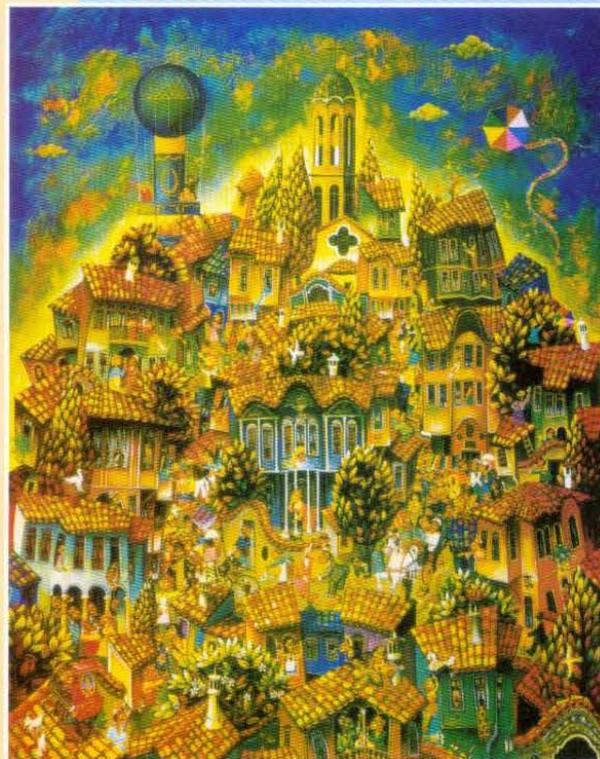


EU TRAIN

Towards a Common Curriculum for the Teaching Practice of Science Teachers

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Chapter 3

Description and comparison of the teacher training programmes in the partner countries

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Abstract

This chapter first of all describes the national educational systems of the partner countries, together with a description of the national resources in the teacher training area. Then there is a comparison of teacher training curricula together with the main common features significant for the future implementation of the unified teacher training curriculum.

Introduction

Most countries are usually dissatisfied with their educational system. Therefore, in making an effort to improve it, they adopt an educational policy in line with their aims and social conditions. Thus, in recent years the school systems in almost all European Union countries have been undergoing essential reforms on different levels of education, the reason being the process of co-ordination of the educational systems. This had made possible co-operation in the field, which was recognised as one of the most important European common goals. In the Maastricht Treaty, in Article 149/1 (Anon., 2008a), it says that: "... the Community shall contribute to the development of quality education by encouraging cooperation between Member States and, if necessary, by supporting and supplementing their actions, while fully respecting the responsibility of the Member States for the content of teaching and the organisation of education systems and their cultural and linguistic diversity."

Taking into account that "science is an important component of our European cultural heritage"... and that "it is the quality of the teacher that is the major determinant of student engagement with science" (Osborne, J. & Dillon, J., 2008), in this chapter we are going to concentrate mainly on the structure of the teacher training programmes, and especially on the science teacher training curricula in the institutions of the EU TRAIN project partner countries. To understand the differences and similarities between the teacher

training programmes it is necessary to begin by describing briefly how the education systems in the partner countries are organized.

Primary and secondary education systems in the partner countries

The present systems of primary and secondary education in our four partner countries (including the results of the recent educational system reforms in Bulgaria, Estonia and Poland) are shown in Figure 1. To compare them, the levels of ISCED (International Standard Classification of Education of UNESCO) were used (UNESCO, 2008c). ISCED uniform levels were established to make the comparison of the education systems in different countries possible. It's important to stress here that the situation is continuously changing because of the process of reforms and conformation of national systems to the European Union regulations.

As we can see, the major differences are observed in the duration of compulsory education and the structure of education at the pre-primary, primary and secondary levels. In general, pre-primary education is not compulsory. In Poland six year old children should only attend the special "zero" class, which is treated as the first preparatory year of primary education. It can be provided by primary schools or kindergartens under the auspices of the local government. In other partner countries pre-primary education is treated as an option for parents. Local governments are obliged to create and supervise the kindergartens. The duration of compulsory education differs in the partner countries from 9 years in Estonia and Finland to 12-13 years in Poland (until the age of 18). In Finland education is compulsory in primary and lower secondary school. In Estonia primary and lower secondary levels are combined but, like Finland and Bulgaria, schooling is obligatory until the age of 16. It is also worth noting that the upper secondary schooling in Bulgaria and Estonia lasts 4 years, but in Finland and Poland 3 years. The different structures of the education systems lead to a situation where pupils who end their compulsory education have different educational backgrounds. In Bulgaria, Estonia and Poland, some upper secondary schooling is compulsory. Thus the process of unifying the school systems seems to be incomplete and needs improving.

