Physics education in Europe

a survey

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PHYSICS EDUCATION IN EUROPE: A SURVEY

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SUMMARY

We have done a survey about physics education in secondary schools in 15 European countries, with the emphasis on the upper classes of pre-university schools. Our aim was to gather information showing differences and similarities in the purposes, contents, and ways of physics teaching.

We prepared a questionnaire based on the Didactical Model of De Corte et al., and sent it out through regular mail to 60 people in 16 European countries. Most of them are physics educators working at educational departments of universities. Some others are physics teachers in secondary schools, strongly interested in education.

Similarities and differences between countries (and even between schools within a country) were found regarding subjects like: Class sizes, teacher training courses, numbers of hours a week teachers teach, contents of textbooks and syllabuses, the amount and structure of experimental work, use of (profemale) contexts, and organisation of final examinations. The reader is referred to the section **conclusions** which contains the major results of our research.

CONTENTS

INTRODUCTION

With the progressive European unification more and more links among different countries are forming. The economical system applies for professionals who can follow the work in the companies' branches in all the European countries, and therefore the number of people working abroad is increasing. Different cultures and educational systems are interacting more often than in the past (just think how easy it is to cross the borders of ex-communist countries nowadays, compared to some years ago); The school system, responsible for the future citizens' education, must become adequate to the pressing requirements of cultural integration. There are actually some projects favouring students interested in studying abroad. In order to accomplish this task it is not enough that degrees are recognized in a foreign country: The teaching and the educational systems must have similar characteristics in different countries as well.

The purpose of this study is to have a survey about physics education in secondary schools in many European countries, with the emphasis on the upper classes of pre-university schools, where pupils can receive a basic knowledge for further studies, and where potential new physicists are formed. These are usually the classes where students begin to know what Physics is and have to make a choice on whether or not they want to deepen their knowledge of this subject. In these times, where physics teaching is changing more or less swiftly in most European countries, the aim of this project is to gather information showing differences and similarities in the purposes, contents, and way of teaching. Furthermore, we hope to get an idea of the effect of any possible cultural motivations that may play a role.

STRUCTURE OF THE RESEARCH

In 1970 the International Association for the Evaluation of Educational Achievement (IEA) [1] investigated about the contents and outcomes of the curricula of several scientific subjects, physics included. In the eighties, the Second International Science Study [2] organised a new research on scientific education at primary and secondary schools, with tests and questionnaires for students, teachers, and schools. But at this moment there is no complete survey about the contents of the physics syllabi and the art of teaching: How are teachers prepared for their job? What and how do they teach? What are the aims of the physics education? What is the physics background before going to the university (contents and studying methodologies)? How can we increase pupils' interest for physics? Is the physics teaching related to society, technology, or science in general? How does the government help and coordinate schools and teachers in the organisation of their job? Are pupils learning to think for themselves in physics, looking for solutions of problems, or organising experiments by themselves? Does the school teach pupils a way to interpret reality?

Writing the questionnaire we had to make some choices: There are a lot of interesting good questions and deciding for some of them we utilized our personal opinion about why it is important to teach physics at the secondary school.

We have many different reasons to believe that physics research is very important and we think most physicists also have an affective link with it because they have spent or are spending a lot of time in it. So from the secondary school we would like for the most gifted students to be prepared and directed to further studies, in

order to become good physicists. Does the educational system give pupils all there is in order to reach that goal? Our research starts from the basic education to see what pupils are learning and by which parameters they can decide about the studying path they want to follow. This is the general reason of the questions. Many of them have been written starting from some findings of the above mentioned SISS research: It was checked that physics achievement is higher:

- For male students than for female students;
- For students with a high interest and positive attitudes towards physics;
- If there are centrally determined examinations or other assessment procedures;
- If teachers belong to professional associations;
- If teachers have positive attitudes towards physics;
- If teachers have experience in professional or technical occupations other than teaching;
- If students have access to hand calculators and/or computing equipment;
- In classes where teachers emphasize the application of concepts to everyday phenomena;
- In cases where teaching methods make provision for individual differences in learning rates and styles.

Furthermore, physics achievement is positively correlated with:

- The experience, the total number of years of post-secondary education, the amount and recency of in-service education of teachers (up to a threshold level, after which there is no correlation);
- The time spent at home by the teachers on the preparation of lessons and the marking of assigned student work;
- The time spent on physics in the classroom;
- The amount of physics class time spent on practical and investigative activities;
- The time spent on homework and on physics related out-of-school activities (?);
- The availability of appropriate equipment and supplies for laboratory and field activities;
- The availability of textbooks;
- The extent to which teachers perceive that they have freedom to determine the contents of their curricula and the methods of teaching to be used;
- The perception by students of the importance of physics.

We will go deeper into the connections between these ideas and the questions in the ***results section*** of this report.

The structure of the questionnaire prepared at the Physics Educational Department, Eindhoven University of Technology, is based on the Didactical Method of De Corte et al..

DIDACTICAL MODEL OF DE CORTE ET AL. (1982)

Didactical models, which are used in didactics, describe the essential components of didactical actions that (can) play a role during preparation, execution, and evaluation of either an educational program, a concrete lesson, or an educational method, as well as the relations between these components. The Didactical Model of De Corte et al. is a widely used example. De Corte has identified four main components in the art of teaching (see figure 1):

- Purposes;
- Starting point;
- Educational process;
- Evaluation.

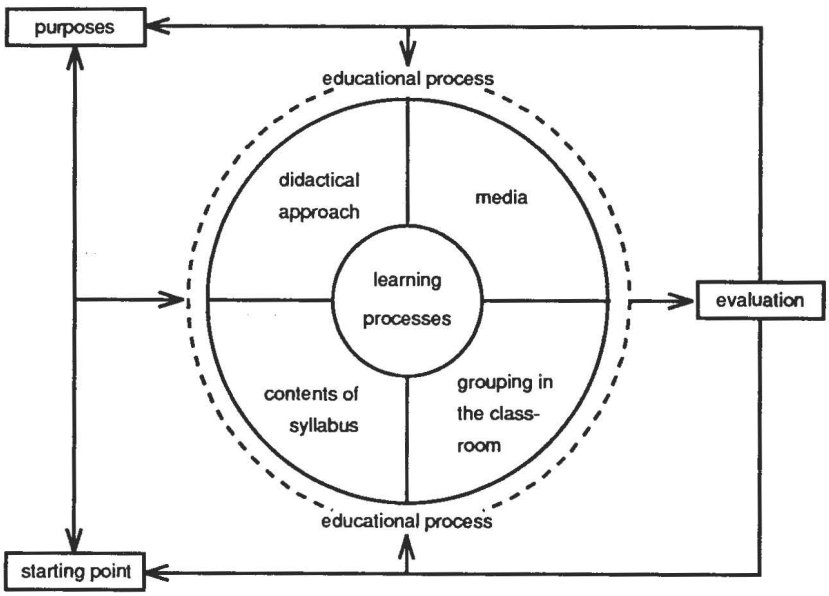

Fig.1: Didactical model of De Corte et al. (1982)

The educator first has to ask himself what are the ***purposes*** of education: Which information he wants to give to pupils, which skills he wants to develop in them, how he wants to modify their knowledge, their behaviour, and their thoughts. This is a great responsibility, therefore it is important that the educator knows many things about his pupils: What is their age, their culture, their physics and mathematics background? What are motivations and hopes of their study? We call this situation ***starting point***. Having a deep knowledge about these two points, the teacher can analyze the means at his disposal in order to organize the ***educational process***.

The cognitive process in pupils' mind is conditioned by the ***didactical approach***, the ***media***, the ***grouping in the classroom***, and the ***contents of the syllabus***. These components are related because they influence each other: For example, the organisation of the lessons must consider the interactions among pupils in the classroom, and the subjects we want to teach them determine the media used in the lessons (textbooks, equipments, video, slices, newspapers, ...).

By analysing the evolution of physics education in the secondary school in some countries, one can notice that everybody is trying to stimulate the pupils' interest in physics: More and more attention is given to practical work and to physics applications in society. This can help also for a better understanding of theoretical concepts. This is the reason we have included in the questionnaire the sections ***practical experience*** and ***context***.

In the examination at the end of the secondary school, pupils have to show that they have acquired the required knowledge and skills. This is the ***evaluation*** of their learning and of the educational process: In order to understand if it is valid or not it is important to compare at the end purposes and starting point.

The model doesn't represent an unchangeable process; The arrows in it mean that there is a mutual interaction between two connected components.

METHODOLOGY OF THE RESEARCH

There are several techniques that can be used in an investigation to collect information. We have decided to use a questionnaire because it allows us to reach people in different countries by mail. Unfortunately, with this approach it is not possible to clarify unclear responses or to gather additional data if the given answers are insufficient, so it is very important to make good and clear questions.

We have tried to prepare a simple questionnaire, not too long, because in that case, we thought, we would receive more responses. The respondents had to give the correct answer by choosing out of five alternatives. Some questions apply for an objective answer, based on the situation of the physics education in each country; Others ask for the individual opinion, hopefully enabling us to look for possible correlations among different opinions and the culture of the country where the respondent lives. The use of a 5-point scale enabled us to do statistical analysis on the data. We used the statistical software-package SPSS/PC+. Some of its features: Calculation of means, standard deviations, medians, and (cross-)correlations. The questionnaire itself is contained in appendix 1.

The questionnaires were sent away at the end of april 1995, to sixty people in sixteen different European countries. Most of them are physics educators working at educational departments of universities. Some others are physics teachers in secondary schools, strongly interested in education (In the past they participated in international conferences on education).

A month later, we had only received around 25% of the questionnaires, which was too low a number. We'd hoped that we'd get at least 50%.
We then thought of two other possibilities to try and get more respondents. One was to send e-mail to certain newsgroups on the internet and request help. We found 6 newsgroups that were more or less appropriate: alt.education.research, bit.listserv.physhare, misc.education, misc.education.science, sci.physics, and science.edu. The other possibility was to pick names from [3] and send them e-mail. Using this directory, we selected 33 people and sent them an e-mail. The result of both these efforts were minimal: Only two additional questionnaires were obtained.

The deadline was set at around early july. We did receive one or two additional questionnaires after this deadline, but these were not processed.

