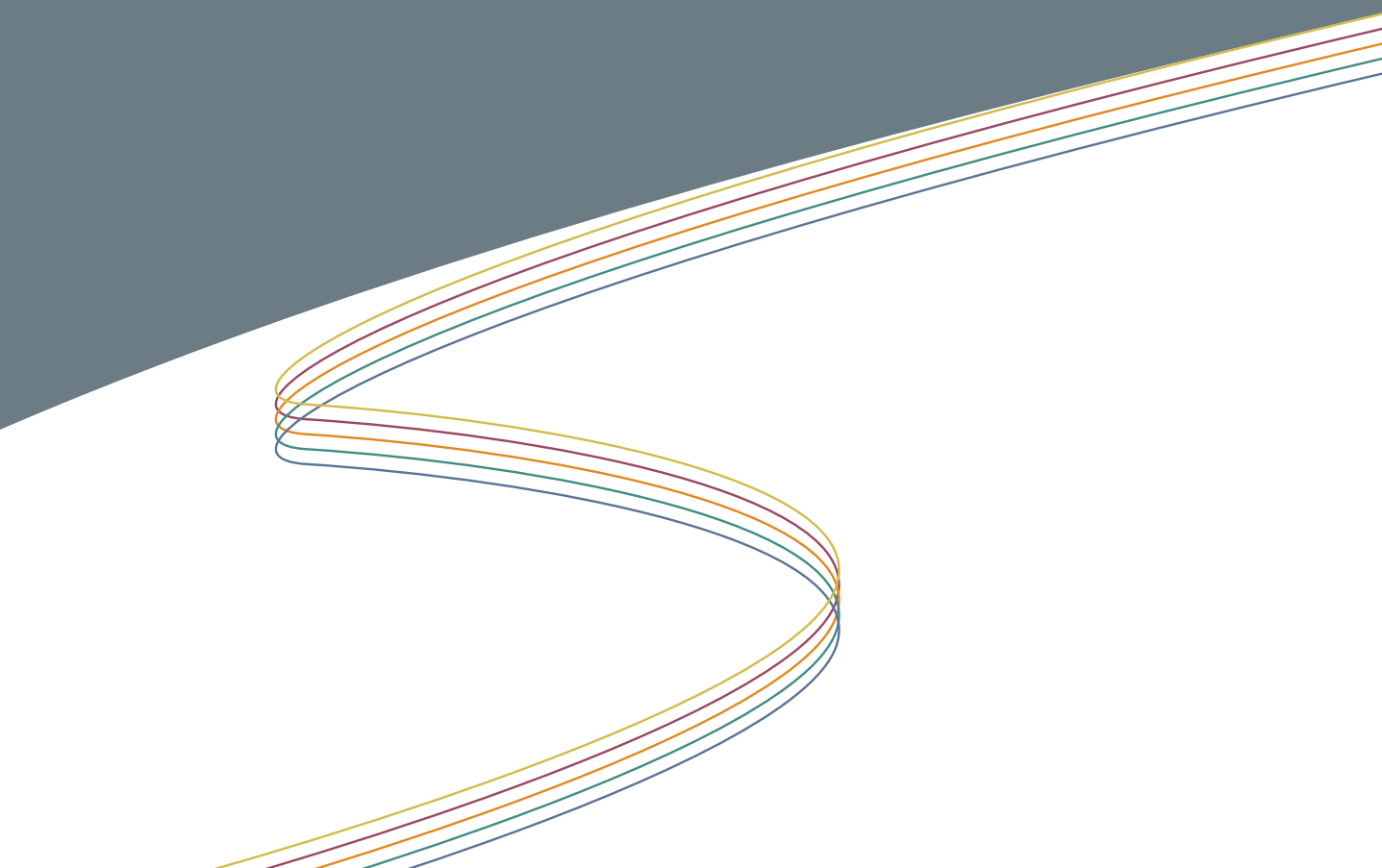
SCIENCE ACROSS EUROPE – NETWORKS FOR INNOVATION AND TRANSFER



SCIENCE ACROSS EUROPE – NETWORKS FOR INNOVATION AND TRANSFER 106

1 ASSIST-ME – Assess Inquiry in Science, Technology and Mathematics Education 107

2 IRRESISTIBLE – Including Responsible Research and Innovation in Cutting-Edge Science and Inquiry-Based Science Education to Improve Teacher's Ability of Bridging Learning Environments 113

3 Further Research 121

SCIENCE ACROSS EUROPE – NETWORKS FOR INNOVATION AND TRANSFER

As a Leibniz institute, the IPN's goal is to further develop knowledge about approaches on teaching and learning and provide the suitable infrastructure to execute projects of international relevance. EU funded projects play an important role for the internationalization of research and research-based development in the field of education as they initiate and strengthen networks between several different countries and allow for an exchange of expertise between researchers, practitioners, and politicians.

