Becoming an Effective Science Teacher

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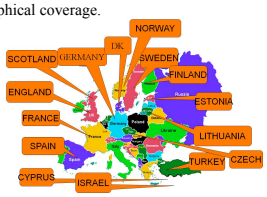
S-TEAM Concept and Objectives

The European Commission's Seventh Framework Programme, Science in Society call has identified deficiencies in scientific literacy, and science, technology, engineering and mathematics career choices, which should be addressed through widespread dissemination of improved methods of science teaching, specifically inquiry-based science teaching and education. The underlying problem is related to the engagement of young people with education in general and science education in particular. Teachers have an important role in shaping young people's perceptions of science, and need to be supported by a wide range of stakeholders in order to achieve this.

The Science-Teacher Education Advanced Methods, or S-TEAM, project now answers the requirements of this call by combining state-of-the-art knowledge about science education with practical experience in teacher education. Framing the problem at a European level provides an opportunity for national expertise in science education curricula, pedagogy and practice to be shared. S-TEAM involves 25 institutions in 15 countries to provide the widest possible geographical coverage.



The three main objectives of the S-TEAM Project are:

1. To improve motivation, learning and pupil attitudes in European science education, resulting in increased scientific literacy and recruitment to science-based careers, by:
2. Enabling large numbers of teachers to adopt inquiry-based and other proven methods for more effective science teaching, by:
3. Supporting teachers by providing training in, and access to, innovative methods and research-based knowledge.

These objectives can be summarised as pupil engagement, teacher empowerment and teacher education.

Strategy

The S-TEAM strategy is based on the realities of teaching science in a hugely diverse range of contexts. The barriers to the adoption of inquiry based methods are different across these contexts, and require different solutions. S-TEAM will therefore connect a wide range of actors with specific areas of expertise to provide a range of solutions and to contribute to the field of science education in Europe. These actors will include science educators, teacher educators and specialists in pedagogy, as well as teachers and policymakers. Students themselves will also be consulted, since it is their perceptions of science and science teaching which are at the centre of the project.

Since achieving the aims of a project such as S-TEAM requires a large number of individual actions, the project is divided into ten work packages, each with a particular function.

WP1 is concerned with the overall management of the project.

WP2 will establish the initial parameters of the project in terms of existing policy.

WP3 will integrate the work of the German SINUS project into S-TEAM, by holding workshops and adapting existing training modules for other contexts.

WP4 is concerned with the role of teacher collaboration and also has the function of disseminating project outputs in France.

WP5 concentrates on initial teacher education and the preparation of training packages to enable new science teachers to adopt inquiry based methods and to assist teacher educators in this task.

WP6 is concerned with the continuing professional development of science teachers, providing training packages on innovative methods for teachers already in schools.

WP7 provides specialist input in the field of argumentation within science teaching, producing teaching sequences which will help science teachers make better use of inquiry to develop scientific concepts and modes of thought in their students.

WP8 provides specialist input in the field of scientific literacy, producing packages designed to stimulate teacher self-efficacy and the use of scientific literacy as a motivating concept.

WP9 is concerned with the development and use of indicators and instruments. These will enable scientific evaluation of the project's own activities, and they will be used formatively by teacher educators, science teachers and students.

WP10 will coordinate the project's dissemination activities, including the quality control of project outputs and overall media relations.

BEST Practice

The objective of work package 5 – Becoming an Effective Science Teacher, or BEST – led by the Department of Curricular Studies at the University of Strathclyde, is to support the incorporation of innovative teaching and learning practices, including inquiry-based science teaching methods, into initial teacher education.

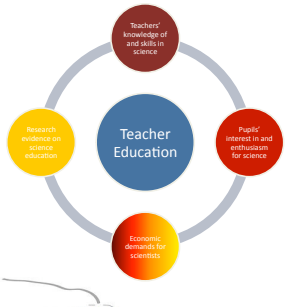
BEST addresses teacher education practice in relation to science education, from initial teacher education into the early years of teaching, teachers and teacher educators. The aim is to provide an ambitious but realistic pedagogy for beginning teachers of science that blends the best of what is practised by accomplished science teachers with an action-oriented disposition to intervention in early professional leaning, informed by a critical evaluation of the literature. Challenges of teaching in an open inquiry-based manner will not be evaded but discussed and conceptualized in a way that accommodates the realities of teaching science.

Concern with maintaining the attainment of pupils in science will be recognized and linked to the features of a practice that can actually improve teaching performance through increased pupil enthusiasm and understanding in a science classroom that encourages and supports creativity through inquiry. Examples of inquiry-based learning experiences in science will be presented and supported with a warrant for theory and practice that will assist new science teachers in becoming effective.

Design and Methods

There will be interviews with experienced teachers, covering the life span of teachers. Data will be collected on the perceived abilities and qualities of participating teachers from interviews with them and their colleagues (and pupils, subject to permission), as well as through the use of research-proven indicators of inquiry-based science teaching practices.

BEST will produce knowledge, practices and tools to help teacher educators and pre-service teachers overcome constraints on the implementation of innovative methods in science education. This will involve adopting these innovative methods and principles in science teacher education itself, for example the use of group work and problem-based learning, dialogical learning and the acceptance of uncertainty within scientific inquiry. Their common theme is that they will be based in existing teacher education institutions or systems, and will address problems raised by teachersin applying innovative methods in science.

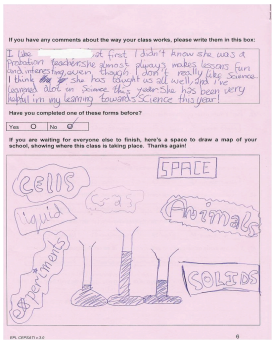


S-TEAM argues that only through teacher education can new methods be sustainably implemented in classrooms. Building on the long experience of collaboration with practicing science teachers and because of the need to ensure adequate focus on the context of science and science teaching, BEST will deploy experienced science teachers in delivery, consultation, negotiation of access, dissemination and evaluation. Joint seminars will be organized in which beginners will make connection with a select group of more experienced teachers, tease out the implicit in teachers theorizing, including their tacit knowledge of the nature of science, and generally acquire a richer discourse about becoming and learning.

The Science Classroom

Concern with maintaining the attainment of pupils in science will be recognized and linked to the features of a practice that can improve teaching performance through increased pupil enthusiasm and understanding in a science classroom that encourages and supports creativity through inquiry. Inquiry-based learning experiences in science will be researched with a warrant for theory and practice that will assist new science teachers in becoming effective. This effectiveness will include the capacity to deliver authentic and investigative experiences, a meta-cognition of professional expertise and teaching confidence and competence in meeting professional standards and public expectations.

As part of this process, the project will measure the science classroom environment on the basis that recent studies have identified the important contribution of pupil voice to professional development in teaching. For example, the use of pupils' ideas in teachers' practice (McIntyre et al. 2005), and evidence of the willingness of new teachers to use pupil opinion to effect self-evaluation (McNally et al. 2008). The Science Classroom Environment Pupil Satisfaction and Achievement Instrument, or SCEPSATI (Gray et al. 2006) will enhance the achievement of new science teachers as learners by providing an innovative, self-administrable instrument for measuring pupil opinion.



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