These differences are not very important from the project partners' point of view. We are focused mainly on a unified science teacher training practice for lower and upper secondary school, where the age of children is not much different in every partner country. The fact that the training practice doesn't involve only subject teaching preparation (methodology of teaching), but also more general pedagogical and sociological preparation for the roles of the teacher and pupils' supervisor, also makes our task more realistic.

In the next sections we analyse the national resources in teacher training and science teacher training curricula in the partner countries which is the starting point for their further comparison.

Organisation of teacher training in the partner countries

The initial (pre-service) teacher training in the partner countries takes place mainly during university education (professional teacher education is realized at the same time as the discipline core subjects education) and this programme of teacher education we call the concurrent model. However, in each of the four partner countries it is also possible to obtain teaching qualifications using an alternative training pathway, e.g. the consecutive model, where students first receive a general education in order to obtain a degree in a particular subject or branch of study, and then begin the initial professional training programme, enabling them to qualify as teachers.

Teacher qualification standards are very alike in all partner countries. These standards consist of a set of core competencies, relevant knowledge (subject, methodical and practical) and skills (such as a foreign language or ICT), that a future teacher must possess. Thus, the initial study programme should make it possible for student teachers to obtain their teaching qualification. The main forms of study programmes are also similar and there are lectures with final exams, laboratory work, exercises, seminars, school practice (supervised by a university or school teacher), individual work of the teachers-to-be or their groups (completing the following tasks: writing essays, preparing exercises, working in libraries, preparing lessons, writing papers, giving seminar talks and passing the final exams). However, it's important to emphasize that in our comparison we take into account only this part of the studies, which should be named "contact hours" (activities organised by the university or a teacher training school). It's very difficult to estimate the approximate amount of time spent by trainees on self studies, group work, etc. Of all the partner countries, only in Finland is this part of the student's work included in the ECTS (European Credit Transfer System) points calculation.

A general comparison of the studies' structure shows that the organisation of the academic year is similar in all universities. The academic year consists of two semesters of almost the same duration (15 to 16 weeks).

We describe next the teacher training resources in partner countries in general (in alphabetical order), and then the few particular peculiarities of each national teacher training system.

