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The Implementation the Bologna Process Reforms into Physics Programmes in Europe: The Master Level

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Introduction

- The study was carried out in 26 Bologna signatory countries and involved:
  - a curriculum analysis of Master level programmes
  - an online questionnaire sent via the national representatives of the EPS to the respective programme coordinators in their country.
- Response rates, participation by country:
  - Curricula:
    - Response rate: 55 %
    - No curricula from: Albania, Denmark, Greece, Poland, Portugal, Spain, and Ukraine
  - Online questionnaire:
    - Response rate: 54 %
    - No responses from Greece and Portugal

Table 1: Countries and number of universities involved in the study, response rates

Country	Total number of universities	Number of universities offering Physics programmes	Number of universities to be included in project	Number of universities having submitted MA curricula	Number of MA programmes from which we have curricula [1]	Number of respondents to the questionnaire	Percentage: curricula [2]	Percentage: questionnaire
Albania	15	4	4	0	0	1	0	25%
Austria	31	6	6	6	10	3	100%	50%
Belarus	28	6	4	1	1	1	25%	25%
Belgium	15	10	6	6	6	3	100%	50%
Croatia	5	4	4	2	3	1	50%	25%
Czech Republic	24	12	5	2	2	5	40%	100%
Denmark	12	4	4	0	0	3	0	75%
Finland	13	11	8	8	8	7	100%	88%
France	87	57	29	7	6	7	24%	24%
Germany	97	59	35	35	71	28	100%	80%
Greece	23	5	5	0	0	0	0	0
Hungary	25	5	5	3	4	5	60%	100%

[1] Can be different from the "Number of universities having submitted curricula", if one university offers more than one Physics programme.
[2] With regard to the column „Number of universities having submitted curricula", since we don't know the total number of programs offered by universities which were included in the project.

Ireland + UK	233	57	34	27	168	21	79%	62%
Italy	89	36	20	9	9	7	45%	35%
Lithua nia	15	4	4	1	1	3	25%	75%
Macedonia	5	2	2	2	2	1	100%	50%
Nether lands	14	9	5	5	7	2	100%	40%
Poland	18	12	8	0	0	8	0	100%
Portugal	34	15	10	0	0	0	0	0
Slovenia	4	3	2	2	3	1	100%	50%
Slovakia	33	14	2	2	15	2	100%	100%
Spain	73	21	12	0	0	6	0	50%
Sweden	21	9	6	1	1	6	17%	100%
Switzer -land	12	7	8	8	10	3	100%	38%
Ukraine	81	10	3	0	0	1	0	33%
Total	**1007**	**382**	**231**	**127**	**327**	**125**		
In Percent			**60% of the sample (382)**				**55 % of the unive rsities to be included in the project**	**54 % of the unive rsities to be included in the project**

Sample Description: Institutions

- Bias in favour of Germany and UK/Ireland (Total: 39 %):
  - 22 % of all responses from Germany
  - 17 % of all responses from UK/Ireland
- Majority of respondents: double function as teachers in the programmes and programme coordinators
- Size of the Physics departments (Mean):
  - 467 students
  - 79 academic staff members
  - 75 doctoral candidates/students

Characteristics of the universities:

- Age of the universities (good balance between old and new universities):
  - 37 % established after World War II
  - 25 % established between 1850 and 1950
  - 23 % established between 1550 and 1850
  - 14 % established between 1210 and 1510
- Type of institutions:
  - 91 % universities
  - 9 % technical universities
- Size and Spectrum of subjects:
  - Mean of 23,260 students and 1,990 staff
  - More than half of the repondents are working in universities with a broad spectrum of subjects (exception: arts and agriculture)

Curricula vs. Programmes

- One Physics programme consists of several specialisations which each have their own curriculum (Italy)
- Specialisations are part of one albeit internally differentiated curriculum (Austria)
- First and second year of the Master programmes each have their own curriculum although it counts as one programme (France): here: remnant of the old structure

Comparison between traditional and currently offered Master physics programme:

- Before Bologna a high percentage of universities offered only one programme
- Nowadays the distribution is more diverse

Table 2: Number of traditional Physics programmes and number of currently offered Master programmes by university (percent)

Number of programmes	Traditional programmes	Currently offered Master programmes
1 programme	42 %	27 %
2 programmes	20 %	25 %
3 programmes	17 %	15 %
4 programmes	5 %	11 %
5 programmes	5 %	10 %
6 programmes	1 %	2 %
7 programmes	2 %	2 %
8 programmes	3 %	5 %
9 programmes	1 %	1 %
10 programmes	4 %	2 %
Total	100.0 % (n=114)	100.0 % (n=121)

Question 2.7: Please state the name (in English translation) of the Physics programmes (and degrees) offered at your institution, , BEFORE changing to the new model of Bachelor and Master (in the following we will refer to these as TRADITIONAL PROGRAMMES) .