The IPN has been involved in EU funded projects for a long time, in some of them as lead partner, in others as contributor to important work-packages. In the past, EU frameworks on science education mainly focused on inquiry-based teaching and learning and the development of local as well as international networks. Based on former experiences with national programs like "SINUS" and "Chemie im Kontext" (Chemistry in Context), the IPN has provided research and theoretical models on cooperation, implementation, and teacher professional development as well as units and materials on context-based and inquiry-based learning in several EU projects like Mind the Gap, S-TEAM, and ESTABLISH. The international as well as the local networks involve researchers, schools, institutes for teacher education (like the Institute for Quality Development of Schools in Schleswig-Holstein, IQSH) and – depending on the outline of the particular project – local companies, or out-of-school learning environments.

Main results of those projects are research-based teaching and learning materials, models of developing the networks and the networks themselves, including partnerships especially with leading international research institutes like the Weizmann Institute of Science (Israel) or King's College London (United Kingdom). Given the structure and heterogeneity of EU funded projects and participants, research is typically based on case studies and trial implementations. The research-based teaching and learning materials provide a rich foundation to support practitioners, not only in the network, but also as a means to strengthen local cooperations. For example, EU projects like ESTABLISH or IRRESISTIBLE developed materials for context-based and inquiry-based teaching and learning, including career perspectives that have been and will be used as examples for teacher training programs in different countries. This is of particular importance for states that introduced new syllabuses with a strong focus on student-relevant contexts and competences. EU projects therefore play an important role for the development of practice by scaffolding implementation processes with tested approaches, materials, and networks.

In the following, two exemplary EU funded projects will be presented: (1) ASSIST-ME, a project combining inquiry-based learning and summative and formative assessment, with a rather strong research involvement of the IPN, and (2) IRRESISTIBLE, a project focusing on responsible research and innovation as well as the formation of networks linking school to out-of-school teaching and learning as well as the development of tools such as guidelines on how to implement Web2.0 or how to develop student-curated exhibitions.

1 ASSIST-ME – Assess Inquiry in Science, Technology and Mathematics Education

Objectives

ASSIST-ME has been funded as a high-level research project within EU's seventh Framework Programme (FP7) Science in Society. It started in 2013 involving a consortium of 10 partners across eight European countries. ASSIST-ME aims to investigate formative and summative assessment methods to support and to improve inquiry-based approaches in science, technology, and mathematics (STM) education. While inquiry-based learning in STM subjects has been developed across Europe in a number of EU funded FP7 projects, only few focused on the assessment of inquiry competences. Aiming to fill this gap, the ASSIST-ME project designed a range of assessment methods that have been tested in primary and secondary schools in different educational cultures in Europe in order to identify opportunities and challenges for implementing an assessment culture using both formative and summative approaches in the context of inquiry-based education. The resulting synthesis will provide the roadmap for formulating recommendations for policy makers, curriculum developers, teacher trainers, and other stakeholders in the different European educational systems with the overarching goal of enabling and facilitating a large-scale adoption of competence-based formative assessment to support inquiry-based education in STM.

Project Structure

The work within the ASSIST-ME project was divided into different work packages (WPs) structured into three project phases (Figure 1): a foundation phase (phase I), a development and implementation phase (phase II), and a dissemination phase (phase III). The foundation phase was sup-

