Impact Objectives

- Combine inquiry-based learning and citizenship education with socio-scientific issues in order to achieve responsible research and innovation (RRI) in science education
- Build on and refine the novel Socio-Scientific Inquiry-Based Learning (SSIBL) approach based on partners' teacher professional development (TPD) programmes in practice
- Document and share existing good educational practices across Europe and develop learning tools, materials and pre- and in-service training courses for science teachers

Rethinking science, rethinking education

Dr Marie-Christine Knippels of Utrecht University's Freudenthal Institute is Project Coordinator of PARRISE. Below, she discusses the need to rethink science education and establish good practices for teacher professional development for schools and informal teaching across Europe

Could you explain more about your personal background and how you came to be involved with the PARRISE (Promoting Attainment of Responsible Research & Innovation in Science Education) project?

Rapid developments in science and technology, like nanotechnology and synthetic biology, have a major impact on society and our personal lives and ask for scientific literate citizens that are able to make informed decisions about these so-called socio-scientific issues (SSIs). My research over the last decade has focused on fostering opinion-forming skills in making young citizens more scientifically literate. In particular, this has involved developing strategies for empowering high school students in decision-making. This is essential in fostering democratic citizenship education. During my postdoctoral research project in biology education on moral reasoning in genomics-related dilemmas, I met Frans van Dam. He was involved in coordinating 'DNA Labs on the Road', a Dutch national programme that brings DNA science and its societal context into the classroom. In 2012, Frans van Dam contacted me about a possible EU project. We saw the need to share our experiences in teaching about science and society on the international level. After the initial meetings, we conceived the PARRISE project and developed it into what it is today.

From your perspective, what barriers currently prevent young adults from engaging in socio-scientific debate?

Science education plays an important role in educating young people about socio-scientific inquiry and debate, however there is a lack of adequate materials for learning and teaching activities, as well as insufficient emphasis on developing teachers' capacities to support student reasoning about socio-scientific issues. Therefore, science teachers at the primary and secondary education levels are not always trained sufficiently. Moreover, it can be challenging to include the social aspects of science and an inquiry-based approach in their lessons, making the need for adequate citizenship education urgent.

Are there particular fields where you believe competencies are currently lacking in primary and secondary science education, and, if there are, how do you propose to address this?

In general, primary school teachers are not specialised in a specific science subject and they often report that they would benefit from additional professional learning about current topics in science, technology, engineering, and mathematics (STEM) disciplines. Many secondary school teachers have been trained in the sciences but some may lack knowledge about recent socio-scientific issues, which have developed after they graduated. PARRISE addresses these issues by providing extended teacher professional development opportunities for pre- and in-service teachers and supporting teachers in integrating the social aspect of science in their national curricula and local contexts. As these teachers teach the modules in their existing curriculum, and report on their experiences, they are building capacity for promoting Socio-Scientific Inquiry-Based Learning (SSIBL) in their local community, thereby strengthening local impact.

Ultimately, what do you hope will be the real-world benefits of helping children and young adults gain a better understanding of the products and processes of science and technology?

I believe that democratisation of science and technology will benefit society, as innovation will result in knowledge and technology which is more socially acceptable. As a result, science and technology will become more socially robust: citizens will be empowered in such a way that they can have more influence on the processes of how knowledge is applied, improving the chances of a sustainable introduction of new ideas and products of science into our society. Hopefully we'll be able to help future and in-service science teachers to extend their teaching repertoire, and even fully integrate socio-scientific aspects as part of the formal curriculum in their own countries.

A focus on education innovation

*The collaborative four-year **PARRISE (Promoting Attainment of Responsible Research & Innovation in Science Education)** project brings together a consortium of primary and secondary education experts. Their goal is to promote and integrate solid socio-scientific education in European science teacher training programmes*

Scientific developments often bring with them the necessity of presenting the advances to the public, as well as addressing future concerns, so that all members of society, regardless of age, culture or role, develop a critical sense in scientific matters and feel capable of participating in decision-making processes regarding common welfare. Fostering understanding and responsivity to current scientific issues is a challenging task, however, due to cultural and political diversity across the world.

Despite media and science communication information outlets having developed greatly over the last decades, allowing a bigger spread of scientific advances among society, there has been a shift in the way public debates on science and technology occur. There is now greater effort being put into maintaining a dialogic approach to these issues, and, most importantly, into including them in current educational systems as part of preparing the younger generations to assume active and responsible roles in society.

PRIORITY ISSUES

Dr Marie-Christine Knippels of the Freudenthal Institute within Utrecht University in the Netherlands is the Coordinator of a project that seeks to build a scientifically literate society, as well as to engage young citizens in socio-scientific dialogue on research and innovation processes. PARRISE is a four-year project financed by the EU's Seventh Framework Programme (FP7) Science-in-Society programme.

The PARRISE consortium aims to introduce the concept of responsible research and innovation (RRI) in primary and secondary education, using a combination of inquiry-based learning and a broader citizenship education, with socio-scientific issues as the core of basic scientific education practices. 'Education through an inquiry approach in science and technology prepares young citizens to understand and participate in the process of scientific development and decision-making,' explains Knippels.

