Experiments take a lot of time and there are curriculum restrictions and pressure on time
- Experiments do not always work
- There is a lack of new technologies in our department
- I haven't been trained to teach labwork
- Labwork is a waste of time
- Labwork is not assessed
- Other reason (please explain below)

The factors which seem important for teachers are:

- the equipment to carry out experiment, and
- the necessity of time.

These two items are more often put as the first reason in all countries (table 11).

### Equipment is not sufficient

	Denmark	France	Germany	England	Greece	Italy	Total
N	32	75	28	23	33	27	218
N valid	29	70	28	20	32	21	200
Average *	4	4	2	3	3	3	3
Mode **	1	1	1	1	1	1	1

Experiments need time to carry out							
	Denmark	France	Germany	England	Greece	Italy	Total
N	32	75	28	23	33	27	218
N valid	29	70	28	21	32	21	201
Mean *	4	3	2	3	3	3	3
Mode **	1	1	1	1	1	1	1

Table 9: Importance of reasons which would be discouraging to carry out experiments.

\* the mean is calculated by giving a number from 1 to 9 to the order of choice, 1 being the first choice

\*\*Mode corresponds to the most frequent choice

The aspects considered as not important by a majority of teachers to carry out labwork (these aspects are those for which mode 9 (which means the last choice) is the most frequent for all countries) are :

- experiment do not work,
- teachers' training,
- the experimental activities are lost time,
- the experimental activities do not intervene in the assessment.

Here again a similar behaviour appears whatever the country and the discipline. The material conditions of labwork give also similar main tendency whatever the countries and the disciplines.

The other items are differently considered according to the country.

The two items "experiments need time to prepare" and " there is not enough technologies" have about the same profile. They are rejected by a majority of French and Danish teachers and put as second choice by a majority of Greek and Italian teachers (first item) and Greek and English teachers (second item), third choice by German teachers (both items) and fourth by English (first item).

## Conclusion

In summary, several common characteristics of labwork practice appear at university and secondary school:

- most of the time, students are in small groups with experiments to carry out according to teachers' instruction;
- the written report plays the main role in the assessment;
- the main common aspect which is evaluated is the "thorough interpretation of results" whereas effective work group is not taken into account;
- if computer is used, this is mainly for data processing.

Moreover, labwork seems important for teachers if we consider the role they give to it in the final mark.

In addition to these common characteristics, it is interesting to consider the characteristics of types of labwork which are less frequent.

- The open-ended labwork appears in some countries even if it is less frequent than the typical one. At secondary level the situation is homogeneous among the countries (among 10-15% of the labwork sessions), whereas at university there is more diversity, the two extremes being Denmark (around 20%) and France (around 5%).
- The use of CD-ROM or Internet seems very rare.

However, there are some differences between levels, disciplines and countries.

First a common aspect of secondary school practice very likely related to school organisation is the strong link between lecture (theory) and labwork; at university level in France, England and Germany the links seem much more weaker whereas in Denmark, Greece and Italy they still exist.

At a more specific level of teachers' practice, for example concerning the type of computer interfaces and the frequency of demonstration, different behaviours appear particularly at secondary level. In France most of the teachers use a commercial interface, in the other countries the personal interface is more frequent. Demonstrations seem more frequent in physics than in biology, chemistry being in between. Moreover demonstrations are practised by teachers who use regular labwork like in England, and France, but also by teachers who, very likely, practice labwork less frequently like in Germany.

Therefore, the labwork practice is not so different from one country to another or from a discipline to another. Particularly at secondary school level where, as it is presented in the part 1, the teaching organisations are rather different, this similarity in labwork practice may seem surprising. In another words, when the analysis investigates a practice, without going to individual differences, the labwork practice presents several similar main characteristics. Could we say that there is an international and implicit paradigm of what a labwork should be? If the answer is positive, any action aiming to improve labwork at a large scale should take into account that the current practice is deeply anchored.

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