RESULTS

0. Introduction

Table 1 shows a list of the European countries involved in the research, together with the number of respondents from each country.

Country	q_1 (q_0)	e_1 (e_0)	Country	q_1 (q_0)	e_1 (e_0)
Austria	0 (0)	1 (1)	Netherlands	1 (1)	0 (0)
Belgium	1 (1)	1 (1)	Norway	1 (4)	0 (0)
Czech Rep.	1 (1)	0 (0)	Poland	3 (7)	0 (0)
Finland	1 (2)	0 (0)	Portugal	3 (7)	0 (0)
Germany	1 (2)	0 (6)	Slovenia	1 (3)	0 (0)
Great Britain	6 (7)	0 (0)	Spain	3 (5)	0 (1)
Hungary	1 (2)	0 (6)	Sweden	5 (7)	0 (0)
Italy	1 (6)	0 (6)			

Table 1: The examined European countries. q_1: The number of returned questionnaires. q_0: The number of questionnaires that were sent out through regular mail. e_1: The number of respondents through e-mail, either replying to direct e-mail, or reacting upon our request in certain newsgroups on usenet. e_0: The number of direct e-mails that were sent out and did not bounce (33 e-mails were sent out in total; 13 of them bounced, either because the address doesn't exist anymore, or the address printed in [3] is not correct).

Countries where we don't have any respondents from are Bulgaria, Croatia, Denmark, France, Greece, Iceland, Ireland, Luxemburg, Romania, Russia, Slovakia, and Switzerland.

In the following sections, please keep in mind that the given answers in a certain questionnaire do not necessarily represent the situation in that country. For example, it is possible that rules, etc. at one school differ from those at another school. Furthermore, there are a few countries in which the educational system is currently undergoing changes, which makes it difficult to answer certain questions. Nevertheless, we will assume that answers given in a certain questionnaire will hold for the country the respondent lives in. In cases of multiple respondents from a certain country, we can of course compare answers.

In the following sections, the obtained data is discussed. We will follow the division made in the questionnaire. In several cases, average scores and standard deviations were calculated. Cross-correlation calculations were also done, but supplied no sensible results. That is the reason why they are not mentioned anywhere. The abbreviation a.s. is used for average score, and σ_n for the standard deviation. The questionnaire itself is contained in appendix 1. The data (i.e. the answers given by the respondents) are contained in appendix 2.

1. Starting point

In many of the examined countries, pupils are not taught **physics at primary schools**, neither in the shape of physics, nor in the shape of science (**1.1**). For example in Norway, Finland, and the Netherlands, (practically) no physics is taught, whereas in the U.K., it's included in the national curriculum. In other countries, it's often optional for the schools.

In none of the examined countries do pupils have to make a **choice for physics** before the age of fourteen (**1.2**). In some countries (Austria, Belgium, Hungary), physics is compulsory in secondary school, and the only possible choice concerns the number of hours of physics lessons a week (Belgium, Hungary). The Polish educational system is apparently undergoing changes, and in the near future pupils will be allowed to make a choice on whether or not to study physics in the upper classes of secondary schools.

One might expect that pupils who get their first physics education at younger ages and don't have to make a choice for physics at too young an age, will have **a good idea about physics** once they get to make that choice. And indeed (**1.3**), this seems to be the case for certain countries (Czech Republic, Hungary, Slovenia). There aren't any major exceptions. Spain might be considered to be a minor exception. Three respondents (Belgium, Spain, Finland) gave a minimum score (0) to question **1.3**. Keep in mind though that answers to this question are of a subjective nature.

The answer to question **1.5** (*"In your country, is physics an attractive subject in pupils' opinion?"*) is, on average, rather low (a.s.=1.30; σ_n=0.92), with an (average) maximum score of 3 only in Hungary, Italy, and Norway. Five respondents awarded the minimum score (0) to that question, namely: Czech Republic, Spain, Sweden, Finland, and the U.K.. Possible reasons for this low average score might be the level of abstraction of physics (especially in the upper classes), the level of difficulty, and the general status of the subject. Other possible (but somewhat far-fetched) reasons might be some teachers' incapacity to transmit to the pupils their love and passion for physics, whereas others may lack this passion altogether.

2. Purposes

If the syllabus contains detailed information about contents, purposes, and way of teaching, teachers can use it as a guide to follow. For them it is good to have such kind of help. At the same time it is important to leave teachers some freedom for fitting the structure of the lessons to pupils' characteristics and requirements. These can be very different because of economical, geographical, social, and cultural reasons. For example, a boy living in a big city will not receive exactly the same education as a boy living in a little village.

Giving teachers this freedom will make them feel directly responsible for the pupils' education, which in turn can stimulate them in their work. Furthermore, the efficient organisation of university studies creates the need for a common syllabus: In order to avoid needless repetition of already acquired concepts for some students, or the lack of an adequate level of profundity of some others for that matter, it is necessary for the pupils' knowledge of physics to be as uniform as possible. Most of the examined countries do have a common, **government-issued syllabus** (**2.1**). Most of

these syllabi contain detailed to very **detailed lists of skills (2.2)**, whereas a fair amount of them also contain some **information for the teachers on how to reach their goals (2.3)**. Only in Belgium there is no such syllabus. According to one of the three Spanish respondents, this is also the case for Spain, but this assertion is contradicted by the other two respondents. The lack of a common syllabus containing a detailed list of skills can pose certain problems, for example to pupils (or teachers) who are considering to move to another country: For them it will be difficult to evaluate whether or not their knowledge and skills are adequate to study (or work) in that country. By the way, looking somewhat ahead of things, we can see that not only does Belgium lack a common syllabus, but also the **final examinations** are always arranged by the schools (teachers) themselves, and never by the government (**9.1.1** and **9.1.2**). This will only increase problems. Finally, low central co-ordination in Finland as well.

In the U.K. the educational process is changing rapidly. In order to reduce the teachers' disorientation in this difficult period, many guides and practical information about the lessons organisation, problems solving, and learning evaluation have been written for them (For example [4]). In Italy the situation is different: At this moment there is a central syllabus (very old), but it doesn't contain any guidelines for the teachers. Furthermore, there is no teacher training course (A university degree suffices). Therefore, in most cases, teachers don't have an adequate pedagogical and didactical knowledge (See also subsection *5. Teachers and teacher education*).

Question **2.4** ("***What are, in your opinion, important goals of physics education?***") lists 10 goals. "***Understanding***" (**2.4.1**) is, on average, considered to be the most important goal (a.s.=3.97; σ_n=0.19). "***Preparing for further education***" (**2.4.9**) is, on average, considered to be the least important goal (a.s.=2.7; σ_n=1.0). We can see that in general, none of the listed goals is considered to be unimportant: The minimum possible score (0) does not occur at all, and a score of 1 occurs only 11 times.

3. Structure of the lessons and the classrooms

The average **size of the classes (3.1)** varies from one country to another, and sometimes also from one school to another. In previous researches [2] it was found that, within an upper and lower threshold limit, there is no association between the size of the class and the physics achievement. The largest classes (over 30 pupils per class) are found in Hungary, Poland, Slovenia, and Spain. Schools in Belgium and Austria have the smallest classes (16-23 pupils per class). Within a particular country, the variation between schools is very little. The U.K. is the only exception, with schools ranging from 10-15 pupils per class, to over 30 pupils per class. The mean value for the entire population is 3.00 (σ_n:0.73), which is equivalent to 24-30 pupils per class. The larger the class-size, the more likely it is that the pupils' active participation in the lessons will be hampered. For the teacher on the other hand, it becomes more difficult to take into account everyone's exigencies, to keep the attention of the pupils, and to keep them under control.

As for the **structure of the lessons (3.2.1-3.2.5)**, in general, the ***teacher-focused form*** **(3.2.1.-3.2.3)** is the most dominant one. Average score is the highest for **3.2.1** ("***explaining problems and theories***"): 3.2 (σ_n=0.7). The ***pupil-directed form***, where each pupil studies by him/herself, with his/her own individual plan (**3.2.5**) is, on average, the least occuring form (a.s.=0.6; σ_n=0.8). Norway and the U.K. are exceptions: In these countries, the teacher-focused form is not dominant.

In order to become good physicists, pupils must learn to think for themselves; They must be curious, ask themselves the reason for the things they see in the world and look for the answer...But in most countries the only way to actively participate in the lessons is to **ask teachers questions** (**3.2.3**). Sometimes (Poland, Finland (1x), Spain (1x)) even this is not possible.

In general, of the two pupil-directed forms, **3.2.4** (***pupils working in small groups***) is more common than **3.2.5** (***pupils studying individually***). This is a good thing, since the future physicist will usually have to function in a co-operating group, and thus this will be a sort of 'training'. As we said before, in Great Britain the educational system is changing rapidly. Therefore we can expect that in the near future the structure of the lessons will change, giving pupils more importance and making them protagonist of the lessons.

One more reason why pupil-focused teaching in general is desirable, is to be more prepared for a study at universities: There, many students experience difficulties because the organisation of the study differs from the one in secondary school: Normally at the university they have to organise their study by themselves. Sometimes they have to study subjects by book that nobody explained to them. In the secondary school however, the teacher was always ready to lead them and they merely had to study a predetermined exact number of pages, sometimes without understanding the real theoretical background of a concept.

Homework (**3.4**) is nearly always given to pupils. Pupils in Austria and Portugal get little homework. In one of the cases, Spanish pupils don't get any homework at all. It would be interesting to know the reason for this: for example, we don't know how many hours a day pupils spend at school (and if they have the time to do homework).

One might assume the **use of computers in the physics lessons** to be more widespread in the (wealthier) west and north of Europe, compared to the (generally poorer) east and south of Europe. However, looking at the data (**3.5**), we can see that this does not seem to be the general rule: In Belgium, Germany, and Sweden, there's little to no use of computers, whereas in the Czech Republic, Italy, and Slovenia a fair amount of computers used in the lessons. A similar result is found for the **use of media** such as slides, film, and video (**3.6**): There's no clear distinction between the north and west of Europe and the east and south of Europe.

As for the **availability of equipment for the students to do practical work** (**3.7**), the general situation seems to be fairly good. There are a few exceptions, where availability is 0 (Finland) or low (Italy, Poland).