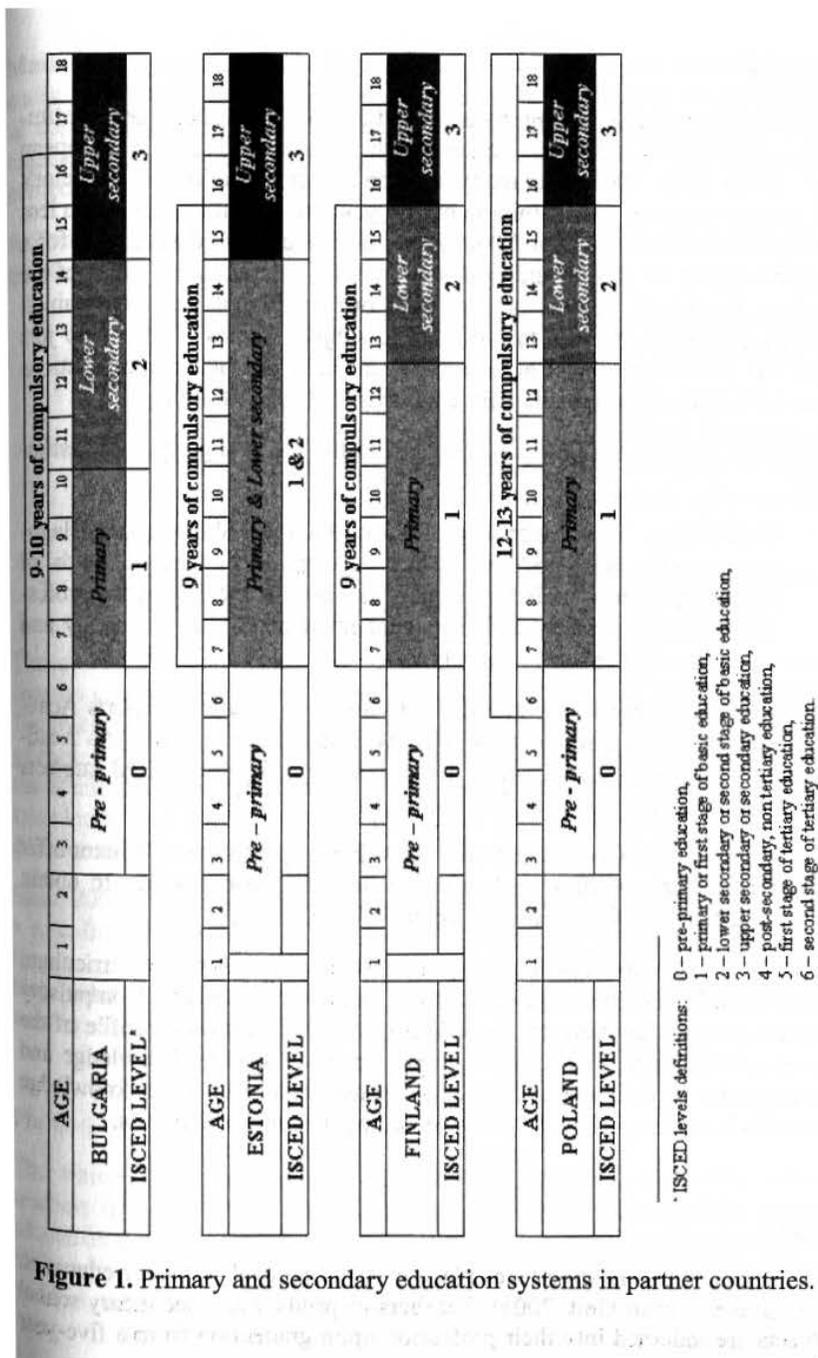


Figure 1. Primary and secondary education systems in partner countries.

Bulgaria

Initial teacher training in Bulgaria is carried out in higher educational institutions – universities and special teacher higher institutes (Eurydice European Unit, 2001). Since 2002, state regulations on higher education for Bachelor's and Master's degrees fixes a minimum of 4 years study with a total of no less than 2,200 and no more than 3,000 hours for a Bachelor's degree, and for a Master's degree for profile and extensive training, related to the major of the previous Bachelor's degree, no less than one additional year is required. Teacher training is parallel to the specific subject studies. Those who just study the particular subject at university can acquire teacher qualifications upon their graduation (the alternative pathway of teacher training).

In Bulgaria teacher training is carried out in the following types of institutions:

- Universities: The universities of Sofia, Plovdiv, Shumen and Blagoevgrad offer Bachelor's and Master's degrees in various fields of higher education, including teacher training in the following professional spheres: theory and management of education, pedagogy and teaching of different school subjects.
- Specialized higher institutes, for instance: The National Sports Academy in Sofia, The National Arts Academy in Sofia, The Arts Academy in Plovdiv, etc., offer teacher training in specialized subjects (physical education, music, arts, etc.).
- Qualification Centres in Sofia, Stara Zagora, Varna and Silistra offer postgraduate studies for teachers, where it is also possible to obtain qualifications for teaching a second subject.

Training in each profession in higher institutions follows a curriculum, which includes compulsory, choice and facultative subjects. Compulsory subjects provide fundamental discipline knowledge in a wide profile of the chosen professional field. Choice subjects provide specific knowledge and competencies in their major field and facultative subjects offer knowledge and skills in various scientific fields according to students' interests.

Estonia

Teacher training in Estonia takes place only at the level of higher education (Eurydice European Unit, 2001). Teachers of primary and secondary school subjects are inducted into their profession upon graduation from a five-year

Master's degree programme. Teachers for kindergartens and vocational education institutions are trained during Bachelor studies and by the realization of applied higher education curricula. As in the other partner countries, the teacher training programme includes discipline core subjects and educational subjects.