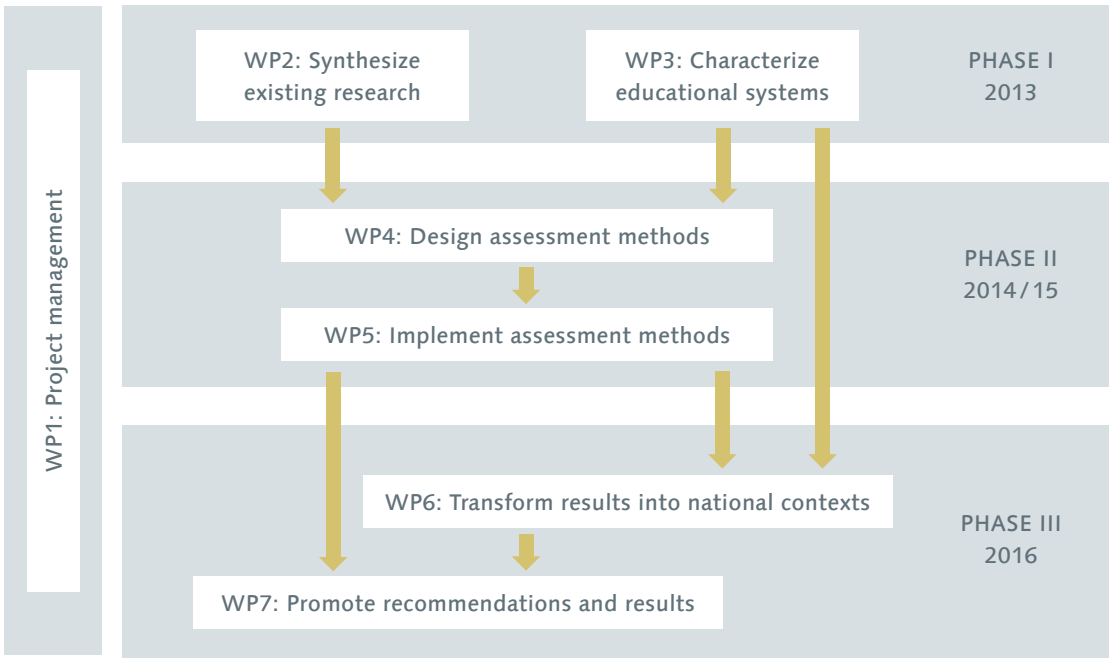


Figure 1. Structure and phases of the ASSIST-ME project. WP = work package.

posed to provide a sound research base for the project by synthesizing existing international and national empirical research related to the assessment of inquiry competences. As part of these activities, a systematic and extensive literature review was carried out by the IPN as the head of WP2. The review provided the project with precise and operational definitions of inquiry in STM as well as formative and summative assessment, respectively. Moreover, formative and summative assessment methods used in the context of inquiry-based education were identified and analyzed to give recommendations and inform the development and implementation of assessment methods for domain-specific and transversal inquiry competences in phase II. The trial implementations in phase II enabled analyzing the viability of the adapted and developed methods, teachers assessment practices, and the conditions that support or undermine the uptake of formative assessment related to inquiry processes. Finally, in phase III the resulting synthesis of opportunities and restrictions for implementing an assessment culture using both formative and summative approaches was evaluated and discussed in relevant forums to formulate guidelines and recommendations for policy makers, curriculum developers, teacher trainers, and other stakeholders in the different European educational systems.

Rönnebeck, S., Bernholt, S., & Ropohl, M. (2016). Searching for a common ground – A literature review of empirical research on scientific inquiry activities. *Studies in Science Education, 52*(2), 161–197.

Bernholt, S., Rönnebeck, S., Ropohl, M., Köller, O., & Parchmann, I. (2013). Report on current state of the art in formative and summative assessment in IBE in STM – Part I. ASSIST ME Report Series, 1. Retrieved from: assistme.ku.dk/resources/report_series/no1/

In addition to its research focus, ASSIST-ME also emphasizes the importance of the relationship between research, policy, and practice. Based on the belief that sustainable changes in the assessment culture can only be achieved if all stakeholder groups cooperate and gain ownership of the process, ASSIST-ME has involved stakeholders in the project in different ways from the very beginning. For example, the development of assessment methods in phase II was attended and supported by teacher expert panels in all partner countries. The aim was to ensure that the methods were applicable to regular teaching practice in order to increase their acceptance by the teachers. In addition, national stakeholder panels (NSP) were formed in each country. The panels consisted of representatives from different stakeholder groups like educational policy, teacher educators, industry, media, teachers, school leaders, parent associations, teacher unions, and educational research. The panels met regularly during the project and gave valuable advice concerning the on-going work and the recommendations that were and will be derived from the project results.

Ropohl, M., Scheuermann, H., & Rönnebeck, S. (2015). Diagnostizieren und bewerten mit dem Forscherbogen – Formative Diagnose beim forschenden Lernen [Diagnosing and judging students' written artefacts – formative assessment in the context of inquiry-based learning]. *Naturwissenschaften im Unterricht – Chemie, 26*(5), 40–44.