Question 3.3: Please state the name of the Master programme(s) (and degrees) in Physics currently offered at your institution (please in English translation), the scheduled duration in years, the number of Credit Points to be earned and the to tal number of students enrolled.

Sample description: Physics programmes

•Total number of currently offered Master programmes: 378

•(compared to 308 traditional programmes, before Bologna)

➢Increase of programmes (on the Master level), probably as a consequence of Bologna

•15 % of the currently offered programmes are so called integrated Master programmes with a duration of 4 to 5 years (in particular in the UK and Ireland, Finland, Poland, Sweden, Switzerland and Austria)

•Research-oriented programmes (77%) – professionally oriented programmes (23 %)

Table 3 Scheduled duration (years) by country (Percent; Multiple Reply)

	1 year	1.5 years	2 years	3 years	4 years	4.5 years	5 years	Total
Albania	100	0	100	0	0	0	0	200
Austria	0	0	100	33	0	0	33	167
Belarus	100	0	0	0	0	0	0	100
Belgium	67	0	100	33	0	0	0	200
Croatia	0	0	100	0	0	0	0	100
Czech Republic	0	0	80	20	0	0	0	100
Denmark	0	0	100	0	0	0	0	100
Finland	0	0	100	0	0	0	14	114
France	0	0	100	0	0	0	0	100
Germany	4	0	100	0	0	0	0	104
Hungary	0	0	100	0	0	0	0	100
Italy	0	0	100	0	0	0	0	100
Lithuania	0	0	100	0	0	0	0	100
Macedonia	100	0	0	0	0	0	0	100
Netherlands	50	0	50	0	0	0	0	100
Poland	0	0	71	0	0	0	29	100
Slovakia	0	0	100	0	0	0	0	100
Slovenia	0	0	100	0	0	0	0	100
Spain	83	33	33	0	0	0	17	167
Sweden	0	0	100	0	0	0	20	120
Switzerland	0	67	0	0	0	33	33	133
UK/Ireland	62	0	29	0	38	0	5	133
Ukraine	0	0	100	0	0	0	0	100
Total	21	3	77	2	7	1	7	117

Question 3.3: Please state the name of the Master programme(s) (and degrees) in Physics currently offered at your institution (please in English translation), the scheduled duratio n in years, the number of Credit Points to be earned and the total number of students enrolled:

Introduction of second cyle Master programmes:

- Mostly between 2002 and 2008
- Forerunners: Denmark, Lithuania, Slovakia
- Latecommers: Austria, Germany, Hungary, Poland, Slovenia, Spain

Table : Introduc tion of Master Physics programme(s) by country (Percent; Multiple Reply)

	Before 2000	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2012	Total
Albania	0	0	0	0	0	0	0	0	0	100	0	0	0	100
Austria	0	0	0	0	0	33	0	0	33	33	33	33	0	167
Belarus	0	100	0	0	0	0	0	0	0	0	0	0	0	100
Belgium	33	0	0	0	0	33	0	33	0	0	0	0	0	100
Croatia	0	0	0	0	0	100	0	0	0	0	0	0	0	100
Czech Republic	0	25	0	0	25	25	25	0	0	0	0	0	0	100
Denmark	67	0	0	0	0	0	0	0	33	0	0	0	0	100
Finland	33	0	0	0	33	0	50	17	17	0	0	17	0	167
France	0	0	0	0	20	20	40	20	0	0	0	0	0	100
Germany	0	0	7	4	4	4	7	14	18	29	21	18	4	129
Hungary	0	0	0	0	0	0	0	0	0	20	80	0	0	100
Italy	0	0	0	14	29	57	0	0	0	0	14	0	0	114
Lithuania	100	0	0	0	0	0	0	0	0	0	0	0	0	100
Netherlands	0	0	0	50	0	50	0	0	0	0	0	0	0	100
Poland	14	0	0	0	0	0	0	0	14	14	14	43	0	100
Slovakia	50	0	0	0	50	0	0	0	0	0	0	0	0	100
Slovenia	0	0	0	0	0	0	0	0	0	0	0	100	0	100
Spain	0	0	0	0	0	0	0	67	0	67	0	17	0	150
Sweden	0	0	0	0	0	0	0	0	100	0	0	0	0	100
Switzerland	0	0	0	0	33	67	0	0	0	0	0	0	0	100
UK/Ireland	80	0	0	0	0	10	0	0	10	10	0	0	0	110
Ukraine	0	0	0	0	0	0	100	0	0	0	0	0	0	100
Total	16	2	2	3	9	13	9	10	13	16	12	11	1	118