4. Teachers and teacher education

In all of the examined countries, a university degree is required in order to become a teacher. Additionally, a **teacher training course** is required in most countries (**4.1**). Exceptions are Hungary and Italy, where there is no specific teacher training course. As for the countries that do have a teacher training course, its length and organisation vary from one country to another. In some countries the course takes place *after* the physics study (Austria, Norway, Poland), whereas in other countries it takes place *during* the physics study. In some cases (Belgium, The Netherlands), the course consists of a part *within* the physics study, and a part *after* the physics study.

The length of the course varies from as low as 1-3 months (Poland, Spain

(1x)), to over 13 months (Germany, The Netherlands). In most cases, the teacher training course is 7-12 months.

As for the **specific subjects of the teacher training course (4.2)**, we can see that there is a difference in their shares. In all of the examined countries, ***training at schools* (2.4/2.5)**, widely regarded as essential, is part of the course. Mostly unpaid (pre-service training), but in some cases (Austria, Portugal, and Germany) paid (in-service training).

In most cases, all of the specific subjects listed in **2.1-2.7** are part of the course. The only exception seems to be Austria, where the course consists solely of paid training at schools.

Additional info on teacher training courses in European countries where we don't have any respondents from were found in [5]. They are listed below. Keep in mind though that this information is from 1989 at the latest, so some of it might not be up to date anymore.

Denmark:
- University degree required;
- 5 month additional post-university teacher training course. Subjects include: didactics, general pedagogy, and training at schools.

France:
- University degree required;
- Complex system of teacher training courses, varying in length (1 year and up) and qualification;

Greece:
- University degree required;
- No specific post-university teacher training course;
- Courses in pedagogy optional for students;
- 1- or 2-year refresher/updating courses available for experienced teachers.

Ireland:
- University degree required;
- 1-year post-university teacher training course comprising theoretical and practical subjects, as well as a training period at schools;
- Teacher training course qualifies for teaching certain other subjects besides physics;
- 1-year trial period for commencing teachers.

Luxemburg:
- University degree required (But since there are no universities in Luxemburg, this degree is to be acquired abroad);
- 3-year teacher training course. Subjects include: courses in educational theory, psychology, sociology, and didactics, and a training period at schools.

We can get an idea about the current validity of [5] by comparing the info in it on teacher training courses for the various countries to the data supplied by our respondents. The following seven countries are concerned:

The Netherlands:
The situation nowadays is the same as described in [5]: The teacher training courses are arranged by the universities, and consist of a 2-month part *within* the physics study, plus a 12-month part *after* the physics study. The latter part is unpaid (pre-

service), and consists of a 6-month theoretical part at the institute, and a 6-month training period (unpaid) at secondary schools.

Belgium:

The teacher training course takes place during and after the university study, and takes 1-2 years. Our two Belgian respondents spoke of 7-12 months (during and after the university study), and 4-6 months (after the university study).

Germany:

The teacher training course takes place during and after the university study. The post-university part ('Vorbereitungsdienst/Refendariat') takes 18-24 months and comprises training at schools and theoretical subjects. Our German respondent spoke of a post-university teacher training course which takes over 12 months.

Italy:

No teacher training course, but candidates have to do competitive examinations ('concorso abilitante'), in which they have to show that they have adequate knowledge of physics, education, and didactics. A 1-year trial period follows next. According to our Italian respondent, there is no specific teacher training course.

Portugal:

There are 2 ways to obtain a teaching degree:

a) A university study, specifically aimed at training for the teaching profession (5 years), or:

b) Training during a provisional appointment ('formacao em servico') (Indefinite duration). According to our two Portugese respondents, the teacher training course takes 7-12 months.

Spain:

A post-university teacher training course, with a 1-year duration, comprising theoretical subjects in didactics, psychology, pedagogy, and a training at schools. Our three Spanish respondents spoke of a teacher training course with a duration of 1-3 months (1x), and 4-6 months (2x).

U.K.:

Two ways to obtain a teaching degree:

a) A study on a so-called "college of higher education" (Duration 3-4 years) to get a 'Bachelor of Education' degree;

b) A university degree not specifically aimed at eduation, followed by a 1-year teacher training course comprising forming in didactics, educational subjects, and the subject(s) one wants to teach.

All of our six respondents from the U.K. speak of a teacher training course with a duration of 7-12 months. According to four of them, it takes place during the university degree.

There seems to be some discrepancy between these data. We get the impression (And we already got it when we analysed other respondents' answers) that the formulation of question **4.1** (***"What is the length of the teacher training course after the first/university degree?"***) should have been clearer.

There are quite a few ways for teachers to obtain information about new developments in education, e.g.: refresher courses, newsletters, journals, and conferences. **Refresher courses (4.3)** are readily available in almost all countries (with Norway apparently being the only exception), anywhere from less than 1 day a year to over 5

days a year. In none of the examined countries are the courses compulsory. **Newsletters and journals (4.4.1)** are readily available in almost all of the countries. Exceptions are Austria, Italy, and Poland, where they are (very) scarce. Roughly the same result is found for **conferences and refresher courses (4.4.2)**: These are scarce only in Austria, Italy, Norway, and Poland.

The **number of hours a week teachers have to teach (4.5)** differs quite a bit from one country to another. The lowest number we encountered is 16-21 hours, which is the case for Austria, The Czech Rep., Finland, Hungary, Italy, Norway, Poland, Portugal, and Spain. The Netherlands has the highest number (28-35 hours). We would suspect that teachers who teach a high (low) number of hours a week, (don't) spend a lot of **time at home preparing lessons, grading tests, etc.**, simply because there are (not) many lessons for them to prepare and tests to grade. Looking at the data in **4.6** and comparing them with **4.5**, we can see that in some cases this is true (Czech Rep., Finland, Spain, Hungary, and Italy), but that there are also exceptions (For example Austria, Norway, Portugal, and Sweden).

5. Physics textbooks

The respondents were asked by whom the **physics textbooks** are chosen **(5.1)**. In the majority of cases, it's done by the teachers. In some cases, the government plays a role, for example prescribing a selection of books from which the teachers must choose (Austria), or by giving recommendations (Czech Rep.). Poland is in a transition period: The situation in the recent past (Until '92) was one where the government imposed the textbooks (and syllabuses). The latest situation is one where the choice of textbooks is left to the teachers.

The respondents were asked **what pupils use in the physics study: Textbooks (5.2.1)** or **their notes (5.2.2)**. As we expected, in all of the cases it is a combination of both, although in some cases the emphasis is on the textbooks (most notably the Czech Rep., Finland, Italy, and the Netherlands), whereas in other cases the emphasis is on pupils' notes (Most notably Austria, Poland, and Slovenia).

The respondents were asked about the **contents of the textbooks (5.3)**. The highest ranking item on average is "***problems to solve***" **(5.3.1)**, followed by "***descriptions of experiments***" **(5.3.2)**. As for both these items, the differences between the countries seem (very) small. There are no major discrepancies. Item **5.3.4** ("***details on the history of physics***") is (as expected) the lowest ranking item. Exceptions are Portugal and Germany, where a fair amount of attention is given to these details. The extremes to **5.3.3** ("***daily life applications of physical subjects***") are Finland (score 0) and Germany (score 4).

6. Practical experiences

Many future physicists will engage in experimental research. Doing experimental work in secondary school can serve as a training for this.

The respondents were asked **how many times pupils work in the laboratory (6.1)**. ***Never*** according to Austria and Finland, and ***only a few times a year*** according to Germany, Hungary, Italy, and the Netherlands. The U.K. on the other hand ranks highest with ***once a week or more***. Other high-ranking countries are Norway and

Sweden, where pupils do experimental work ***at least twice a month***. From our own experience, we know that for instance in the Netherlands there are big differences between schools. In some schools, pupils in the upper classes do practical work more than once a week, whereas in others, no experimental work is done at all, despite the fact that it is compulsory!

Question **6.2** lists 9 possible **aims of experimental work in upper classes of secondary school**. The respondents were asked about their opinion on these aims. The on average highest ranking aims are:
6.2.2: "***to aid understanding of physical concepts***" (a.s.=3.1; σ_n=0.9);
6.2.4: "***to arouse and maintain pupil interest***" (a.s.=2.8; σ_n=0.9);
6.2.7: "***to train pupils in problem solving by experimental research***"
(a.s.=2.8; σ_n=1.0);
6.2.8: "***to promote scientific methods of thought***" (a.s.=2.9; σ_n=1.0).
The (on average) lowest ranking aims are:
6.2.5: "***to verify facts and principles already taught***" (a.s.=2.3; σ_n=1.0);
6.2.9: "***to illustrate the applications of physics to real life situations***" (a.s.=2.3; σ_n=1.1).
The relatively large value of σ_n in all cases indicates that overall unanimousness is low. The same goes for unanimousness between respondents from one particular country. There is no obvious "pattern" to be detected.

The respondents were asked about the kind of **equipment in the laboratory** (**6.3**). ***Objects from daily life*** (**6.3.1**) aren't all too common (a.s.=1.5; σ_n=0.8), with some respondents (Italy, Poland (1x)) even stating that they are not present altogether. This is rather remarkable, since these objects usually are easily found and not too expensive, and illustrate very well how physical concepts are applied to real-life situations. This in turn helps to make physics less abstract to pupils. ***Manufacturers' apparatus*** (**6.3.3**) on the other hand are (very) common (a.s.=3.4; σ_n=0.8), with no exceptions. Finally, ***self-made apparatus*** (**6.3.2**) are fairly common (a.s.=1.7; σ_n=0.7), again with no exceptions.

The respondents were asked about **the kind of practical work that pupils do** (**6.4**). The on average lowest ranking form is ***experimenting individually*** (**6.4.1**) (a.s.=1.2; σ_n=1.0), closely followed by ***investigations with an open end*** (**6.4.4**) (a.s.=1.3; σ_n=1.0). Exceptions to the former are Germany and the U.K. (3x), who each awarded 3 points. An exception to the latter is the U.K., with an average score of 2,7 (σ_n=0.5). The on average highest ranking form is ***experimenting in small groups using similar sets of apparatus at the same time*** (**6.4.2**), with an average score of 2.7 (σ_n=0.9). Major exceptions are Hungary (score 1), Poland (score 0 (1x)), and Spain (score 1 (1x)). ***Experimenting in small groups using the same set of apparatus in turn*** (**6.4.3**) is less common (as=1.8; σ_n=1.0).