Ropohl, M., Rönnebeck, S., & Scheuermann, H. (2015). Naturwissenschaftliche Erkenntnisgewinnung im Chemieunterricht. Das Konzept des forschenden Lernens [Aquiring knowledge in chemistry instruction. The concept of scientific inquiry]. *Praxis der Naturwissenschaften – Chemie in der Schule, 64*(6), 5–8.

Method

Local working groups (LWGs) of teachers within each country implemented the assessment methods in phase II of the trial. The LWGs were set up as a form of research–practice partnership. Over a period of 18 months the teachers worked collaboratively on the project objectives and were supported by researchers. Part of their work was the development of inquiry-based student activities related to specific learning goals and including different formative assessment methods that they subsequently tested in their classrooms. Within the ASSIST-ME project, different formative assessment methods have been investigated. In Germany, the LWG focused on the assessment method of teachers' written feedback. In collaboration with researchers from the IPN, lower and upper secondary school physics and chemistry teachers developed templates and rubrics to guide their students through the formative assessment cycle of collecting evidence, forming a judgment based on the evidence, and providing feedback in order to support students' learning.

The trial implementations were analyzed using a case study approach. The analyses focused specifically on the quality of the teachers' feedback as one of the crucial elements of effective formative assessment. The feedback analysis was complemented using teacher questionnaires and interviews and addressed specific challenges and opportunities the teachers encountered during the implementations.

Additionally, the effectiveness of feedback on students' learning was investigated as part of a PhD-project. Three different types of feedback were contrasted in an intervention study with pre-, post-, and follow-up tests

to analyze which information has to be provided by the feedback to support students' competences in planning an experiment with a special focus on the control-of-variables strategy. The three different types of feedback differed regarding the information the individual student received: (a) information on the learning goal, the current state of learning, and on possible next steps in order to reach the learning goal; (b) information on the learning goal, and the current state of learning, and (c) information on the learning goal. The intervention study was carried out in chemistry classes of eighth-graders at lower secondary schools in the federal state of Schleswig-Holstein (N = 214; M_{age} = 13.6, SD_{age} = 0.6; 51.2 % female). It was conducted during the regular chemistry lessons. Each class was allocated to one of the three different intervention groups. Hence, the intervention study followed a quasi-experimental design. In order to gauge the effects of the interventions, students' competences regarding planning an experiment were assessed at the pre-, post-, and follow-up measurement point.

Scheuermann, H., & Ropohl, M. (2016). Do different types of feedback in formative assessment enhance inquiry skills differently? In J. Lavonen, K. Juuti, J. Lampiselkä, A. Uitto, & K. Hahl (Eds.), *Electronic Proceedings of the ESERA 2015 Conference. Science education research: Engaging learners for a sustainable future*, Part 11 (co-ed. J. Dolin & P. Kind), (pp. 1560–1566). Helsinki, Finland: University of Helsinki.

Results

The repeated-measures ANOVA showed a significant within-subjects main effect (F (1, 190) = 257.35, p < .001, η_p^2 = .575) as well as a significant interaction effect (F (2, 190) = 11.99, p < .001, η_p^2 = .112) on students' competences in planning an experiment. The growth in students' competences in planning an experiment differed as a function of the type of feedback they received. Bonferroni post-hoc tests determined the highest learning growth in the intervention group with the most elaborate feedback (group 1, η^2 = .44). Based on the results of the intervention study one can conclude that feedback is most effective in students planning an experiment if it provides information pertaining to three aspects: the learning goals, the current level of learning, and the next steps for the individual learning.

Therefore, the teachers of the ASSIST-ME project implemented and evaluated individual feedback that addressed these three aspects; the actual implementation processes in the eight countries, however, differed with respect to the education level, content, inquiry competence, and formative assessment method. The analyses of teachers' assessment practices showed that in most of the participating countries teachers do not use formative assessment in a structured and systematic way in their daily teaching practice. Here, the formative assessment tools developed in the ASSIST-ME project provided scaffolds having the potential to support teachers in formatively assessing their students' inquiry competences and providing effective feedback. The teachers thereby regarded the individual matching of the feedback as one of the biggest

strengths, both for the students to develop their competences but also for the teachers to develop and adapt their instruction. At the same time, however, for the teachers this meant investing a huge amount of time and work, which in turn made the integration of the method in regular teaching practice more difficult if not impossible. Moreover, in many countries teachers struggled aligning these formative approaches with the predominant and often high-stakes summative assessment practices in their countries. During the work in the LWGs, it became obvious that both inquiry-based teaching and formative assessment are challenging for teachers. For example, they had difficulties developing inquiry-based student activities or providing feedback related to next steps in learning. These findings are in agreement with literature results stating that transferring a new concept into their regular teaching is difficult for teachers – simply introducing them to the concept of formative assessment and providing them with teaching examples is not sufficient. Teachers need time and support to evolve and develop these formative practices and tools to fit their classroom contexts and to be able to transfer them to new situations.