Emphasising science education in citizenship education has become critical in many countries and there are diverse stakeholders and perspectives involved. This empowerment action is set to start at an important foundation ground of citizenship education – classrooms or science centres – through the improvement of learning tools, materials and professional development courses for primary and secondary teachers and students across Europe. Building better learning opportunities involves the integration of three pedagogical approaches – inquiry-based science education (IBSE), socio-scientific issues (SSI) and citizenship education (CE). The PARRISE consortium calls this integrated approach Socio-Scientific Inquiry-Based Learning (SSIBL). SSIBL engages students in personally relevant inquiry on questions about controversial issues.

A SELF-SUFFICIENT STRATEGY

PARRISE's workflow follows a four-aspect model of teacher professional development (TPD) where the teachers act as learners, teachers, designers and reflective practitioners. In order to ensure the development of an educational framework that integrates IBSE and SSI into RRI to be implemented in schools across Europe, the team started by analysing good practices in both formal and informal international education. They then redefined guidelines and developed TPD programmes based on the initial SSIBL framework. This core was then tailored to the professional development needs of teachers as a result of intergroup discussions and feedback from professional development activities in SSIBL. Experiences with the first round of TPD programmes informed and refined the SSIBL framework, which was then used in the second round of TPD implementation by all partners. 'Facilitating and empowering teachers is crucial in the intended implementation process in the course of the PARRISE project,' says Knippels.

The establishment of projects such as PARRISE reflects the need for restructuring current educational models and teaching frameworks. Previous reports on educational performance showed that, although there has been a successful development of IBSE materials in Europe over the years, these materials don't find their way to classrooms,

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practice. Apparently there are factors that hinder science teachers to implement it in daily practice. By focusing on TPD programmes in which IBSE and SSI are integrated, PARRISE is promoting sustainable integration of SSIBL in science education and raising awareness of the importance of relevant social aspects in science education practices.

HELPING HANDS

PARRISE is built around a self-strengthening core that allows the establishment of updated teaching practices. The project operates in a cyclical manner of designing and implementing TPD programmes and informing its pedagogical framework with experiences from these in order to be able to adapt them to broader and more diverse audiences. One of the first TPD programmes, facilitated by Malmö University in Sweden, focused on nanotechnology topics over the course of four workshops. The workshops promoted a synergy and exchange of knowledge, with teachers studying, investigating and sharing their own projects and producing SSIBL activity modules for their students to be used in real-world educational contexts.

Several partners have been successful in integrating the PARRISE approach beyond the local level. In the UK, two universities, the UCL Institute of Education and the University of Southampton, collectively carry out TPD programmes. Klagenfurt University in Austria has introduced the approach in the ‘Climate Schools’ project in three regions in Carinthia (10 schools and about 250 students). In Sweden, Umeå University has been invited by the Swedish National Agency for Education to introduce the PARRISE approach into the national curriculum for teacher training. ‘Most partners have presented the SSIBL approach at national or international meetings for teachers, teacher educators or science education researchers,’ says Knippels.

In addition, teacher education activities are being developed across Europe, in teams with long-standing expertise in both formal and informal education for ages 10–18 – a crucial element of the project. ‘Most efforts are to be spent on developing these competencies among European science

The PARRISE Final Conference, ‘Science and Society in Education’, is to be held in Dublin, Ireland, on 20 August 2017. For more information and registration visit www.parrise.eu.

teacher educators and science teachers at both primary and secondary informal and formal areas of education,’ explains Knippels. ‘PARRISE builds communities consisting of science teachers, science teacher educators, science communicators, and curriculum and citizenship education experts to exchange, improve and implement its best practices of teacher training.’

MUTUAL AND COLLABORATIVE SHARING

The strength of the project’s workflow lies in mutual sharing, learning and feedback among the different teams and the participating teachers, as well as thorough troubleshooting of future roadblocks. ‘Experiences with TPD courses through our project are shared and discussed in the consortium meetings of PARRISE,’ says Knippels. She notes that these meetings take place at different partner institutes each year, to facilitate easier access for national science teachers, teacher educators and colleagues from the hosting institute.

As the project nears its conclusion – PARRISE’s final conference will take place in Dublin on 20 August 2017 – the team is reflecting on the results drawn from the second round of TPD programmes, and reiterating the need to maintain open communication between the scientific and teaching communities and the public. ‘Transparency is one of the main components of RRI and thus of the SSIBL approach. All TPDs are evaluated and implemented locally. The project website will contain a repository for sharing TPD designs, and examples of fruitful learning and teaching activities, ensuring access to these assets is to keep in mind the aims of RRI: ethical acceptability, social desirability and sustainability,’ concludes Knippels.

Project Insights

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PARTNERS

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CONTACT

Marie-Christine Knippels
Project Coordinator

T: +31 302532213
E: M.C.P.J.Knippels@uu.nl
W: http://www.parrise.eu/

PROJECT COORDINATOR BIO

Dr Marie-Christine Knippels holds a PhD in Genetics Education and has been an Assistant Professor in Biology Education at the Freudenthal Institute, Utrecht University, since 2007. She coordinated the national science teachers’ PhD programme ‘DUDOC’, and teaches in undergraduate and postgraduate science courses for future teachers and science education researchers. Knippels completed a postdoc research project on moral reasoning in genomics-related dilemmas. Her research interest is in fostering students’ opinion-forming competences in socio-scientific issues.

Utrecht University

PARRISE

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