In Estonia teacher training is carried out in the following types of institutions:

- Universities: Most teacher training in Estonia is run by the two largest universities in the country, Tartu and Tallinn and their colleges in Narva, Haapsalu and Viljandi.
- Specialized higher institutes, for instance: the Cultural Academy of the University of Tartu in Viljandi, the Estonian Academy of Music and Theatre and the Estonian Academy of Arts, which offer training of special subject teachers
- Tallinn Pedagogical College, the only school of applied higher education, which prepares kindergarten teachers.

Those who did not obtain their teacher's qualifications during their basic courses can complete them through additional studies. For example, Tallinn Technical University and University of Tartu offer such in-service programmes for teachers of vocational subjects. Universities are also offering the additional programmes for working teachers, where they can acquire the knowledge and skills needed for teaching a second, additional subject. The duration of these extra studies is generally a year.

Since 2004, graduates of teacher training programmes have had to undertake a so-called "mentor year". The "trainee" is assisted by an experienced colleague – mentor and by the support programmes offered by the universities. Only after this, qualifying on-the-job, phase do future teachers obtain full teacher's qualifications.

Finland

The training of prospective pre-primary, primary and secondary school teachers in Finland takes place at the universities and at vocational teacher education colleges. Physics and chemistry teacher education is given at the University of Helsinki, the University of Joensuu, the University of Jyväskylä, the University of Oulu, the University of Turku and the Akademi.

Unique in the European scale system are thirteen teacher training schools, which belong to the faculties of behavioural sciences of Finnish universities and play a central role in training prospective teachers (Finnish Ministry of Education, 1995). There are two such schools in Helsinki, and the others are located in Hämeenlinna, Joensuu, Jyväskylä, Kajaani, Oulu, Rauma, Rovaniemi, Savonlinna, Tampere, Turku and Vaasa (language of instruction is Swedish). These teacher training schools are also called “normal schools” as at one time their primary duty was considered to be setting the norm, or providing the model, for good teaching. Other than handling vacancies (which is the responsibility of the universities), these schools enjoy independence. Their operations are governed by the relevant legislation on the teacher training schools and regulations issued directly by the Ministry of Education.

The teacher training schools' basic duties are:

- providing teaching for comprehensive and upper secondary levels,
- supervising teacher trainees,
- making school teaching experiments,
- doing research.

The teacher training schools also support and complement the teacher education and research activities of the universities. The close relationship between theory and practice forms the basis of the whole concept of a teacher's education. In the teacher training schools, knowledge in various fields of the arts and sciences, together with educational theory and know-how are applied in practice.

Besides the pre-service training system, future teachers can complete their professional education after graduation using the alternative pathways (Eurydice European Unit, 2001). To qualify as a secondary school teacher (subject teacher) a candidate must complete separate, one year, pedagogical studies after her/his higher education graduation.

Poland

Initial education of teachers for the different levels and types of schools is provided within the higher education and teacher education sectors (Eurydice European Unit, 2001). Until 2004 in the framework of each study area the students had a choice of teacher specialisation, which meant that they could acquire their teaching qualifications in parallel with their core discipline subject studies. In 2004 the National Ministry of Education issued new

regulations and now the education of lower secondary (gymnasium) two-subject school teachers may last three years (in parallel with the Bachelor's studies). For those who graduate with no teaching specialisation and later decide to enter the teaching profession, it is possible to acquire teaching qualifications during postgraduate studies or during in-service education.

In the academic year 2006/2007 there were more than 300 higher educational institutions in Poland, of which 130 were public. About 70 of them are in charge of teacher education for all levels of education.

- Universities, technical universities and teacher education schools (pedagogical universities) train teachers of various specialisations for schools at all levels and teachers of vocational subjects for secondary schools.
- Academies, for instance Academies of physical education, Academies of fine arts and Academies of music, train teachers of physical education, art and music respectively. Academies of economics, agriculture, medicine and the Academy of Mining and Metallurgy train teachers of vocational subjects for secondary vocational schools
- Schools of higher vocational education train teachers of various specialisations for nursery, primary and basic vocational schools, continuing education establishments, school libraries as well as teachers of theoretical vocational subjects and practical vocational skills for secondary schools.
- Teacher education colleges train teachers of various specialisations for nursery, primary and basic vocational schools, educational and child care establishments as well as school libraries.
- Foreign language teacher education colleges train teachers of one foreign language for primary and secondary schools.