Question 3.1: When did you or will you introduce Master degree programme(s) in Physics in your institution?

Duration of Physics programmes

- Traditional programmes:
  - In more than two twirds: duration of four or five years
- Currently offered Master programmes:
  - In two thirds: duration of two years
  - In slightly less than 18 percent: duration of one year
- More students than before study five years
- + a sizeable proportion of students take a bit longer to finish then the prescribed period of study (28 %)

➢ The Bologna process has lead to a lenghtening of time-to-degree or at least has not reduced it

Table 5: Duration of traditional Physics programmes and currently offered Master programmes in Physics (in percent)

Duration in years	Traditional programmes	Currently offered Master programmes
1.0 year	6.1 %	17.7 %
1.5 years	--	1.9 %
2.0 years	6.1 %	66.5 %
2.5 years	--	--
3.0 years	15.5 %	0.8 %
3.5 years	0.3 %	--
4.0 years	24.6 %	8.6 %
4.5 years	2.0 %	0.3 %
5.0 years	45.5 %	4.3 %
Total	100.0 % (n=297)	100.0 % (n=373)

Question 2.7: Please state the name (in English translation) of the Physics programmes (and degrees) offered at your institution, BEFORE changing to the new model of Bachelor and Master (in the following we will refer to these as TRADITIONAL PROGRAMMES)

Question 3.3 : Please state the name of the Master programme(s) (and degrees) in Physics currently offered at your institution (please in English translation), the scheduled duration in years, the number of Credit Points to be earned and the total number of students enrolled:

Use of Credit Points:

- Use of ECTS widely established:
  - 82 % stated that ECTS is applied generally
  - 6 % stated that it is applied for ERASMUS students only
  - 12 % stated that ECTS is not applied at all
- Out of these 12 %, 44 % stated that they use their own CP system, but compatible with ECTS (e.g. UK and Ireland, Sweden, some of the Central and Eastern European countries)
- Typically, 120 ECTS for second cycle Master programmes (exceptions: Switzerland, UK)

Table 6: Applicaton of ECTS by country (Percent)

	Yes, (in all of them)	No, for ERASMUS students only	No, we don't apply ECTS	Total
Albania	100	0	0	100
Austria	100	0	0	100
Belarus	0	0	100	100
Belgium	100	0	0	100
Croatia	100	0	0	100
Czech Republic	100	0	0	100
Denmark	100	0	0	100
Finland	100	0	0	100
France	100	0	0	100
Germany	93	4	4	100
Hungary	60	20	20	100
Italy	100	0	0	100
Lithuania	0	100	0	100
Macedonia	100	0	0	100
Netherlands	100	0	0	100
Poland	100	0	0	100
Slovakia	100	0	0	100
Slovenia	100	0	0	100
Spain	100	0	0	100
Sweden	83	0	17	100
Switzerland	100	0	0	100
UK/Ireland	35	10	55	100
Ukraine	100	0	0	100
Total	82	6	12	100

Question 4.1: Do you apply ECTS Credit Points in the framework of your Master Programme(s) in Physics for all students?

Calculation of CP:

•In 8 %: CP are calculated only on the basis of contact hours (in some institutions in Belgium, the Czech Republic France, Hungary, Poland, and Switzerland).