As for the **instructions for practical work** (**6.5**), these are both ***verbal*** (**6.5.1**) and ***written*** (**6.5.2**), with a slight preference for the latter in general.

The respondents were asked about **laboratory assistents** (**6.6**). 15 (!) respondents stated that there are no assistents. One would expect that in these cases, pupils rarely/never do practical work (see **6.1**). This is indeed true in some cases (Austria, Finland, Germany, Poland), but not in others (Most notably Norway, Portugal, Spain (2x), Sweden (3x)). The only country where pupils rarely do practical work, yet a laboratory assistent is always present, is the Netherlands.

The respondents were asked about the **method of recording practical work**

(**6.7**). Writing a ***comprehensive report*** (**6.7.3**) is, on average, the most frequent method (a.s.=2.4; σ_n=1.1), with Belgium, Finland, Portugal (1x), and Sweden (1x) being the most notable exceptions. The least frequent method is using ***worksheets with spaces left for observations and results*** (**6.7.1**) (a.s.=1.9; σ_n=1.2), with the most notable exceptions being Portugal, Spain, and Sweden (1x in each case). ***Writing up own notes*** (**6.7.2**) is fairly common in most cases with major exceptions being Finland and Italy.

For pupils, it can be very clarifying to **visit for instance companies and hospitals to see how physicists work in practice**. Yet, on average, it appears that there are not many possibilities to do so (**6.8**): The average score is only 1.6 (σ_n=0.9). Only a few cases present a favourable exception (Czech Rep., Finland, U.K. (2x), Poland (1x), Spain (1x), and Sweden (1x)).

7. Syllabus contents

This section lists some 33 subjects in 6 categories (**Introduction, Mechnanics, Oscillations and waves, Electricity and magnetism, Matter and particle physics, Other subjects**). The respondents were asked to state to what degree these subjects are presented to pupils who choose physics.

Taking a first general look at the data, we can see that there are some major differences between countries. For instance, some countries (Most notably the Czech Rep., Germany, the U.K., Hungary, Poland, and Slovenia) claim to present almost all of the listed subjects fairly complete, as indicated by the abundance of scores 4 (and 3), whereas others (Most notably Austria and Finland (and Italy)) stated that the listed subjects are presented far from complete, with some of the subjects not even presented at all. What could be the *cause* of these observed large differences between countries? The difference between the syllabus of one country and that of another will of course be a contributing factor, but is unlikely to account for these large differences. Perhaps there might be a *reason* for these differences. For instance the respondents' conception of the term "fairly complete". Take a look at the Czech Republic for example. The respondent stated that both ***quantum phenomena*** (**7.5.9**) and ***relativity*** (**7.6.1**) are presented "fairly complete". In these cases, it's obvious that "fairly complete" cannot mean "most of the knowledge there is on these subjects", since: a) pupils in secondary school lack a certain mathematical background that is often needed to study these subjects, and b) it is very unlikely that many subjects can be presented fairly complete, simply because of the limited number of hours of physics lessons.

Looking closer at the specific categories, the following observations can be made:

1. Introduction:
Finland is the only country where ***vector notation*** (**7.1.2**) is not presented at all.
2. Mechanics:
In all cases, almost all of the subjects are presented to a considerable degree. Most notable exceptions are Norway, where ***statics*** (**7.2.5**) is not treated, and the Netherlands and Sweden (1x), where ***rotational motion*** (**7.2.6**) is not treated.
3. Oscillations and waves:
Again, in all cases, almost all of the subjects are presented to a considerable degree.

Most notable exceptions: Portugal (1x) and Finland (No ***physical optics*** (**7.3.5**)).

4. Electricity and magnetism:

In all cases, almost all of the subjects are presented to a certain degree. Exceptions: No ***electromagnetic field*** (**7.4.4**) in Portugal (1x) and Sweden (1x). No ***electronics*** (**7.4.5**) in Belgium (1x), Norway, Portugal (1x), Spain (2x), and Sweden (1x).

5. Matter and particle physics:

In all cases, almost all of the subjects are presented to a certain degree. Exceptions: in a few cases, some subjects (for instance ***quantum phenomena*** (**7.5.9**)) are not treated.

6. Other subjects:

Finland: None of the subjects are treated. Other countries where a significant number of the listed subjects are not treated are: Belgium, Italy, and Spain.

In question **7.7** (***"How many hours do pupils spend in physics lessons in a week?"***), the respondents were supposed to state the numbers of hours of physics lessons pupils have in a week, by writing those numbers in the boxes, with each box corresponding to a specific year of secondary school. Nevertheless, quite a few respondents didn't fill in numbers, but ticked a box, apparently mistaking the numbers that represent the year of secondary school for numbers of hours of physics lessons. Some of the respondents didn't fill in anything at all.

Looking at the data (Not included), we can see that there are not only major differences between countries, but also between respondents from one particular country (Most notably Sweden), indicating that the numbers apparently differ from one school to another. And indeed: our Italian respondent makes that very remark.

Looking at the **numbers in upper classes for pupils who do choose physics** (**7.7.1**), we can see that these vary, anywhere from 2 hrs a week (Belgium, Finland, Austria, and Poland) to 5-6 hrs a week (Germany, the U.K., Hungary, Portugal, and Norway). One U.K.-respondent even stated 8 hrs a week. As a side note: One might expect that the higher this number, the higher the degree at which the subjects are presented. And indeed, of the latter 5 countries, the first 3 are also among the 6 countries where respondents claimed that many subjects were presented fairly complete. Poland however, with only 2 hrs a week, was also among these 6 countries.

In some countries (Belgium, Hungary, and Austria), physics is compulsory. In these cases, the choice concerns the number of hours of physics lessons a week. This number varies from 1 (Belgium) to 2-3 (Hungary and Austria).

8. Context

In the past few years, several countries (i.e. the U.K., the Netherlands) have included in their physics curriculum the use of context. There are various definitions of the term "**context**", one of which is: "*A structured part of a pupil's experiental world, in which connections between concepts and phenomena are established*" [6]. One of its purposes is to motivate pupils by making physics more concrete, more comprehensible, more vivid, and more meaningful.

Section **8.1** lists a number of daily life phenomena that can serve as **contexts** for physics education. The respondents were asked to state to what degree they are presented to the pupils. Looking at the data, we can see that differences between respondents from one particular country are small, whereas the differences between

the various countries are fairly large in certain cases. Countries with a widespread use of contexts are the Czech Rep., Germany, and the U.K.. In the remaining countries there is little (Austria, Hungary, Netherlands, Norway, Poland, Portugal, Slovenia, Spain, and Sweden) to very little (Belgium, Italy) use of context.
The on average lowest ranking subjects are:

- **Meteorology** (a.s.=0.7; σ_n=0.8);
- **Geophysics** (a.s.=0.9; σ_n=1.1);
- **Physics of music** (a.s.=0.8; σ_n=0.8).

The on average highest ranking subjects are:

- **Nuclear plants** (a.s.=1.7; σ_n=1.3);
- **Computers** (a.s.=1.7; σ_n=1.2);
- **Safety** (a.s.=1.9; σ_n=1.3);

The term "professionals" in question **8.2** (*"Are professionals involved in physics lessons?"*) proved to be unclear to some respondents. We were referring to physicists who work for example in companies or factories, who are invited to secondary schools to tell something about their work, or to give lectures. The data make it clear that this never/rarely happens. There are a few favourable exceptions: the U.K. (1x), Portugal (1x), Slovenia (1x), Spain (1x), and Sweden (1x).

Question **8.3** asks about the attention paid to **profemale contexts** in ***syllabuses*** (**8.3.1**) and ***textbooks and lessons*** (**8.3.2**). The overall situation is not all too good, with favourable exceptions being the U.K., the Netherlands, Norway, and Spain. Some other incidental exceptions are: Poland (1x), Portugal (1x), and Sweden (1x).

9. Evaluations

At the end of secondary school, pupils have to show that they've acquired the required knowledge and skills. This is the evaluation of the learning process.

The respondents were asked **how the final examinations are arranged** (**9.1**): By ***the school (teachers)*** (**9.1.1**) or by ***the government*** (**9.1.2**). Several combinations are found:

- **Always** by the school and **never** by the government: Austria, Belgium, the Czech Rep., and Poland;
- **Never** by the school and **always** by the government: Hungary and Italy;
- **Partly** by the school and **partly** by the government: Germany, The Netherlands, and Norway.

As for the remaining countries (Finland, U.K., Portugal, Slovenia, Spain, and Sweden), there is a discrepancy between respondents from the same country. For instance the U.K.: Here, almost all of the forms mentioned above are found; There seems to be a lack of unity among schools.

The respondents were asked about **how the pupils' learning of physics is evaluated** (**9.2**). ***Written examinations*** (**9.2.1**) are used in all of the examined countries, except for Italy and Poland (1x). ***Verbal examinations*** (**9.2.2**) are not used in Finland, the U.K., and Slovenia (and in some cases in Portugal, Spain, and Sweden). Evaluations by way of ***experimental tests*** (**9.2.3**) are common only in the U.K., the Netherlands, and Slovenia. In the remaining countries, there are little to no experimental tests.

Pupils are allowed to use **calculators** (**9.3**) in their exams in all countries but one (Italy).

The final question regards the **participation of girls in the final examinations in physics (9.4)**. Almost a third (!) of the respondents stated "***more than 40%***" (Hungary, Italy, Portugal, Belgium (1x), Spain (1x), Sweden (3x)). The lowest percentage is found in Finland: 0-10%.

CONCLUSIONS

The major conclusions for each section are listed below. When we speak of "countries", we mean "examined countries".

1. Starting point

In many countries, pupils are not taught physics at primary school. In some countries, it's optional for the schools, but for instance in the U.K., it's included in the national curriculum. In none of the countries do pupils have to make a choice for physics before the age of fourteen. In some countries (Austria, Belgium, Hungary), physics is compulsory in secondary school. In most countries, pupils don't find physics an attractive subject.

2. Purposes

Most countries have a common, government-issued syllabus, and most of these contain (very) detailed lists of skills. Understanding is (on average) considered to be the most important goal of physics education.

