

SCIENCE TEACHERS TRAINING ACROSS EUROPE: Establishing a pathway for a common science teachers training framework

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In European countries, there is an urgent need for high quality initial training, supported by good induction and continuing professional development.

European Report on quality of school education:
“Sixteen Quality Indicators”, May 2000.

Upgrading the initial education and in-service training of teachers and trainers so that their knowledge and skills respond both to the changes and expectations in society, and to the varied groups they teach and train is a major challenge to the education and training systems over the next 10 years.

Report from the Education Council to the European
Council on the Concrete Future Objectives of Education and Training Systems, February 2001

The way to interest children in mathematics and science is through teachers who are not only enthusiastic about their subjects, but who are also steeped in their disciplines and who have the professional training – as teachers – to teach those subjects well.

Before It's too Late. A report to the Nation from the National Commission on Mathematics and Science Teaching for the 21st Century, U.S. Department of Education, September 2000.

Introduction

Despite the dramatic transformations throughout our society over the last half-century, teaching methods in science classes have remained unchanged. The basic teaching style in too many science classes today remains essentially what it was two generations ago. This is the main outcome of surveys taking place in Europe and in the US [1], [2], [3]. The last years there is a growing body of research on how teachers of science will develop strategies to ensure that teaching is effective and matched with what is known about effective learning.

The national teachers training systems and curricula in Europe are based in traditional standardized models not taking into account, most of the times, the outcomes of the research undergone in the field of science teaching [4]. As a result they are losing the chance to respond to the challenges of the 21st century and they are failing to capture young people's interest for scientific ideas. In addition, the structure of science teachers training systems is not uniform across Europe and the national educational training curricula targeted to science teachers have significant deviations in their structure and context depending on the country. For instance in Italy teachers for secondary schools must attend, after having obtained their university degree, a two-year course in-school training. In Germany there are specialized University departments to prepare science teachers for secondary education while in Greece there is no initial science teachers' training. The way to interest children in science is through teachers who are not only enthusiastic about their subjects but who are also steeped in their disciplines and who have the professional training to teach these subjects as well. **Better science teaching is therefore grounded, first of all, in improving the quality of teacher preparation and in making continuing professional education available for all teachers.**

Furthermore International assessments, such as the recent Third International Mathematics and Science Study (TIMSS) [5], which tested students of 41 nations, show a wide range of attainments in science by children across Europe. Students' achievements are neither related to the amount of time for science in the curriculum nor related to the amount of money spent on science education. Students will need not only to know scientific and technological information and to be able to do scientific experiments, but also to be able to know how to analyze and synthesize scientific and technological information. Factors such as the quality of teaching and learning and teachers' training and professional development programs should be taken into account in order to meet successfully the challenges that science education faces today.

These challenges make obvious the need to focus on and improve the training of science teachers. The need for high-quality teaching demands a vigorous response that unifies the efforts of all stakeholders in science education.

The European co-funded project (Socrates programme), *SCIENCE TEACHERS TRAINING ACROSS EUROPE: Establishing a pathway for a common science teachers training framework* aims at developing a common initial and in service training framework for science teachers across Europe in order to facilitate the implementation of the "Report on the future objectives of education and of training systems" [2] using in particular, the exchange of experience between policy makers, curriculum developers, researchers, teachers' trainers and teachers from different countries. The partnership does not intend to develop a common science teachers' training curriculum for all European countries. The partnership - through an extended survey - aims to develop a series of main principles and standards that could be applied to the different national training curricula across Europe, taking into account and respect the differences and the diversity of the existing systems and approaches. The partnership aims to develop a framework that will give common answers to common European problems in the field of science education.

General Aims, Objectives and Outcomes of the "Pathway" Project

The focus of the project will be to observe and evaluate the structure of science teacher education and therefore design and test an innovative and effective training framework. The project aims to contribute to the improvement of the quality of science teaching. The overall contribution of the project will be **the determination of the basic principles and standards for science teachers' training across Europe**, that will help teachers a) to increase their ability to monitor student's work, so they can provide constructive feedback to students and redirect their own teaching, b) deepen their knowledge of the subjects they are teaching, c) sharpen their teaching skills, d) keep up with developments in their fields, and in education in general and e) generate and contribute new knowledge to the profession. In this framework, focus will be put on possible contributions by ICT, also in agreement with the EU global recommendations about basic science education of the citizen. In fact, the informatics revolution is producing in the schools a twofold, deep mutation of the boundary conditions within which the scientific formation is taking place: on one side the computer is more and more widely used as a cognitive and operational tool, extremely powerful and versatile as it is; on another side it allows the access in diffused and flexible modes to a network of explicit, sharable competence supporting a permanent education.

The general aims of the project are to:

- **Contribute to the improvement of the quality of scientific teaching** in order to promote its attractiveness and its effectiveness concerning in particular the content of the initial and in-service teachers training curricula. This will be achieved by bringing together policy makers, curriculum developers, researchers, teachers' trainers and teachers from different countries in order to design a common training framework based on the most important parameters of science teaching. Establishing a **common European** training framework in science teaching is expected to enhance the professional mobility of science teachers across Europe since it will provide the base for the unification of science teachers' professional skills (one of the main aims of Bologna Declaration [6]).