•In 92 %: CP are calculated on the basis of contact hours + independent study → workload based calculation: But considerable differences in the calculation of required hours of learning/workload for earning one credit point:

- 35 % require 30 hours
- 27 % require 25 hours

➢ These correspond to the Bologna guidelines (between 25 and 30 hours)

Table 7: Calculation of Credit Points by country (Percent)

	On the basis of contact hours and independent study	Only on the basis of contact hours
Albania	100	0
Austria	100	0
Belgium	50	50
Croatia	100	0
Czech Republic	80	20
Denmark	100	0
Finland	100	0
France	40	60
Germany	100	0
Hungary	80	20
Italy	100	0
Lithuania	100	0
Macedonia	0	100
Netherlands	100	0
Poland	83	17
Slovakia	100	0
Spain	100	0
Sweden	100	0
Switzerland	50	50
UK/Ireland	100	0
Total	92	8

Question 4.4: How are the Credit Points calculated?

Table 8: One-Credit-Point Workload Equivalent by country (percent)

	10 hours	15 hours	20 hours	25 hours	30 hours	Other
Albania	0	0	0	100	0	0
Austria	0	0	0	100	0	0
Belgium	0	0	0	100	0	0
Croatia	0	0	0	0	100	0
Czech Republic	0	50	0	50	0	0
Denmark	0	0	0	100	0	0
Finland	0	0	0	67	0	33
France	0	50	50	0	0	0
Germany	0	0	0	0	100	0
Hungary	0	25	0	0	50	25
Italy	0	0	0	86	0	14
Lithuania	0	0	0	0	0	100
Netherlands	0	0	50	0	0	50
Poland	33	50	0	0	17	0
Spain	0	0	33	67	0	0
Sweden	0	0	0	75	0	25
Switzerland	0	0	0	0	100	0
UK/Ireland	59	0	18	12	0	12
Total	13	8	6	27	35	11

Question 4.5: How many hours of student workload are required to earn one credit point?

Modularisation, responses from the questionnaire:

•In 68 % of the Physics departments all programmes are modularised (Albania, Denmark, Germany, Macedonia, Netherlands, Ukraine)

•In 4 % some programmes are modularised

•In 28 % programmes are not modularised (Belarus and Slovenia)

Modularisation, information from the curriculum analysis:

•In many countries: Modules tend to be rather small (1 to 6 CP); Bigger modules in relationship to practical phases

•In some countries: Classes have been put together into larger study blocks, e.g. a module called „Compulsory Courses" or „Elective Courses" or even a whole specialisation like „Medical Physics" (Austria, Netherlands, Belgium Switzerland)

•Especially in Germany modules are composed of two or more courses which are linked through content. Here also often larger modules like Particle Physics I ans II (20 ECTS)

Table 9: Modularisation of Master Physics Programme by country (Percent)

	Yes, (all of them)	Yes, some of them	No	Total
Albania	100	0	0	100
Austria	33	33	33	100
Belarus	0	0	100	100
Belgium	33	0	67	100
Croatia	0	100	0	100
Czech Republic	40	20	40	100
Denmark	100	0	0	100
Finland	43	0	57	100
France	83	0	17	100
Germany	100	0	0	100
Hungary	0	20	80	100
Italy	86	0	14	100
Lithuania	67	0	33	100
Macedonia	100	0	0	100
Netherlands	100	0	0	100
Poland	13	0	88	100
Slovakia	50	0	50	100
Slovenia	0	0	100	100
Spain	80	0	20	100
Sweden	50	0	50	100
Switzerland	33	0	67	100
UK/Ireland	86	5	10	100
Ukraine	100	0	0	100
Total	68	4	28	100

Question 4.6: Have you modularised your Master Physics Programme(s) (a module being a self-contained unit of study)?

Diploma Supplement

•12 % stated that the introduction is envisaged for the next years (mostly between 2010 and 2014)

•25 % stated the introduction has not been discussed yet (Albania, Croatia, a high proportion of respondents from Denmark, France, and Spain)

•67 % stated that the provide graduates with a Diploma Supplement:

- 87 % automatically for Master students
- 13 % upon request

Table 10: Introduction of the Diploma Supplement by country (percent)