3. Structure of the lessons and the classroom

The size of the classes varies from one country to another, and sometimes also from one school to another, ranging anywhere from 16-23 pupils (Austria, Belgium) to over 30 pupils per class (Hungary, Poland, Slovenia, Spain). In general, the teacher-focused form is the most dominant type of lessons. Pupils nearly always get homework. Computers are used to various degrees in all countries. The same goes for media such as slides/film/video.

4. Teacher and teacher education

All countries require a university degree to become a teacher. Additionally, most countries require a teacher training course, but there are differences in its length, contents, and organisation. In all countries, training at schools (unpaid in most cases) is part of the course. There are large differences in the number of hours a week teachers have to teach: Anywhere from 16-21 hours a week to 28-35 hours a week in the Netherlands.

5. Physics textbooks

In the majority of cases, the books are chosen by the schools (teachers), but in some cases (Austria, Czech Rep.), the government plays a role (i.e. prescribing a selection of books, giving recommendations, etc.). In their study, pupils use both textbooks and their notes.

6. Practical experiences

As for the amount of experimental work, in many countries (for instance the Netherlands), the situation differs strongly from one school to another. In some countries (Austria, Finland), pupils never do experimental work. The U.K. ranks highest with pupils doing experimental work at least once a week. The on average highest ranking aims of experimental work are: to aid understanding of physical concepts, to arouse and maintain pupil interest, to train pupils in problem solving by experimental research, and to promote scientific methods of thought. The on avarage most occurring form of experimental work is experimenting in small groups using similar sets of apparatus at the same time. In half the cases, there is no laborotary assistant.

7. Syllabus contents

Practically all of the listed subjects are presented to the pupils, but there are differences between countries as to the degree at which they are presented. Some countries (Czech Rep., Germany, U.K., Hungary, Poland, Slovenia) claim to present almost all

of the listed subjects fairly complete, whereas others (Austria, Finland) state that the subjects are presented far from complete, or even not presented at all. The number of hours of physics lessons varies from one country to another (and in some cases from one school to another), anywhere from 2 hours a week (Austria, Belgium, Finland, Poland) to 5-6 hours a week (Germany, UK, Hungary, Portugal, Norway).

8. Context

As for the degree at which daily life phenomena are used as contexts, there are large differences between countries. Lowest ranking countries are Belgium and Italy. Highest ranking countries are the Czech Rep., Germany, the U.K., and also increasingly the Netherlands. In general, there's not much attention being paid to profemale contexts in syllabuses, textbooks, and lessons. Exceptions are the U.K., the Netherlands, Norway, and Spain.

9. Evaluations

The arrangement of final examinations is done either by the school (Austria, Belgium, Czech Rep., Poland), by the government (Hungary, Italy), or by both of them (Germany, Netherlands, Norway). In some countries (Finland, U.K., Portugal, Slovenia, Spain, Sweden), there seems to be a lack of unity among schools and several combinations are found within one country. Written examinations are used in all countries. Verbal examinations in many countries and experimental tests in some countries (U.K., the Netherlands, Slovenia). In almost a third of the cases, the participation of girls in the final examinations is over 40%. The lowest percentage (0-10%) is found in Finland.

LITERATURE

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[2] Second International Science Study - technical report
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[3] 1994 AAPT Membership Directory
Melba N. Philips and Jack M. Wilson
American Association of Physics Teachers, 1994

[4] AS & A Level Syllabus 1994
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[5] Grenzenloze Verscheidenheid
A description of teacher training courses in the EC
NUFFIC, The Hague, January 1989

[6] Valkuilen Bij 'Contexten'
Jan Hondebrink
NVON Maandblad 14 7, September 1989

APPENDIX

Appendix 1 (pages 24-29) contains the questionnaire.

Appendix 2 (pages 30-38) contains the data (the respondents' answers).
Column 1 ('COUNTRY') lists the countries the respondents hail from.
Column 2 ('FUNC') lists the respondents' function (PE: physics educator; UT: teacher at university; ST: teacher at secondary school).
Columns 3 and up list the respondents' answers. For example: Column V672 lists the answers to question 6.7.2, V8112 lists the answers to question 8.1.12, etc. The number 9 denotes missing values.

QUESTIONNAIRE ABOUT PHYSICS EDUCATION IN EUROPE

concerning the upper classes of pre-university education

Please fill in the questions in accordance with the actual situation in your country. Unless stated otherwise, the questions apply to the upper classes of pre-university education.
All questions have five possible answers, usually ranging from 0(=absolutely negative) to 4(=absolutely positive). Please tick the number (answer) you want. If you make a mistake circle the wrong answer and tick the right one.

Ex. 0 1 2 3 4
wrong right

If you find an asterisk * after some words in italics, cross out the incorrect or worst option.

1)Starting point:

	negative				positive
1. Do pupils study *physics/science* * at primary school?	0	1	2	3	4
2. At what age do pupils have to make a choice for Physics courses?	Less than 10	10-11	12-13	14-15	more than 16
3. In your opinion, do pupils have a good idea about Physics before choosing?	0	1	2	3	4
4. Do teachers seriously take pupils' ideas (preconceptions and misconceptions) into account when they are explaining a new physical theory?	0	1	2	3	4
5. In your country is Physics an attractive subject in the pupils' opinion?	0	1	2	3	4

2)Purposes:

	no				very detailed
1. Is there a physics syllabus issued by the government?	0	1	2	3	4
2. Is there a list of skills in the syllabus?	0	1	2	3	4
3. Does the syllabus contain information for the teachers on how to reach their goals?	0	1	2	3	4
4. What are, in your opinion, important goals of physics education?	disagree				agree
4.1 understanding	0	1	2	3	4
4.2 problem solving	0	1	2	3	4
4.3 acquiring knowledge	0	1	2	3	4
4.4 developing skills	0	1	2	3	4
4.5 appreciating usefulness and limits of Physics	0	1	2	3	4

		disagree				agree
4.6	acquiring practical experience	0	1	2	3	4
4.7	acquiring an inquiring mind	0	1	2	3	4
4.8	acquiring an open attitude towards Physics	0	1	2	3	4
4.9	preparing for further education	0	1	2	3	4
4.10	preparing pupils as members of society	0	1	2	3	4

3) The structure of the lessons and the classrooms:

1.	How many pupils are there in a classroom, normally?	less than 10	10-15	16-23	24-30	more than 30
2.	About the structure of the lessons:	never				always
2.1	teacher focused, explaining problems and theories	0	1	2	3	4
2.2	teacher focused, demonstrating experiments	0	1	2	3	4
2.3	teacher focused, answering pupils' questions	0	1	2	3	4
2.4	pupils working in small groups (explaining, solving problems and so on)	0	1	2	3	4
2.5	each pupil studying by him/herself, with his/her individual plan	0	1	2	3	4
3.	In the lesson, is there attention for actual physics and the work of physicists?	0	1	2	3	4
4.	Do the pupils get homework?	0	1	2	3	4
5.	Do pupils use computers in the physics lessons?	0	1	2	3	4
6.	Do teachers use slides/film/video in the physics lessons?	0	1	2	3	4
7.	Is there equipment available for pupils to do practical work?	0	1	2	3	4

4)Teachers and teacher education:

1.	What is the length (in months) of the teacher training course after the *first/university* * degree?	0	1-3	4-6	7-12	13 or more
2.	In this course, how much time do teachers spend in	0	1-10%	11-30%	31-60%	more
2.1	pedagogy (theory)	0	1	2	3	4
2.2	pedagogy (training)	0	1	2	3	4
2.3	psychology	0	1	2	3	4
2.4	unpaid training at schools	0	1	2	3	4
2.5	paid training at schools	0	1	2	3	4
2.6	didactics of Physics	0	1	2	3	4
2.7	didactical research	0	1	2	3	4
3.	Are there any *compulsory/voluntary* * refresher courses for teachers?	no	less than 1 day a year	1-2 days a year	3-5 days a year	more

4. Can teachers get information on physical and educational research in	no				yes
4.1 newsletters and journals	0	1	2	3	4
4.2 conferences or refresher courses	0	1	2	3	4
5. How many hours a week do full-time teachers have lessons at school?	Less than 15	16-21	22-27	28-35	More than 35
6. How many hours a week do they spend at home preparing lessons and correcting homework?	Less than 3	4-6	7-10	11-15	more than 15

5)Physics textbooks:

1. Who chooses the Physics textbook?	never				always
1.1 the government	0	1	2	3	4
1.2 the school (teachers)	0	1	2	3	4
2. What do pupils use in physics study?					
2.1 textbooks	0	1	2	3	4
2.2 their notes	0	1	2	3	4
3. In the textbooks are there					
3.1 problems to solve?	0	1	2	3	4
3.2 descriptions of experiments?	0	1	2	3	4
3.3 daily life applications of physical subjects?	0	1	2	3	4
3.4 details on the history of Physics?	0	1	2	3	4

6)Practical experiences:

1. How many times do pupils work in the laboratory?	never	few times a year	once a month	twice a month	once a week/ more
2. What are, in your opinion, the aims of experimental work in the upper classes of the secondary school?	disagree				agree
2.1 to encourage accurate observation and careful recording	0	1	2	3	4
2.2 to aid understanding of physical concepts	0	1	2	3	4
2.3 to be an integral part of finding facts by investigation and arriving at principles	0	1	2	3	4
2.4 to arouse and maintain pupil interest	0	1	2	3	4
2.5 to verify facts and principles already taught	0	1	2	3	4
2.6 to develop manipulative skills	0	1	2	3	4
2.7 to train pupils in problem solving by experimental investigation	0	1	2	3	4
2.8 to promote scientific methods of thought	0	1	2	3	4
2.9 to illustrate the applications of physics to real life situations	0	1	2	3	4
3. What equipment is there in the laboratory?	never				always