Discussion

In general, the ASSIST-ME approach to transfer research into practice by involving relevant stakeholders throughout the project has proven to be successful. Nevertheless, it has to be noted that especially the recruitment of teachers for the LWGs turned out to be difficult in several coun-

tries. The many obligations teachers face in their daily school life seem to make them more reluctant to commit to additional long-term projects involving intense cooperation and research studies. With respect to the overarching goal of the project to support the sustainable development of an assessment culture using both formative and summative approaches three major recommendations can be derived: (a) national assessment policies that recognize the different roles and potential involved in the interactions between formative and summative assessment should be developed, (b) a teaching approach integrating formative assessment into the classroom culture by framing the educational resources and the curriculum accordingly should be promoted, and (c) professional development activities that offer teachers opportunities to exchange ideas and share practice with peers and that are guided and supported by teacher educators and researchers should be provided.

Rönnebeck, S., Ropohl, M., & Bernholt, S. (2016). Formative assessment in inquiry-based science education – an extensive systematic literature review. In J. Lavonen, K. Juuti, J. Lampiselkä, A. Uitto, & K. Hahl (Eds.), *Electronic Proceedings of the ESERA 2015 Conference. Science education research: Engaging learners for a sustainable future,* Part 11 (co-ed. J. Dolin & P. Kind), (pp. 1702–1713). Helsinki, Finland: University of Helsinki.

Ropohl, M., Nielsen, J. A., Papadouris, N., Rönnebeck, S., Bruun, J., Birch Jensen, S., & Brøndt Nielsen, T. (2016). The viability of written feedback as part of formative assessment in IBSE. In J. Lavonen, K. Juuti, J. Lampiselkä, A. Uitto, & K. Hahl (Eds.), *Electronic Proceedings of the ESERA 2015 Conference. Science education research: Engaging learners for a sustainable future,* Part 11 (co-ed. J. Dolin & P. Kind), (pp. 1792–1799). Helsinki, Finland: University of Helsinki.

IPN RESEARCH GROUP // Sascha Bernholt, Olaf Köller, Silke Rönnebeck, Mathias Ropohl, Hilda Scheuermann

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DURATION // 2013 – 2016

COOPERATION // King's College London, United Kingdom; Pearson Education International, United Kingdom; The National Center for Scientific Research (CNRS) Lyon, France; University of Applied Sciences and Arts Northwestern Switzerland, Switzerland; University of Copenhagen, Denmark (project coordinator); University of Cyprus, Cyprus; University Joseph Fourier Grenoble, France; University of Jyväskylä, Finland; University of South Bohemia, Czech Republic

HOMEPAGE // assistme.ku.dk/

2 IRRESISTIBLE – Including Responsible Research and Innovation in Cutting-Edge Science and Inquiry-Based Science Education to Improve Teacher's Ability of Bridging Learning Environments

Introduction and Objectives

In many areas science research is strongly related to relevant personal and societal demands, such as medical treatments, energy supply, or food safety, just to name a few. The main goal of the IRRESISTIBLE project was to design activities fostering a better understanding and engagement of students and the public in areas of responsible research and innovation (RRI). RRI encompasses aspects like science education, open access to information, gender equality as well as ethical and governance issues. The aim of the project was to raise awareness on RRI by increasing students' content knowledge about research and its interdependency with society. IRRESISTIBLE combined formal (school) and informal (science center, museum, or festival) educational approaches to introduce relevant topics and cutting-edge science into curricula and educational approaches.