	No, but is envisaged	No, and hasn´t been discussed yet	Yes	Total
Albania	100	0	0	100
Austria	0	0	100	100
Belarus	0	0	100	100
Belgium	0	67	33	100
Croatia	100	0	0	100
Czech Republic	0	0	100	100
Denmark	50	0	50	100
Finland	17	17	67	100
France	40	40	20	100
Germany	4	4	93	100
Hungary	0	20	80	100
Italy	29	29	43	100
Lithuania	0	0	100	100
Macedonia	0	100	0	100
Netherlands	0	0	100	100
Poland	0	0	100	100
Slovakia	0	0	100	100
Slovenia	0	0	100	100
Spain	40	20	40	100
Sweden	0	50	50	100
Switzerland	0	0	100	100
UK/Ireland	15	55	30	100
Ukraine	0	0	100	100
Total	12	21	67	100

Question 4.9: Do you provide graduates in Physics with a Diploma Supplement?

Specialisation and Interdisciplinarity (findings from the online survey)

- 56 % standard Physics programmes
- 22 % specialised programmes
- 23 % interdisciplinary programmes (engineering Physics included).

These are combined:

- in 64 % with other natural sciences
- In 55 cases with engineering sciences
- In 24 % with medical sciences
- Few with economics, social sciences and humanities

- Consecutive programmes: 97 % (almost all are delivered in classical presence delivery mode)
- Continuing edcuation programmes: 3 %

Specialisation and Interdisciplinarity (findings from the curriculum analysis):

•Basically no programme without a specialisation

•Five main models of specialisation:

- one or more specialisations added or parallel to a general Physics part
- a variety of independent specialisation curricula plus electives
- Specialisations are independent programmes with their own degrees and titles.
- research oriented programmes, interdisciplinary programmes, and teacher training programmes. Distinction between professional and research orientation is important.
- France as a special case: separate curricula for the first and the second year of Master level studies.

Mobility and internationalisation: four dimensions

1.Proportion of double and joint degree programmes :

- Only 11 % of the Physics departments offer these programmes

2.International composition of the student body:

- High proportions of international students indicated from Finland (32%), Germany (26 %), Sweden (68%), UK/Ireland (29%)

3.Teaching in a foreign language:

- Only few countries don´t offer it at all (UK/Ireland)
- In some countries this happens to 100 % (Austria, Denmark, Finnland, Netherlands, Sweden, Switzerland)
- Changes regarding teaching in a foreign language in the last years?
  - Only 18 % saw a link to the Bologna process
- Languages offered: English (71 %), German (17 %), French (14 %), Spanisch and Italian (each 7 %)

4. Mobility of students

4.1 Phases of study aborad part of the curriculum?

- 77 %: no
- 14 %: in some programmes
- 8 %: in all programmes

4.2 In what phase of their studies do do students normally go abroad?

- 57 %: in the first year of the Master programme
- 34 %: in the second year
- 37: between the Bachelor and the Master

4.3 Duration of the mobility:

- Between 3 and 5 months: 50 %
- Longer than 5 months: 40 %
- Between one and two months: 10 %

4.4 Percentage of mobile students from own institution and from foreign students (only second cycle programmes):

- High percentages from own institution: Austria, Germany, Slovakia, Netherlands, Belgium
- High percentages of foreign mobile studnets: Belgium, Finland and Sweden (more than 50 %)
- Changes regarding student mobility in recent years?
  - 52: no changes
  - 28: Changes, but not related to the Bologna process
  - 20 %: Changes, and related to the Bologna process
  - Out of these 20 %, respondents answered that:
    - Outgoing student mobility (Bachelor) has gone down
    - Incoming student mobility (Bachelor) has increased
    - Mobility in Master has increaed (both: for outgoing and incoming mobility)

Table 11: Changes in student mobility (Percent)

	%	count
The number of students in our BACHELOR Physics programme(s) going} abroad is		
Higher	41	7
Lower	59	10
Total	100	17
The number of students in our MASTER Physics programme(s) going}abroad is		
Higher	57	8
Lower	43	6
Total	100	14
The number of international students in our BACHELOR Physics programme(s) is		
Higher	75	6
Lower	25	2
Total	100	8
The number of international students in our MASTER Physics programme(s) is		
Higher	100	11
Total	100	11

Question 4.17: Do you observe any changes regarding student mobility in the Physics Master programme(s) at your institution in recent years, and if yes, are they linked to the Bologna process?