Anyone, who has higher education with relevant pedagogical qualifications or has graduated from a teacher education institution, can undertake a teaching job in a school or other educational establishment. A teacher, who is going to undertake her/his first job as a fully qualified teacher, is employed for a period of one year in order to undergo a “trainee period” required for promotion to the post of contract teacher. A trainee teacher in Poland is upgrading her/his practical qualifications needed for taking an initial position in the four levels promotion scale.

The completion of teachers' qualifications is also possible during additional, postgraduate studies of general pedagogy (pedagogical course) offered by

universities and other educational institutions, like the National Teachers Professional Development Centre in Warsaw (in Polish CODN) and the 16 Regional Teachers Professional Development Centres (ODN). Furthermore, a working teacher may acquire the skills necessary for teaching an additional second subject during 18 months postgraduate studies at a university.

Considering that teaching is a very important profession, there is need for continuous professional development. Thus, in-service teachers' training courses are organized in Poland by the above mentioned CODN institution CODN, ODN, universities and other educational institutions. Due to the efforts of the Polish Ministry of Education the national system of certification and provisions for the consecutive steps of teachers' professional advancement was developed. The teacher at the beginning of her/his career can be employed as a "trainee teacher", then as a "contract teacher" and after fulfilling the specified requirements as "nominated teacher", and finally as a "diploma teacher". A diploma teacher with extraordinary merits in the educational field can be also distinguished by receiving the honorary title of "professor of education".

Requirements and evaluation of the prospective teacher's qualifications

According to the national teacher qualification standards, future teachers in every partner country should complete their Bachelor's or Master's subject studies, and either prepare a diploma thesis or pass the subject diploma exam. Additionally, candidate teachers are obliged to pass exams devoted to the pedagogical part of the curriculum. Table 1 (Eurydice European Unit, 2001, Finnish Ministry of Education, 1995), compares the models of education of future teachers, information about the duration of studies for the degree obtained and teaching qualifications level.

Table 1. Requirements for prospective secondary school teachers in the partner countries.

Country	Number of study years	Degree	Qualifications level
Bulgaria	4	BSc	Lower & upper secondary ISCED 2 & 3
	4+1,5	MSc	Lower & upper secondary ISCED 2 & 3
Estonia	5	MSc	Lower & upper secondary ISCED 2 & 3
Finland	5	MSc	Lower & upper secondary ISCED 2 & 3
Poland	3	BSc	Lower & upper secondary ISCED 2
	3+2	MSc	Lower & upper secondary ISCED 2 & 3

The specific differences in the teacher training system for each partner country, important from the point of view of the common curriculum of practical training, are related to the length of the teacher training programme, its place in the whole curriculum and its organisation in general. Also the number of ECTS points given for the whole programme, and for the teacher training practice in particular, is different. For example:

- in Finland and Estonia only Master's degree graduates can be teachers of Physics and Chemistry in secondary schools; in Poland it's possible for Bachelor's degree graduates to teach in lower secondary schools, while in Bulgaria Bachelor's degree graduates can be teachers in upper secondary schools as well;
- the length of the Bachelor's degree study periods varies from three years in Estonia and Poland to four years in Bulgaria;
- the pedagogical training of students in Bulgaria, Poland and Finland starts in the Bachelor degree studies, while in Estonia it takes place only during the Master degree studies.

The special requirements and forms of assessment of the future teacher's qualifications are different in every country. Table 2 shows teachers' qualifications evaluation strategies and certification procedures present in the partner countries (Eurydice European Unit, 2001).

Table 2. Evaluation and certification of prospective teachers in the partner countries.

Country	Education	Final teachers qualification exam	Certificate
Bulgaria	examination and course work	integrated practical and applied teachers state exam	Diploma certifying completion of the teachers' vocational studies or Certificate to the diploma of the graduated degree of higher education
Estonia	examination and course work	not present	Diploma certifying completion of the teachers' training curriculum
Finland	examination and course work	not present	Diploma certifying completion of the teachers' training curriculum
Poland	examination and course work	not present	Diploma certifying completion of the teachers' vocational studies

In every partner country the future teacher receives a special document: diploma or certificate proving her/his professional qualifications. Only in Bulgaria is there a final state examination phase. This special teacher's state exam includes a theoretical part and a lesson given by the candidate in the presence of the examination committee.