Project Structure

The consortium consists of scientists and practitioners from 10 countries. In each country a team of about 10 different people, the so-called community of learners (CoLs), developed a thematic module. The CoLs involved school teachers, researchers in education, and topic-related areas from universities, as well as exhibition experts from museums and science centers. The length of the developed modules differed according to the national needs and possibilities and lasted from about 10 lessons up to half a year. The teachers of the CoL first implemented the newly developed modules in their classes. Additionally, the students visited research laboratories or other informal education venues. To employ their own learning results, student-curated exhibitions were developed offering insights into the relationship between research and society for a broader audience.
In phase I of the project 17 modules on various cutting-edge research topics were developed. These were trialed by the CoL teachers in the country of development, usually with five to 10 classes per country ranging from Grades 8 to 12, depending on the module. In phase II, these modules were translated and adapted to be used and evaluated in at least two additional countries, then being implemented in another 10 to 12 classes per country. Teachers from the first phase served as trainers for the new colleagues – in teaching RRI as well as in adapting the modules

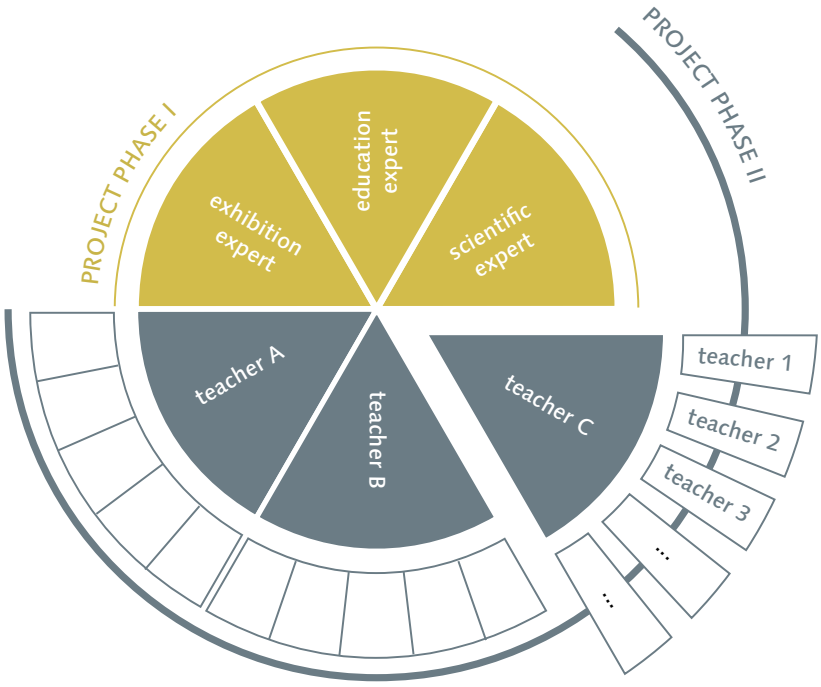

Figure 2. Project phases of the IRRESISTIBLE project. Phase I: developing and testing of modules; Phase II: adaptation of modules to new settings and second test phase.

to the new settings (see Figure 2). After a final revision various country-specific versions of the modules were collated (see Table 1). They are now available for free on the project website so other interested teachers may easily use them.

Method

All modules developed within the project are based on inquiry-based science education (IBSE), allowing students a deeper insight into the process of knowledge development in science – and thus a better understanding of the relevance of RRI. A so-called 6E model was used as a framework for all modules. The 6E model is an extension of Bybee's 5E model for instruction (with the phases Engage, Explore, Explain, Elaborate, and Evaluate) and includes an explicit Exchange phase to institutionalize the exchange of information between the students, but also to foster the exchange with a wider group of people using student-curated exhibitions. As an example, Table 1 shows the main structure of the teaching module "Plastic – Bane of the Ocean" using the 6E model as the backbone for the module.

Table 1. Main Structure of the IRRESISTIBLE Teaching Module "Plastic – Bane of the Ocean"

Phase	Lessons (45 min)	Content
Introductory unit	1–2	The unit "Plastic in daily life" explains the basic structure, properties, and use cases of plastics, which are relevant for understanding the more complex processes in the ocean. (to be used with lower grades)
Engage	1	The module starts with a PowerPoint slideshow, showing flora and fauna of the ocean in fascinating pictures. Gradually the presentation shifts from great pictures to touching photographs showing the impact of plastic on the ocean and its inhabitants.
Explore	3	Mystery: "Why is the health of the Larsson family in Greenland possibly in danger because they don't want to give up their traditional diet?" Students get 16 fact cards with different statements. In groups of four they analyze the statements and try to create a path to solve the question. This exercise should give an idea of the complex relations coming together in the ocean.
Explain	2	As a result of the mystery students describe a possible way in which the Larsson family is connected to the global problem of plastic waste in the ocean. This usually induces a lot of new questions to be answered in the "Elaborate" phase.
Elaborate	6	Students deal with further research questions about the local observation of the plastic problem. In this phase students perform their own experiments, read scientific publications on the subject, and confront extracurricular learning partners with questions. In the second part of the Elaborate phase the aspects of RRI are discussed in class, looking back and highlighting them in the module performed so far.
Exchange	~10	An exhibition is developed to exchange the gained knowledge with peer students and/or parents.
Evaluate	1	At this stage the expertise of the students is checked with a test. This includes questions about both the global and the local view of the problem.