Assessment and Examination

•Types of assessment

- High percentages: written tests, homewpork papers, oral examination, project presentation
- Low percentages: Multiple choice questions, Interviews
- Assessment happens in 91 % of the cases after each module or unit of teaching and learning
- What is assessed?
- Only subject kowledge : 44%
- 56 % subject knowledge as well as transferable skills

Table 12: Marking types (Percent; Multiple Reply)

	%	count
just pass/fail/passed with distinction or honours	20	(24)
Relative marking (performance of individual student in relation to the group)		11
Absolute marking (degree of fulfilment of established criteria)		89
Individually acquired knowledge/competencies during a module/class		16
Other forms	3	(3)
Total	138	(120)

Question 6.7: What forms of marking are used in your Master Physics Programme?

Table 13: Final steps for the award of a Master degree in Physics (Percent; Multiple Reply)

	%	count
Written thesis	32	(38)
Written thesis plus defence	63	(76)
Written test(s)	18	(21)
Oral examination	26	(31)
Demonstration of an experiment, mathematical formula (or similar)		3
Project presentation	23	(27)
Other, please indicate	7	(8)
Total	170	(120)

Question 6.2: What are the final steps for the award of a Master degree in Physics in your institution?

Transferable skills and cooperation with employers

- Cooperation with employers:
  - 46 %: in all programmes
  - 17 %: for some programmes
  - 37 %: No → High proportions in Netherlands (100%), Belgium (67 %), Hungary (60 %), Germany (57 %), Sweden (50%)
- Acquisition of transferable skills: more often in technical universities

Table 14: Acquisition of transfer able skills part of the Master in Physics curriculum by university type (Percent)

	Yes, (in all programmes).	Yes, in some programmes	No	total
University	71	8	22	100
Technical University	90	0	10	100
total	72	7	21	100

Question 8.1: Is the acquisition of transfer able skills part of the Master curriculum in Physics?

Table 15: Acquisition of transferable skills part of the Master in Physics curriculum by country (Percent)

	Yes, (in all programmes).	Yes, in some programmes	No	total
Albania	100	0	0	100
Austria	100	0	0	100
Belarus	100	0	0	100
Belgium	67	0	33	100
Croatia	100	0	0	100
Czech Republic	50	0	50	100
Denmark	100	0	0	100
Finland	71	0	29	100
France	60	20	20	100
Germany	82	4	14	100
Hungary	80	0	20	100
Italy	71	14	14	100
Lithuania	67	33	0	100
Macedonia	0	0	100	100
Netherlands	50	0	50	100
Poland	43	14	43	100
Slovakia	100	0	0	100
Slovenia	100	0	0	100
Spain	75	0	25	100
Sweden	60	20	20	100
Switzerla nd	67	0	33	100
UK/Ireland	75	10	15	100
Ukraine	0	0	100	100
total	73	7	21	100

Question 8.1: Is the acquisition of transferable skills part of the Master curriculum in Physics?

- Transferable skills
  - Integrated into the Physics curricula: 61 %
  - Mixture of integration and provision in separate courses (32%)
- Types of transferable skills: Communication skills the most important
- Changes in the acquisition of transferable skills in recent years?
  - Technical universities: mostly no and if yes, not related to the Bologna process
  - Universities: no (40%) and some see a link to the Bologna process

Table 16: Types of transferable skills (Percent; Multiple Reply)

	%	count
International competencies (i.e. foreign languages)	77	(73)
Communication skills (i.e. presentation skills, scientific writing)	96	(91)
Social skills (i.e. team work)	78	(74)
Cognitive competencies (dealing with complexity)	72	(68)
Self-(organisation) competencies (i.e. personal responsibility, autonomy)	74	(70)
Additional qualifications (i.e. project management)	54	(51)
Other	5	(5)
total	455	(95)

Question 8.2: What type of transferable skills can students in your Master Physics programme(s) acquire?

Table 17: Changes in transferable skills in the Physics Master programme(s) in recent years by university type (Percent)

	No, there aren't any changes.	Yes, risen, but not linked to the Bologna process	Yes, risen and linked to the Bologna process	total
University	40	37	23	100
Technical University	75	25	0	100
total	43	36	21	100

Question 8.4: Do you observe any changes regarding the acquisition of transferable skills in the Physics Master programme(s) at your institution in recent years, and if yes, are they linked to the Bologna process?