3.1	objects from daily life	0	1	2	3	4
3.2	self-made apparatus	0	1	2	3	4
3.3	manufacturers' apparatus	0	1	2	3	4
4.	What kind of practical work do pupils do?					
4.1	experimenting individually	0	1	2	3	4
4.2	experimenting in small groups using similar sets of apparatus at the same time	0	1	2	3	4
4.3	experimenting in small groups using the same set of apparatus in turn	0	1	2	3	4
4.4	investigations (with an open end)	0	1	2	3	4
5.	What is the method to give instructions for practical work?					
5.1	verbal, *with/without* * class discussion	0	1	2	3	4
5.2	written (blackboards, cards or textbooks)	0	1	2	3	4
6.	Are there any laboratory assistants?	0	1	2	3	4
7.	What is the method of recording practical work?					
7.1	pupils use worksheets with spaces left for observations and results	0	1	2	3	4
7.2	pupils write up own notes as the experiment proceeds	0	1	2	3	4
7.3	pupils make a comprehensive report after practical work	0	1	2	3	4
8.	Can pupils visit companies or hospitals to see how physicists work in practice?	0	1	2	3	4

7)Syllabus contents

Are the following subjects presented to the pupils who choose for Physics (pre-university schools)?		not at all				fairly complete
1.	INTRODUCTION					
1.1	physical quantities and their units	0	1	2	3	4
1.2	vector notation	0	1	2	3	4
2.	MECHANICS					
2.1	kinematics	0	1	2	3	4
2.2	dynamics	0	1	2	3	4
2.3	work, impulse, energy	0	1	2	3	4
2.4	gravitational fields	0	1	2	3	4
2.5	statics	0	1	2	3	4
2.6	rotational motion	0	1	2	3	4
3.	OSCILLATIONS AND WAVES					
3.1	simple harmonic motion	0	1	2	3	4
3.2	vibrations	0	1	2	3	4
3.3	waves	0	1	2	3	4
3.4	sound	0	1	2	3	4

3.5	physical optics	0	1	2	3	4
4.	ELECTRICITY AND MAGNETISM					
4.1	electric currents	0	1	2	3	4
4.2	electric field, electrostatics	0	1	2	3	4
4.3	magnetic field	0	1	2	3	4
4.4	electromagnetic field	0	1	2	3	4
4.5	electronics	0	1	2	3	4
5.	MATTER AND PARTICLE PHYSICS					
5.1	structure of matter	0	1	2	3	4
5.2	gases	0	1	2	3	4
5.3	liquids	0	1	2	3	4
5.4	solids	0	1	2	3	4
5.5	thermodynamics and heat transfer	0	1	2	3	4
5.6	structure of atoms and molecules	0	1	2	3	4
5.7	nuclear physics	0	1	2	3	4
5.8	radioactivity	0	1	2	3	4
5.9	quantum phenomena	0	1	2	3	4
6.	OTHER SUBJECTS					
6.1	relativity	0	1	2	3	4
6.2	astronomy and astrophysics	0	1	2	3	4
6.3	cosmology	0	1	2	3	4
6.4	geometrical optics	0	1	2	3	4
6.5	transport of matter	0	1	2	3	4
6.6	solid state physics	0	1	2	3	4
6.7	...	0	1	2	3	4

7. How many hours do students spend in Physics lessons in a week?

year	1º	2º	3º	4º	5º	6º	7º	8º	9º
7.1 pre-university education for pupils who choose Physics									
7.2 pre-university education for pupils who don't choose Physics									

8) Context

1. Are the following subjects presented to the pupils?	no				fairly complete
1.1 nuclear plants: safety, usefulness...	0	1	2	3	4
1.2 Health Physics: lasers, diagnostic processes with NMR, X-rays, ultrasounds...	0	1	2	3	4
1.3 meteorology: weather forecast...	0	1	2	3	4
1.4 space: satellites, spaceships...	0	1	2	3	4
1.5 geophysics: earthquakes, volcanoes...	0	1	2	3	4
1.6 computers: collecting data, programming...	0	1	2	3	4
1.7 safety: electricity, radiations...	0	1	2	3	4
1.8 biophysics: eye, ear, bloodsystem...	0	1	2	3	4
1.9 physics in and around the house: electricity and gas	0	1	2	3	4

1.10 telecommunication	0	1	2	3	4
1.11 the physics of music	0	1	2	3	4
1.12 transport: cars, trains	0	1	2	3	4
...	0	1	2	3	4
	never				always
2. Are professionals involved in Physics lessons?	0	1	2	3	4
3. Is attention paid to a profemale context in					
3.1 the syllabus	0	1	2	3	4
3.2 textbooks and lessons	0	1	2	3	4

9)Evaluations

1. How is the final examination arranged?	never				always
1.1 by the school (teachers)	0	1	2	3	4
1.2 by the government	0	1	2	3	4
2. How is the pupils' learning of Physics evaluated?					
2.1 by a written examination	0	1	2	3	4
2.2 by a verbal examination	0	1	2	3	4
2.3 by experimental tests	0	1	2	3	4
3. Are pupils allowed to use calculators in their exams?	0	1	2	3	4
4. What is the participation of girls in the final examination of Physics?	0-10%	10-20%	20-30%	30-40%	more than 40%

COUNTRY	FUNC	V11	V12	V13	V14	V15
Austria	PE	4	9	1	1	1
Belgium	UT	1	9	9	1	1
Belgium	PE	1	3	0	1	1
CzechRep	UT	4	4	4	2	0
Finland	PE	0	4	0	0	0
Germany	PE	2	4	1	2	1
GreatBri	ST	4	3	3	2	2
GreatBri	PE	4	4	3	2	1
GreatBri	PE	4	3	3	4	1
GreatBri	PE	4	4	1	1	1
GreatBri	PE	3	4	3	2	1
GreatBri	??	2	3	1	1	0
Hungary	ST	4	4	4	3	3
Italy	PE	2	4	1	0	3
Netherla	PE	1	3	3	2	1
Norway	PE	0	4	1	3	3
Poland	UT	4	3	3	1	1
Poland	ST	2	3	2	3	2
Poland	PE	4	4	2	1	1
Portugal	UT	1	4	3	1	1
Portugal	ST	1	3	2	3	3
Portugal	PE	4	3	3	1	2
Slovenia	ST	2	4	4	1	2
Spain	PE	1	4	2	1	0
Spain	??	2	3	1	2	2
Spain	PE	2	4	0	1	1
Sweden	UT	4	4	2	1	0
Sweden	UT	0	4	2	1	1
Sweden	ST	4	3	2	9	1
Sweden	UT	4	3	3	4	2
Sweden	PE	4	9	9	9	9

COUNTRY	FUNC	V21	V22	V23	V241	V242	V243	V244	V245	V246	V247	V248	V249	V2410
Austria	PE	4	4	0	4	1	2	3	4	3	4	4	1	4
Belgium	UT	0	1	0	4	1	2	1	4	1	2	3	2	4
Belgium	PE	0	9	9	4	3	3	3	4	4	3	3	3	3
CzechRep	UT	2	2	1	4	2	2	3	3	2	2	3	2	4
Finland	PE	1	0	1	4	4	3	3	3	3	3	3	3	3
Germany	PE	3	4	3	4	2	3	3	3	2	4	3	1	2
GreatBri	ST	2	0	0	4	4	2	4	4	3	4	3	2	4
GreatBri	PE	3	4	4	4	3	3	3	2	3	3	3	2	1
GreatBri	PE	1	4	2	3	3	1	2	3	3	4	1	2	3
GreatBri	PE	3	4	1	4	4	4	4	4	4	4	4	4	4
GreatBri	PE	3	2	1	4	4	3	3	3	3	3	4	2	4
GreatBri	??	4	4	4	4	4	4	4	2	3	4	2	2	4
Hungary	ST	3	4	0	4	3	3	2	4	4	4	4	4	4
Italy	PE	4	0	0	4	4	3	4	4	3	4	3	2	4
Netherla	PE	4	4	1	4	4	3	4	4	4	4	4	4	4
Norway	PE	3	3	2	4	4	3	4	4	3	4	3	2	4
Poland	UT	4	9	9	4	4	4	4	4	3	3	4	4	4
Poland	ST	4	4	2	4	3	2	4	4	4	3	2	2	1
Poland	PE	3	2	0	4	4	4	3	2	2	2	2	3	2
Portugal	UT	4	4	2	4	3	3	4	4	3	4	3	4	2
Portugal	ST	2	2	2	4	4	3	4	3	4	4	3	3	3
Portugal	PE	4	4	3	4	4	3	3	3	2	4	4	4	4
Slovenia	ST	4	4	2	4	3	3	4	3	2	4	4	3	3
Spain	PE	0	9	9	9	9	9	9	9	9	9	9	9	9
Spain	??	3	2	1	4	4	4	4	4	4	4	4	4	4
Spain	PE	2	3	1	4	3	3	4	2	3	4	3	2	4
Sweden	UT	4	2	1	4	2	3	2	4	2	4	2	1	1
Sweden	UT	3	3	1	4	4	4	4	4	4	4	4	3	4
Sweden	ST	4	2	2	4	3	4	4	4	4	4	4	3	4
Sweden	UT	4	4	3	4	4	2	3	2	2	2	2	4	3
Sweden	PE	3	9	9	9	9	9	9	9	9	9	9	9	9

COUNTRY	FUNC	V31	V321	V322	V323	V324	V325	V33	V34	V35	V36	V37
Austria	PE	2	4	4	4	1	0	2	2	2	2	3
Belgium	UT	2	3	3	3	1	0	0	3	1	2	3
Belgium	PE	2	3	2	1	0	0	1	3	1	2	2
CzechRep	UT	3	4	4	2	1	0	2	3	2	2	3
Finland	PE	3	4	2	0	0	3	0	4	2	1	0
Germany	PE	3	3	3	3	1	0	2	4	1	3	2
GreatBri	ST	3	2	1	1	3	1	2	3	3	3	3
GreatBri	PE	1	3	3	2	2	2	2	4	3	2	4
GreatBri	PE	2	2	2	3	2	1	2	4	3	3	4
GreatBri	PE	3	3	3	2	3	0	2	3	1	1	4
GreatBri	PE	3	3	2	2	1	1	3	3	1	1	3
GreatBri	??	3	1	1	2	3	1	2	4	3	2	4
Hungary	ST	4	3	3	3	1	1	1	4	1	1	2
Italy	PE	3	3	1	2	0	1	1	3	3	0	1
Netherla	PE	3	3	2	2	1	1	1	4	2	1	3
Norway	PE	3	2	2	2	3	2	1	4	3	2	2
Poland	UT	4	4	1	0	0	0	0	3	1	1	0
Poland	ST	4	3	1	2	1	0	2	3	1	1	1
Poland	PE	3	4	2	1	1	0	1	3	1	2	2
Portugal	UT	3	4	3	3	1	0	1	1	1	1	2
Portugal	ST	2	3	3	3	2	1	1	2	1	2	2
Portugal	PE	3	3	2	3	1	0	2	3	1	2	3
Slovenia	ST	4	4	4	1	3	0	2	3	2	3	3
Spain	PE	4	4	1	1	1	0	1	0	1	1	2
Spain	??	4	3	2	3	3	1	3	3	0	2	3
Spain	PE	4	4	1	0	1	1	1	3	1	1	3
Sweden	UT	3	3	3	2	1	0	1	3	1	3	2
Sweden	UT	3	3	3	3	1	0	1	3	1	2	4
Sweden	ST	3	3	3	2	1	0	1	3	2	2	3
Sweden	UT	3	4	4	3	3	0	1	4	1	3	4
Sweden	PE	3	9	9	9	9	9	1	3	0	2	2