Description of science teacher training at the partner institutions

In this section we are going to describe the teacher training programmes and possibilities of science subjects teaching qualifications in the five universities taking a part in the EU TRAIN project.

University of Plovdiv, Bulgaria

Education at Plovdiv University has recently been undergoing reform aimed at meeting the requirements of the Bologna process, which is supported by Bulgaria. One of the targets of this reform was to gradually introduce a three-tier degree system – for Bachelor's, Master's and Doctor's degrees, as well as ECTS credit points for different subjects. Students of science studies at three faculties – those of Physics, Chemistry and Biology, and in three double subjects – Physics and Mathematics, Chemistry and Physics, and Biology and Chemistry were the main objectives of this process. The courses for these subjects last 4 years and correspond to the Bachelor's Degree. Students who graduate in the above double subjects can teach two of the selected subjects: physics, chemistry or biology in secondary schools. For four years the university has also had a license to train Master's students, but completion of this degree takes an additional one and a half years of full-time study (Anon., 2008d).

Tartu University, Estonia

The University of Tartu is the only institution in Estonia training future physics teachers for the secondary school level (Anon., 2008c). To become a Physics or other science subject teacher at secondary school level it's necessary to complete Master degree studies. The Bachelor's programme of Physics or other selected subject provides a general introduction to the area of Science and more advanced knowledge of the selected discipline. The aim of the Bachelor's degree course is to qualify the undergraduate student for Master's level studies in the selected speciality (for example Fundamental Physics, Applied Physics or Teaching of Physics).

It's also possible to obtain the qualifications to teach two selected science subjects in primary school (for example physics and chemistry, biology and chemistry etc.) during the Bachelor's programme in Educational Sciences. In this situation completing the Master's degree programme enables a student to qualify to teach the third subject in primary school.

Another way to qualify as a Physics or other Science subject teacher at the secondary school level when the student has not earlier specialized in the educational area (Anon, 2008e) is to follow the Bachelor's and Master's programmes with the addition of a Teacher Training Year.

Helsinki University, Finland

The basic degree in the Finnish higher education system is an advanced degree equivalent to the Master's degree in the British and American university systems. The average time to complete the degree is five years. To qualify at Helsinki University, as in other Finnish universities, all teachers are required to have a Master's degree. Within a degree programme student teachers usually take one or two minor subjects to complete the studies in their major subject. For example: chemistry as a major with physics and teachers' pedagogical studies as minors. Points are awarded according to basic degrees, courses and studies in general- a Master's degree is valued as 300 ECTS points. The studies are classified with respect to their contents and their position in the curriculum, into the following types: general studies, basic studies, subject studies and advanced studies. Subject teachers for comprehensive school and upper secondary school take a degree in their respective faculties, with the subject of instruction as their major (for example chemistry, 180 ECTS) and another school subject as their minor (for example mathematics 60 ECTS) and teachers pedagogical studies as their other minor (60 ECTS) (Eurydice, 2008b; Anon., 2008e).

University of Jyväskylä, Finland

The University of Jyväskylä is one of the ten multi-faculty institutions in Finland. The Department of Teacher Education in Jyväskylä University provides courses to qualify as a teacher in pre-school education, comprehensive education (primary and lower secondary schools), and upper secondary schools. The qualifications needed are set down in more detail in statutes. Those wanting to become subject teachers apply to the respective university faculties and departments of their main subject. The studies included in the Master's degree in subject teacher education are basic, intermediate and advanced studies in the major teaching subject; and basic and intermediate

studies in another subject. Students usually study their major subject for one or two years, after which they apply separately for the teacher's pedagogical studies. It is also possible to take the teacher's pedagogical studies after the completion of the Master's degree (Eurydice, 2008b; Anon., 2008f).

Nicolaus Copernicus University, Toruń, Poland

The Subject Core of the pedagogical studies curricula was elaborated by the Polish Ministry of Higher Education and Science and the construction of all the institutional curricula was based on this document (Standardy kształcenia nauczycieli, 2004). At the Nicolaus Copernicus University, education of two-subject (physics – mathematics and physics – informatics) primary and lower secondary school teachers lasts 3 years and follows Bachelor's degree studies (Turlo J., 2001). The curricula of these studies contain general subjects related to the specialization (mathematics, physics, informatics and others), general pedagogical subjects, subject educational studies (theory and laboratory exercises) and school practice as a part of pedagogical preparation (Anon., 2007). After graduation, Bachelor studies students can then complete 2 years Master's degree teacher studies, to get competencies needed to teach one selected subject in the upper secondary school.