Transition:

•Selection and admission in the programmes:

- 67 %: yes, there are entry requirements
- Different for second cycle and integrated masters

•Transition of Master graduates into labour market (compared to traditional graduates):

- Has increased in Albania, Belgium, France, Poland
- Has decreased in Denmark, Lithuania, the Netherlands, Slovakia, Spain, Sweden, UK/Ireland

•Transition into doctoral porgrammes:

- Has increased in Albania, Belarus, Denmark, Finland, Germany, the Netherlands, Slovakia , Spain, Sweden, and UK/Ireland
- Has decreased in Belgium, France and Lithuania

Table 18: Entrance requirements for second cycle programmes by university (Percent; Multiple Reply)

	%	count
Written test, Second cycle programmes	6	(4)
Interview, Second cycle programmes	34	(24)
Grade point average, Second cycle prog rammes	63	(45)
Other, Second cycle programmes	32	(23)
Total	135	(71)

Question 3.11: Do you have entrance requirements for the Master phase?

Table 1 9: Entrance requirements for integrated programmes by university (Percent; Multiple Reply)

	%	count
Written test, Integrated pro grammes	0	(0)
Interview, Integrated programmes	8	(3)
Grade point average, Integrated programmes	73	(27)
Other, Integrated programmes	35	(13)
Total	116	(37)

Question 3.11: Do you have entrance requirements for the Master phase?

Table 20 **Percentage of Physics Master and traditional Physics programme(s) graduates into the labour market by country (Mean)**

	percent of Physics Master graduates going into the labour market	percent of graduates of traditional Physics programme(s) going into the labour market
Albania	75	70
Austria	.	58
Belarus	100	100
Belgium	57	48
Czech Republic	60	.
Denmark	75	80
Finland	72	74
France	24	20
Germany	47	48
Hungary	.	70
Italy	56	56
Litauen	60	70
Macedonia	90	90
Netherlands	73	95
Poland	100	88
Slovak Repu blic	20	30
Slovenia	.	80
Spain	41	55
Sweden	35	73
Switzerland	50	50
UK/Ireland	53	71
Ukraine	60	60
Total	54	63

Question 9.2: Please estimate the percentage of Physics Master graduates as well as of graduates of traditional Physics programme(s) going in to the labour market:

Table 2 1 Percentage of Physics Master and traditional Physics programme(s) graduates into a Doctoral programme by country (Mean)

	percent of Physics Master graduates	percent of graduates of traditional Physics programme(s)
Albania	10	5
Austria	.	52
Belarus	95	20
Belgium	35	43
Croatia	.	20
Czech Republic	33	.
Denmark	68	20
Finland	48	42
France	71	80
Germany	54	50
Hungary	.	29
Italy	43	43
Lithuania	5	10
Macedonia	50	.
Netherlands	45	40
Poland	10	10
Slovakia	80	70
Slovenia	.	20
Spain	70	53
Sweden	65	27
Switzerland	43	43
UK/Ireland	49	22
Ukraine	40	40
Total	49	36

Question 9.3: Please estimate the percentage of Physics Master graduates as well as of graduates of traditional Physics programme(s) going into a Doctoral programme:

Quality Assurance, Accreditation, Evaluation

- Quality assurance regulated by national law???
- Institutional level:
  - 92 %: yes
  - 8 %: no; mainly from Switzerland, Italy, Finland
- Quality assurance:
  - Related to the Bologna process: predominantly periodic accreditation and re-accreditation

Table 22: Nationally -regulated Quality Assurance by country (percent)

	Yes	No
Albania	100	0
Austria	33	67
Belarus	100	0
Belgium	33	67
Croatia	100	0
Czech Republic	100	0
Denmark	67	33
Finland	43	57
France	60	40
Germany	63	37
Hungary	100	0
Italy	43	57
Lithuania	100	0
Netherlands	100	0
Poland	75	25
Slovakia	100	0
Slovenia	0	100
Spain	80	20
Sweden	100	0
Switzerland	33	67
UK/Ireland	71	29
Ukraine	100	0
Total	69	31

Question 7.1: Is quality assurance regulated by national law in your country?