COUNTRY	FUNC	V41	V421	V422	V423	V424	V425	V426	V427	V43	V441	V442	V45	V46
Austria	PE	3	0	0	0	0	4	0	0	4	1	1	1	4
Belgium	UT	3	2	0	1	3	0	2	0	4	2	2	2	4
Belgium	PE	2	1	0	1	3	0	3	1	2	2	2	2	3
CzechRep	UT	3	2	1	2	2	0	2	1	2	4	4	1	1
Finland	PE	3	9	9	9	9	0	9	9	9	3	3	1	1
Germany	PE	4	2	2	2	2	2	2	2	3	4	4	2	3
GreatBri	ST	3	1	1	1	3	0	1	0	2	4	4	2	4
GreatBri	PE	3	0	3	0	4	0	1	2	9	4	3	1	4
GreatBri	PE	3	9	9	9	9	9	9	9	3	3	3	3	3
GreatBri	PE	3	1	1	1	3	0	1	9	0	2	2	2	4
GreatBri	PE	3	1	3	1	3	0	1	1	3	4	4	2	1
GreatBri	??	3	2	2	1	2	0	1	0	4	4	4	1	3
Hungary	ST	0	9	9	9	9	9	9	9	4	4	4	1	2
Italy	PE	0	0	0	0	0	0	0	0	4	0	1	1	1
Netherla	PE	4	1	1	1	3	1	1	1	3	4	4	3	3
Norway	PE	2	2	2	2	3	0	1	1	0	2	1	1	3
Poland	UT	1	9	9	9	9	9	9	9	4	3	3	1	9
Poland	ST	1	1	1	1	4	0	9	1	2	1	1	1	3
Poland	PE	4	0	0	0	0	0	2	1	2	1	1	1	2
Portugal	UT	3	1	0	1	0	1	1	0	4	3	3	1	2
Portugal	ST	0	1	1	1	0	1	1	1	1	2	2	1	4
Portugal	PE	3	9	9	9	0	3	9	2	4	4	4	1	2
Slovenia	ST	9	1	1	2	2	0	2	2	4	4	4	2	2
Spain	PE	2	2	2	2	1	0	1	0	0	2	2	1	2
Spain	??	2	1	1	0	1	1	2	1	1	2	2	1	3
Spain	PE	1	3	3	3	1	0	2	1	4	4	3	1	1
Sweden	UT	3	2	2	1	3	0	2	0	0	4	4	1	4
Sweden	UT	2	9	9	9	9	9	9	9	2	3	3	2	3
Sweden	ST	3	3	2	9	2	0	1	1	3	4	2	2	4
Sweden	UT	3	2	0	1	0	3	1	0	3	1	2	2	3
Sweden	PE	9	9	9	9	9	9	9	9	2	9	9	9	9

COUNTRY	FUNC	V511	V512	V521	V522	V531	V532	V533	V534
Austria	PE	9	4	2	4	4	3	2	2
Belgium	UT	0	4	2	4	3	4	2	1
Belgium	PE	0	4	3	1	3	3	2	1
CzechRep	UT	2	2	4	1	3	3	2	2
Finland	PE	0	4	4	2	4	2	0	1
Germany	PE	0	4	2	2	4	4	4	3
GreatBri	ST	0	4	3	3	3	2	2	1
GreatBri	PE	0	4	4	4	4	3	2	1
GreatBri	PE	0	4	3	4	4	4	3	3
GreatBri	PE	0	4	1	3	4	4	4	2
GreatBri	PE	0	4	3	3	4	4	2	2
GreatBri	??	0	4	2	2	4	4	2	2
Hungary	ST	0	4	3	2	4	3	3	2
Italy	PE	0	4	4	2	4	2	1	1
Netherla	PE	0	4	4	1	4	3	3	2
Norway	PE	9	4	4	4	3	3	3	2
Poland	UT	0	4	2	4	3	3	3	2
Poland	ST	4	3	1	4	2	2	1	1
Poland	PE	2	3	3	4	2	3	1	1
Portugal	UT	0	4	3	4	4	4	3	3
Portugal	ST	0	4	3	4	4	4	4	4
Portugal	PE	0	4	4	4	4	4	3	2
Slovenia	ST	1	3	1	3	4	4	3	1
Spain	PE	0	4	2	3	4	4	3	1
Spain	??	0	4	4	2	4	3	1	1
Spain	PE	0	4	3	2	4	4	2	1
Sweden	UT	0	4	3	3	4	3	3	1
Sweden	UT	0	4	4	9	4	4	2	2
Sweden	ST	0	4	4	2	4	2	2	2
Sweden	UT	0	4	4	3	4	4	3	2
Sweden	PE	0	4	2	2	3	3	3	3

COUNTRY	FU N C	V 6 2 1	V 6 1 1	V 6 2 2	V 6 3 2	V 6 4 2	V 6 5 2	V 6 6 2	V 6 7 2	V 6 8 2	V 6 9 2	V 6 1 3	V 6 2 3	V 6 3 3	V 6 1 4	V 6 2 4	V 6 3 4	V644	V651	V652	V661 6	V671	V672	V673	V662 8
Austria	PE	0	2	4	2	4	3	1	3	2	2	3	1	4	9	2	2	1	1	1	0	0	2	4	1
Belgium	UT	2	4	3	2	4	2	1	3	3	3	1	2	3	0	2	2	0	3	2	1	2	3	1	1
Belgium	PE	1	3	2	2	2	1	3	2	2	1	1	1	4	1	2	1	0	2	2	1	3	1	0	1
CzechRep	UT	2	3	4	3	4	2	3	3	4	2	1	1	3	1	3	2	1	1	3	0	9	9	4	3
Finland	PE	0	2	2	3	2	2	2	3	4	1	1	1	3	2	3	0	0	3	3	0	3	1	1	3
Germany	PE	1	4	3	1	3	3	4	1	2	1	1	1	4	3	4	2	2	4	4	0	2	3	2	2
GreatBri	ST	4	1	1	0	2	1	1	4	4	2	3	3	4	3	3	1	3	1	3	4	2	3	3	2
GreatBri	PE	4	4	2	3	2	4	4	2	2	3	1	1	4	3	2	4	2	1	3	4	1	2	3	3
GreatBri	PE	4	1	2	1	3	3	1	4	4	2	3	2	4	1	3	1	3	2	3	4	3	3	3	3
GreatBri	PE	4	4	4	4	2	3	3	3	4	1	1	2	4	1	4	2	3	4	2	2	3	2	2	1
GreatBri	PE	4	3	3	3	4	1	3	3	2	1	2	2	4	1	3	2	3	3	3	1	2	2	2	2
GreatBri	??	4	2	3	2	3	2	2	4	4	2	2	2	4	3	3	2	2	2	2	2	1	3	2	1
Hungary	ST	1	3	3	4	3	4	2	1	2	4	2	2	3	2	1	3	1	1	3	3	1	3	2	1
Italy	PE	1	3	3	3	4	1	9	2	4	3	0	1	3	2	2	1	0	3	2	1	2	1	3	0
Netherla	PE	1	3	2	4	2	2	2	4	4	3	1	1	4	1	3	2	1	1	3	4	1	3	3	1
Norway	PE	3	1	3	2	3	2	2	3	3	2	1	1	3	0	3	3	1	1	3	0	1	3	4	2
Poland	UT	9	4	4	3	3	3	3	3	3	3	9	9	9	9	9	9	9	9	9	9	9	4	4	3
Poland	ST	1	2	4	4	3	4	3	2	1	3	1	1	3	1	0	1	0	3	1	0	1	1	3	2
Poland	PE	2	3	2	2	2	3	1	2	2	0	0	1	3	1	3	3	1	3	1	0	0	3	2	1
Portugal	UT	3	4	4	2	3	3	3	4	3	4	3	2	4	1	2	3	0	3	2	0	2	0	1	1
Portugal	ST	4	3	4	3	2	2	2	2	3	4	2	3	1	1	3	2	1	2	3	0	1	3	4	1
Portugal	PE	2	2	1	1	2	0	2	4	4	3	2	2	4	0	2	1	1	1	3	0	4	1	2	1
Slovenia	ST	2	2	4	2	4	2	3	3	3	2	9	2	3	9	3	3	1	9	4	3	3	2	3	1
Spain	PE	3	3	3	1	1	3	3	1	1	1	1	2	3	1	1	3	2	1	2	0	2	3	2	1
Spain	??	4	3	3	4	2	2	3	1	3	2	2	3	1	0	4	0	1	0	4	0	4	0	2	1
Spain	PE	1	2	3	3	2	2	3	3	2	2	2	2	3	0	3	1	2	1	3	1	0	4	4	3
Sweden	UT	3	2	4	3	3	0	1	3	3	1	1	3	3	1	3	1	1	4	3	4	1	3	2	2
Sweden	UT	3	4	4	4	4	3	4	4	3	3	9	2	4	9	3	1	1	3	2	0	3	2	2	0
Sweden	ST	3	3	4	2	3	3	4	4	4	4	1	2	4	1	3	3	3	1	3	0	1	3	3	3
Sweden	UT	3	2	4	3	4	3	2	4	1	3	1	1	4	0	4	0	0	2	2	0	4	0	0	1
Sweden	PE	4	3	3	3	3	3	3	3	3	3	9	9	9	9	9	9	9	9	9	9	9	9	9	9