A main goal of the IRRESISTIBLE project was to bring responsible research and innovation into schools. All modules that were developed use Hilary Sutcliffe's approach of defining six main aspects of RRI (see Figure 3). But the approaches of implementing these RRI aspects vary greatly from module to module, ranging from class discussions and role plays to dice games and museum / laboratory visits.

Different representations of knowledge, expertise, and ways to present RRI aspects have been introduced by including informal learning sites like research or student laboratories, science centers, or museums. Web2.0, apps, and other ICT tools are an integrative part of each module as well, used for very different purposes – from collecting data to exchange and collaborative development to presenting content in the exhibitions. These tools not only support the ideas of IBSE, but support teachers in the process of implementing the concept into their everyday teaching. At the end of each module students develop an exhibition on the topic including scientific as well as societal aspects. This not only fosters a stronger engagement of the students with the topic, but also serves as a tool for reflection. It further allows a dissemination of the topic to a much wider audience: other students, teachers, and the public. The development process was accompanied by evaluation studies. One study carried out by partners in Finland with co-responsibility of the IPN evaluated teachers' expectations and experiences based on the concern-based adoption model. With regard to the exhibitions, the group at the IPN was responsible for a qualitative analysis of the module design pertaining to the RRI and 6E criteria as well as the use of media. This analysis has led to an overview of the different educational approaches applied in different models and showed the practicability of realizing all aspects of RRI within different topics.

- ENGAGEMENT
  Joint participation of researchers, industry, and civil society in the research and innovation process
- GENDER EQUALITY
  Unlocking the full potential of society
- SCIENCE EDUCATION
  Creative education to foster the future needs of society
- ETHICS
  Including societal relevance and acceptability of research and innovation outcomes
- OPEN ACCESS
  Free, online access to the results of publicly funded research
- GOVERNANCE
  The responsibility of policy makers to develop harmonious models for RRI

Figure 3. Hilary Sutcliffe's aspects of responsible research and innovation as implemented in the IRRESISTIBLE teaching modules.

Results

The final modules (see Table 2) are available for download on the project website (www.irresistible-project.eu/index.php/en/resources).

Table 2. Modules developed in the IRRESISTIBLE project

	Module name	Developed by	Languages
1	Carbohydrates in Breast Milk	The Netherlands	
2	Nano in Health Science	Turkey	
3	The RRI of Perovskite-Based Photovoltaic Cells	Israel	
4	The Catalytic Properties of Nanomaterials	Poland	
5	Nanotechnology for Solar Energy	Italy (Bologna)	
6	Nanotechnology for Information	Italy (Bologna)	
7	Energy Sources	Italy (Palermo)	
8	Nanoscience and Nanotechnology Applications	Greece	
9	Geoengineering	Portugal	
10	Evaluate Earth's Health Through Polar Regions	Portugal	
11	Plastic – Bane of the Oceans	Germany (Kiel)	
12	Offshore Wind Energy	Germany (Munich)	
13	Ferrofluids Technology	Romania	
14	Lotus Effect	Romania	
15	Nanoscience	Romania	
16	Natural Nanomaterials	Romania	
17	Climate Change	Finland	

One example of a module relating the content to RRI aspects is shown in Figure 4.

The guidebook "IRRESISTIBLE Exhibitions – A Development Guide" (download on project website) offers a general, practice-oriented introduction to student-curated exhibitions and presents selected examples from the IRRESISTIBLE project. The new format of student-curated exhibitions – exhibitions created by the students to present and disseminate their knowledge on the topic they have worked on – was developed, explored, and extensively used within the IRRESISTIBLE project. The EXPOneer framework for student-curated exhibitions (www.exponeer.de/index.php/en/) is one of the main products of the IPN involvement and has not only been evaluated, but has also been adapted by other projects, for example, by the new EU/Interreg project PANaMa

Kampschulte, L., & Parchmann, I. (2015). The student-curated exhibition – A new approach to getting in touch with science. *LUMAT, 3*(4), 462–482.

Figure 4. Example pages from the teaching module "Plastic – Bane of the Ocean" that was developed by the German CoL.