Table 23: Implementation of quality assurance in institution by country (Percent)

	Yes	No
Albania	100	0
Austria	100	0
Belarus	100	0
Belgium	100	0
Croatia	100	0
Czech Republic	75	25
Denmark	100	0
Finland	71	29
France	80	20
Germany	100	0
Hungary	80	20
Italy	71	29
Lithuania	100	0
Macedonia	100	0
Netherlands	100	0
Poland	88	13
Slovakia	100	0
Slovenia	100	0
Spain	100	0
Sweden	100	0
Switzerland	33	67
UK/Ireland	100	0
Ukraine	100	0
Total	92	8

Question 7.2: Is quality assurance implemented in your institution/programme(s)?

Table 116: types of quality assurance activities by university (percent, count)

	%	count
System of approval		
Related to the Bologna reforms	29	23
Not related to the Bologna reforms	49	39
Not applicable	23	18
Total	100	80
Periodic accreditation/re-accreditation of the programme(s)		
Related to the Bologna reforms	47	48
Not related to the Bologna reforms	43	44
Not applicable	11	11
Total	100	103
Evaluation of courses/modules by student questionnaire		
Related to the Bologna reforms	21	24
Not related to the Bologna reforms	72	81
Not applicable	6	7
Total	100	112

Question 7.3: What types of quality assurance activities are carried out in your Master programme(s) in Physics? Please indicate also, if they were introduced in the context of the Bologna reforms or not. (Multiple replies possible)

Table 116: types of quality assurance activities by university (percent, count)

	%	count
Inclusion of external examiners		
Related to the Bologna reforms	6	5
Not related to the Bologna reforms	38	29
Not applicable	56	43
Total	100	77
Monitoring of teaching material and preparation of teachers		
Related to the Bologna reforms	13	10
Not related to the Bologna reforms	40	31
Not applicable	47	36
Total	100	77
Obligatory participation of teaching staff in pedagogical/didactic courses		
Related to the Bologna reforms	3	2
Not related to the Bologna reforms	35	24
Not applicable	62	42
Total	100	68
Other		
Related to the Bologna reforms	44	4
Not applicable	56	5
Total	100	9

Question 7.3: What types of quality assurance activities are carried out in your Master programme(s) in Physics? Please indicate also, if they were introduced in the context of the Bologna reforms or not. (Multiple replies possible)

Preliminary Conclusions:

•A trend seems to be emerging that getting a Master degree in Physics takes the same time, in some institutions more time than getting a degree in the previous long-cycle programmes.

• No uniform use of credit points; the workload concept is often not taken into account; modularisation is widespread though not everywhere; the size of modules varies considerably.

•The provision of a Diploma Supplement upon graduation is becoming more widespread.

•There is a high level of specialisation at the Master level. Somewhat less than one quarter of the respondents stated that they also offer interdisciplinary programmes.

•In quite a number of countries the composition of the student body at the Master level has become quite international. A mixed picture emerges with respect to outgoing student mobility. Respondents from many central and eastern European countries stated that mobility is not included in their Physics curricula but also respondents from Austria, Finland, and Switzerland. But actual outgoing mobility is high in Austria, Germany, the Slovak Republic, the Netherlands, and Belgium, while incoming mobility is high in Belgium, Finland, and Sweden. Mobility in Bachelor Physics programmes has gone done and in Master Physics programmes it has gone up. Apart from UK and Ireland teaching in a foreign language (though not always exclusively) has increased overall. English is most common (71%).

Preliminary Conclusions:

•Assessment and examinations rather traditional. However, increasingly student performance during the programme is included in the final mark, thus reducing the weight of the final examination.

•The acquisition of transferable skills to help smooth transition into employment is receiving more attention. Also employers are involved in the development of Physics curricula.

•A European mainstream is emerging which differs from Anglo-American models, requiring the successful completion of a Master degree for selection into a doctoral programme. Concerning transition into the labour market or into a doctoral programme we have a mixed picture

•Quality management has been on the agenda in most countries already before the Bologna Declaration. By now a broad range of quality assessment and improvement instruments have been introduced. Programme accreditation is the only instrument which is closely related to BP

•No uniformity of implementation among countries and among institutions within a given country

•Some structural convergence at the macro level (system) but not at the micro level (department/faculty/programme)

•Changes in the institutions due to the Bologna reforms: hardly any in quality issues, mobility mixed, esp. at Master level, not very pronounced with regard to teaching in a foreign language, more attention to transferable skills in universities