	F	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V
	U	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
	N	1	1	2	2	2	2	2	2	3	3	3	3	3	4	4	4	4	4	5	5	5	5	5	5	5	5	6	6	6	6	6	6
COUNTRY	C	1	2	1	2	3	4	5	6	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6
Austria	PE	3	2	2	2	2	2	1	2	2	2	1	1	1	3	3	3	2	1	1	2	0	1	1	0	1	1	0	1	1	1	3	3	0
Belgium	UT	4	1	4	4	4	4	4	2	4	4	4	4	4	4	4	4	4	4	1	2	4	4	4	4	2	3	3	1	1	0	0	4	4	2
Belgium	PE	4	3	4	4	4	3	2	2	3	3	2	2	1	3	2	2	2	0	2	2	1	1	1	1	1	1	0	0	0	0	1	1	0
CzechRep	UT	4	4	4	4	4	4	4	3	4	4	4	3	3	4	4	4	4	3	4	4	4	4	4	4	4	4	4	4	4	9	4	4	2
Finland	PE	4	0	3	3	3	1	2	1	3	2	2	1	0	3	2	2	1	1	1	1	0	1	2	2	3	3	1	0	0	0	0	0	0
Germany	PE	4	4	4	4	4	4	4	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	2	2	1	4	4	9
GreatBri	ST	3	3	4	4	4	4	4	1	4	4	4	4	4	4	4	4	4	4	2	2	2	2	2	3	4	4	4	4	3	1	1	1	1	0
GreatBri	PE	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	3	3	3	3	3	3
GreatBri	PE	0	2	2	3	3	4	3	3	4	4	4	3	4	4	2	2	3	1	4	1	1	1	4	4	4	3	4	3	4	1	3	3	2
GreatBri	PE	4	4	4	4	4	4	4	2	4	4	4	4	4	4	4	4	4	4	3	4	4	4	4	4	4	4	4	3	1	2	1	2	2	2
GreatBri	PE	3	2	4	4	4	2	2	2	4	4	4	4	3	4	4	4	4	3	4	4	4	3	4	2	3	2	3	1	1	1	0	2	2	1
GreatBri	??	4	4	4	4	4	4	2	2	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	2	2	2	4	4	4
Hungary	ST	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	2	4	4	4	4	4	4	4	4	4	0	2	4	1	1	1
Italy	PE	4	2	4	3	4	3	2	2	3	1	3	1	2	3	3	2	1	1	1	3	0	0	4	1	1	1	0	1	0	0	3	3	0
Netherla	PE	4	3	4	4	4	3	1	0	4	4	4	2	2	4	4	2	2	3	3	3	3	3	3	3	3	3	2	0	1	0	3	3	1
Norway	PE	4	4	3	3	4	3	0	3	2	2	3	2	2	3	3	2	2	0	2	2	1	1	2	1	2	3	1	2	2	2	1	1	0
Poland	UT	4	4	4	4	4	4	3	3	4	3	4	2	3	4	4	4	4	2	3	4	4	4	4	3	2	2	2	2	2	2	2	2	1
Poland	ST	4	4	4	4	4	4	3	4	4	4	4	3	3	4	4	4	3	1	4	4	4	4	4	4	4	3	4	1	2	0	3	3	1
Poland	PE	4	3	4	4	3	3	2	3	3	3	3	3	3	3	3	3	3	2	3	4	3	3	3	3	3	3	2	2	2	1	0	0	1
Portugal	UT	4	3	4	4	4	4	3	3	3	3	3	2	0	4	4	4	3	1	3	3	3	3	4	3	1	1	1	1	3	1	1	1	0
Portugal	ST	4	4	4	4	4	3	3	3	3	3	3	3	3	4	3	2	0	0	4	3	2	2	2	4	2	1	3	0	2	2	1	1	0
Portugal	PE	4	4	4	4	4	4	3	4	3	3	3	2	3	3	4	4	3	1	4	2	2	2	4	3	2	2	3	2	2	1	2	2	1
Slovenia	ST	4	4	4	4	4	4	4	3	4	4	4	4	4	4	4	4	4	4	2	4	4	4	4	3	4	4	4	1	2	2	9	9	9	2
Spain	PE	3	3	3	3	4	3	3	3	2	2	2	1	2	3	2	2	2	0	1	2	2	2	3	3	1	1	1	0	0	0	1	1	0
Spain	??	4	4	3	3	3	3	1	2	3	2	2	1	1	3	3	2	3	0	2	3	3	1	2	2	1	1	0	1	9	0	2	2	9
Spain	PE	1	2	4	4	4	4	3	2	3	2	2	2	2	4	4	4	3	2	2	2	1	1	3	2	1	1	1	1	1	0	2	2	0
Sweden	UT	4	1	4	4	4	1	4	2	4	3	1	3	3	4	4	3	2	3	1	4	1	1	1	1	1	1	1	1	1	1	3	3	0
Sweden	UT	4	1	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	3	0	2	2	2	2	3	3	3	3	1	2	2	2	4	4	2
Sweden	ST	4	3	4	4	4	3	4	3	4	4	4	4	4	4	4	4	4	4	1	4	2	2	2	2	1	4	4	2	3	9	9	9	9	9
Sweden	UT	4	4	4	4	4	4	4	0	4	2	2	4	3	3	3	3	3	0	1	2	0	0	1	2	4	2	1	0	0	3	1	3	3	0
Sweden	PE	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9

COUNTRY	FUNC	V811	V812	V813	V814	V815	V816	V817	V818	V819	V8110	V8111	V8112	V82	V831	V832
Austria	PE	2	0	1	1	0	3	0	1	1	1	0	1	0	0	0
Belgium	UT	1	1	0	0	0	0	2	1	2	1	1	1	0	1	1
Belgium	PE	0	0	0	0	0	1	0	0	0	0	0	0	0	1	1
CzechRep	UT	3	2	1	3	1	2	4	2	3	2	1	2	1	0	0
Finland	PE	3	1	0	0	0	0	2	0	0	0	0	0	0	0	2
Germany	PE	3	1	2	4	2	4	4	4	4	3	2	2	1	1	1
GreatBri	ST	3	2	1	2	1	4	3	1	3	3	2	2	2	2	3
GreatBri	PE	3	3	1	1	1	3	3	3	2	1	3	1	1	1	3
GreatBri	PE	2	4	1	2	1	3	4	3	9	4	1	3	1	2	4
GreatBri	PE	2	2	1	2	4	3	4	4	3	1	1	1	1	3	3
GreatBri	PE	1	1	1	1	1	2	3	1	2	1	2	2	1	2	2
GreatBri	??	4	3	1	2	2	2	3	2	3	3	2	2	1	2	2
Hungary	ST	4	0	0	2	3	0	3	0	2	1	1	0	1	0	0
Italy	PE	0	0	0	1	0	2	0	0	1	1	0	0	0	0	0
Netherla	PE	1	0	0	0	0	3	1	3	3	0	1	2	1	3	2
Norway	PE	3	2	0	2	0	1	1	1	1	0	0	0	0	3	2
Poland	UT	1	1	1	1	1	1	9	0	2	2	2	2	9	2	2
Poland	ST	1	1	0	1	1	2	1	0	1	0	0	0	1	0	0
Poland	PE	1	1	0	1	0	2	1	0	1	0	0	0	1	1	1
Portugal	UT	0	0	0	0	2	2	3	2	3	2	1	4	3	0	0
Portugal	ST	0	1	0	1	0	2	2	2	9	1	0	1	0	2	2
Portugal	PE	0	1	1	1	0	0	1	2	1	0	0	0	0	0	0
Slovenia	ST	3	2	2	2	1	2	1	1	1	1	1	1	3	0	0
Spain	PE	1	1	2	1	0	1	0	0	0	0	0	0	3	3	3
Spain	??	0	0	0	0	0	0	2	0	3	1	0	0	0	1	2
Spain	PE	1	1	1	2	1	1	2	1	1	0	1	0	0	1	2
Sweden	UT	0	0	1	1	1	3	2	3	1	3	1	0	4	4	4
Sweden	UT	3	1	0	1	0	1	1	1	1	1	1	1	9	0	0
Sweden	ST	3	2	0	1	0	9	9	1	1	1	1	1	1	1	1
Sweden	UT	3	0	3	2	3	0	0	0	0	0	0	0	1	0	0
Sweden	PE	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9

COUNTRY	FUNC	V911	V912	V921	V922	V923	V93	V94
Austria	PE	4	0	2	3	0	4	1
Belgium	UT	4	0	4	4	0	4	4
Belgium	PE	4	0	2	2	0	1	3
CzechRep	UT	4	0	2	4	1	3	2
Finland	PE	9	4	4	0	0	4	0
Germany	PE	4	4	4	2	0	4	2
GreatBri	ST	0	3	4	0	4	4	1
GreatBri	PE	3	3	4	0	3	4	2
GreatBri	PE	4	0	4	0	3	4	2
GreatBri	PE	0	4	4	0	4	4	3
GreatBri	PE	9	4	3	0	2	3	2
GreatBri	??	9	4	4	9	4	4	1
Hungary	ST	0	4	4	1	1	4	4
Italy	PE	0	4	0	4	0	0	4
Netherla	PE	4	4	4	2	3	4	9
Norway	PE	1	3	3	2	1	4	3
Poland	UT	4	4	4	4	0	4	9
Poland	ST	4	0	2	3	1	3	2
Poland	PE	4	0	0	4	0	0	2
Portugal	UT	4	2	4	0	0	3	4
Portugal	ST	3	3	3	3	3	3	4
Portugal	PE	4	0	4	3	0	4	4
Slovenia	ST	9	3	4	0	4	4	9
Spain	PE	3	0	3	1	0	4	9
Spain	??	4	1	4	0	1	2	3
Spain	PE	4	2	3	1	1	3	4
Sweden	UT	4	0	3	3	0	2	4
Sweden	UT	4	0	4	2	1	4	1
Sweden	ST	3	4	4	0	0	4	4
Sweden	UT	4	0	4	0	0	4	4
Sweden	PE	2	9	2	1	2	9	9