Comparison of the science teacher training curricula at the partner institutions and conclusions

Table 3 shows the content of core subjects and pedagogical training (including teaching practice) in the science subjects studies curricula of the partner institutions (Anon., 2008d; Anon., 2008c; Anon. 2008e; Anon., 2008f; Anon, 2007).

Table 3. Comparison of teacher training curricula in partner institutions.

University	Proportion of curriculum devoted to:	
	Core subjects	Pedagogical training
Plovdiv, Bulgaria	78 %	22 %
Tartu, Estonia	69 %	31 %
Helsinki & Jyvaskyla, Finland	80 %	20 %
Toruń, Poland	72 %	28 %

From the table 3 it can be seen that the proportion of the whole curriculum devoted to pedagogical training does not differ too much in all the partner countries. However, it is important to emphasize that the structure of the core subjects depends strongly on the type of studies. Sometimes it's difficult to distinguish between different parts of the curriculum (subject or pedagogical). For example in Finland, a part of the major subject curriculum could be named as pedagogically oriented subject studies. A similar situation is observed in Poland, where the core subject curriculum is constructed especially for the teacher studies at Bachelor's and Master's levels and also contains pedagogical aspects of the subjects studied. Figure 2 shows a comparison of the curricula structure and pedagogical programme contents in the partner countries. The teaching practice content in the whole curriculum is almost the same in every partner country.

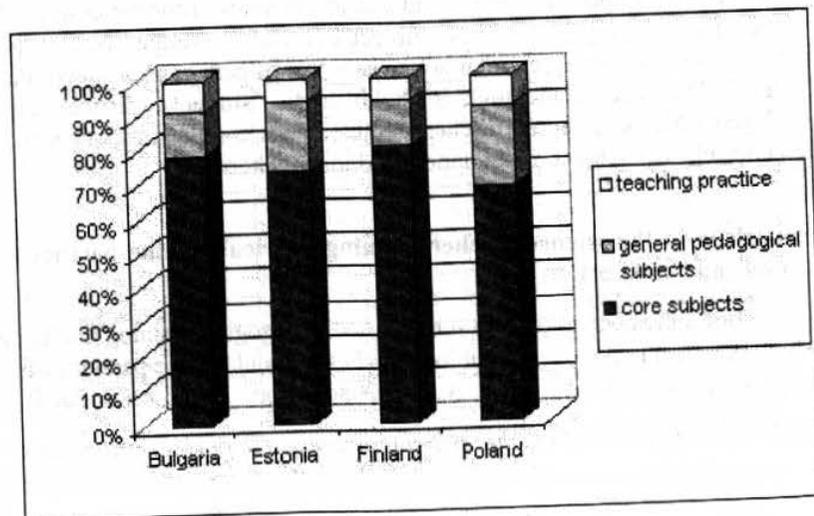


Figure 2. General pedagogical training and practice training contents as percentage of total hours assigned to the whole curriculum in the partner countries.

Summarizing, we can say that the analysis and comparison of the national curricula show a set of common features, significant for the future implementation of the common curriculum of the practice training in the project partner countries (Przegietka, K., Turlo J., Valtonen S. et al., 2007, Raykova, S. et al., 2007). Thus, it should be mentioned that:

- the structure of the academic year and the forms of study programmes are similar in all the partner countries which facilitates the organization of practice periods abroad for trainees from the partner institutions;
- the common part of the training of future science teachers includes the general scientific (subject) studies as the main and second (additional) subjects and pedagogical training (including teaching practice);
- the content of the teaching practice in the whole curriculum is similar in every partner country.

Furthermore, we would like to stress that all the partner universities emphasize pedagogical training and school teaching practice, because they are convinced that theory without practice, especially in case of science teaching is irrelevant. In constructing the common curriculum for practice training it's very important that we are in agreement in such a fundamental area. On this basis other concerns, like organisational differences in the curricula, seems less significant.

In the next chapter we concentrate on more detail on the teacher training practice structure and its role in every partner country.