- **Perform a correlation survey and analysis on how the different national science teachers' education programs prepare teachers to teaching science.** The work of the partnership will be based on the first results of the STEDE (Science Teachers Education Development in Europe) Thematic Network, which is comparing and contrasting the structure and function of science teacher education across Europe and surveying how distance learning technologies can facilitate the initial and in-service training of science teachers [7]. The aim of the partnership is through this survey to identify successful approaches and expand the pool of exemplary institutions and well-prepared new teachers. In order to do so rigorous criteria are needed beyond those already used by teacher's preparation institutions.
- **Identify and assess a series of case studies to be used as examples of good practice.** The partnership aims to identify exemplary models of teachers' preparation that can be widely replicated. Amongst these, emblematic research-based guide lines and materials. These case studies will be tested in different environments across Europe during the life cycle of the project. The portfolio assessment method will be adopted through the implementation of these case studies.
- **Determine the main principles and standards of an effective training framework.** The determination of the underlying principles that should govern a science teachers' training framework will be based on the concepts and the theoretical approaches deriving from recent educational research on the field and the data collected from the application of the exemplary models. The partnership aims **at the development of a pathway for a common science teachers training framework** that imparts a deep understanding of content, teaches prospective teachers many ways to motivate young minds, especially with the appropriate use of technology, and to guide them in active and extended scientific inquiry, and instills a knowledge of – and basic skills in using – effective teaching methods in the discipline. The proposed framework will give more emphasis on continuously assessing student understanding, supporting a classroom community with cooperation, shared responsibility and respect and working with other teachers from other disciplines to enhance the aims of the school curriculum.
- **Prepare a series of four reports on the teachers' training framework.** The project's reports will present the conclusions deriving from the observational and comparison research concerning the current situation in science teachers' training curricula and will propose a science teacher' training framework based on the parameters that could guarantee a high-quality science teaching.

The final report and main outcome of the project “**The pathway to high quality science teaching**” will be the first step on a journey of educational reform that might take many years. The achievement of the high quality science teaching requires the combined and continued support of all involved actors, researchers, policy makers and curriculum developers, science teachers' educators, teachers, students and parents.

Project's approach and methodology

The project through an extended survey across Europe, which will be mainly based on the work of the STEDE network, plans to identify the kinds of teacher preparation programs that are most effective. Then the partnership will assess these exemplary models in different environments in order to improve them and expand them. Based on this assessment the partnership aims to develop the main principles and standards of an effective science teachers training framework.

In order to meet its objectives the project will evolve through the following steps:

- **Identification of the science teachers' needs**
- **Correlation survey on the existing training systems**
- **Identification of successful approaches – case studies across Europe**
- **Assessment of the exemplary models in different environments (teachers' preparation institutions, schools) across Europe**
- **Design and Development of a common training framework**

- **Determination of the science teachers standards**
- **Determination of the science teachers professional standards**

In order to realise the above-described plan the project will evolve through the steps that are described in figure 1.

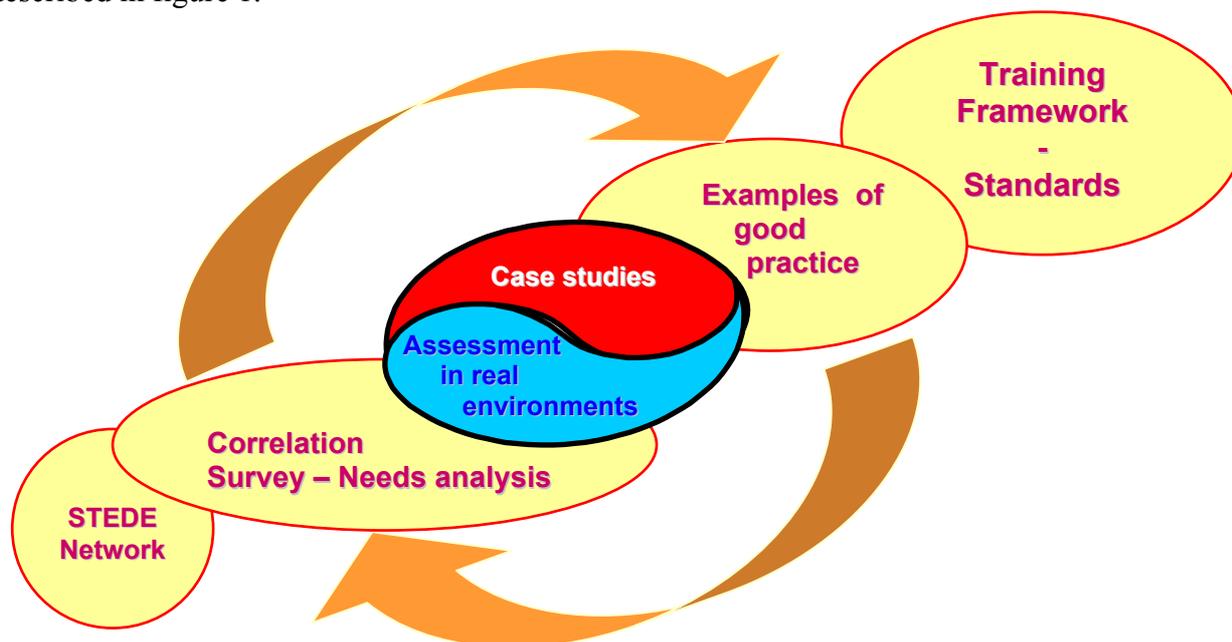


Figure 1: The project's approach: The pathway to high quality science teaching through the development of a common training framework.

Following the clearly defined common goal of Bologna Declaration, to create a European space for higher education in order to enhance the employability and mobility of citizens and to increase the international competitiveness of European higher education, the project aims to bring together the European science teaching community in establishing the pathway to high quality teaching.

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