Figure 5. Student-curated exhibition "Impact of Mankind on the Ocean", developed by a 10th and 11th Grade at Peter-Ustinov School in Eckernförde. The left wing highlights the issue of increasing plastic pollution of oceans, the right wing offers an overview on the problem of CO_2 uptake of oceans and its influence on flora and fauna.

Figure 6. The IRRESISTIBLE exhibition at the European Researchers Night in Kiel. Students presented the best exhibits from all 10 countries to roughly 2 000 visitors (September 30th, 2016).

(see Outlook). Within the IRRESISTIBLE project around 300 student-curated exhibitions were developed, offering insights into research topics and ethical as well as societal issues related to them. Figure 5 shows one example for an exhibition on the topic of oceanography.
Since one of the core features of the IRRESISTIBLE modules was the integration of ICT, Web2.0 tools, and apps in the process of learning, a guidebook "ICT Tools in School – a Practical Guide" was published. In its first version aimed to support the CoLs in the different countries to ease the integration of ICT in the modules, it is now in its final version a comprehensive guide on integrating ICT, Web2.0 tools, and apps into teaching. The document not only lists about 50 tried-and-tested programs that could be used in IBSE teaching units, but also offers many examples of practical integration of ICT tools in teaching and reports on the experience using ICT tools in the IRRESISTIBLE teaching modules. The guidebook is available for free on the project website.

Discussion

The IRRESISTIBLE project has shown that integrating RRI into school teaching is a manageable challenge. Various activities were developed and implemented in the teaching modules that foster the involvement of students in the process of RRI. The format of student-curated exhibitions proved to be a suitable tool for students to develop products showing

their results to a wider audience. Ultimately, this project allowed about 8 000 students, 250 teachers, and the public to consider the societal impact of scientific research.
The final meeting of the IRRESISTIBLE project was organized by the IPN and held in Kiel end of September 2016. It offered a perfect venue for the event with Kiel being the German venue of the European Researchers Night 2016. Students presented the best student-curated exhibits from all 10 countries in a 300 m² joint exhibition (see Figure 6). The mayor of Kiel, Dr. Ulf Kämpfer performed the opening speech and the exhibition attracted roughly 2 000 visitors.

Guides and materials:

Kampschulte, L., & Eilert, K. (2016). ICT Tools in School – a Practical Guide. www.irresistible-project.eu/data_storage/resources/IRRESISTIBLE_ICT-Tools_Practical_Guide_2016.pdf

Rocha dos Reis, P., Marques, A. R., & Azinhaga, P. (2016). IRRESISTIBLE Exhibitions – A development guide. www.irresistible-project.eu/data_storage/resources/IRRESISTIBLE_Exhibitions_Guide_2016.pdf

Teaching modules: www.irresistible-project.eu/index.php/en/resources

IPN RESEARCH GROUP // Lorenz Kampschulte, Ilka Parchmann, Maria Weisermann

FUNDED BY // European Union's seventh Framework Programme(FP7)

DURATION // 2013–2016; grant agreement no. 612367

COOPERATION // Bogazici University, Turkey; Deutsches Museum Munich, Germany; Eugenides Foundation, Greece; History Museum Targoviste, Romania; Istanbul Technical University (ITU) Science Center, Turkey; Jagiellonian University, Poland; Jagiellonian University Museum, Poland; Museum of Bali, Italy; Pavilhão do Conhecimento and Ciência Viva, Portugal; Prahova Natural Science Museum, Romania; The Clore Garden of Science, Israel; University of Bologna, Italy; University of Crete, Greece; University of Groningen (project coordinator), The Netherlands; University of Helsinki, Finland; University of Jyväskylä, Finland; Universidade de Lisboa, Portugal; University of Palermo, Italy; Valahia University Targoviste, Romania; Weizmann Institute of Science, Israel

HOMEPAGE // www.irresistible-project.eu/

3 Further Research

The presented EU projects built important bridges between research and practice. The formation of international networks not only fosters the exchange and establishment of cooperation with outstanding science institutions; they also initiate local networks as a foundation for the implementation of research results in a way suitable for practice. One major outcome of this area therefore is the establishment of networks that will continue internationally and within the countries. The IPN has currently set up a network of cooperating schools, involving IRRESISTIBLE schools as well as results from the project, such as the EXPOneer framework. Accompanying research studies emphasize specific foci like the design of effective assessment tools or the embedding of RRI elements into topic–oriented modules. They have not produced transferable data yet but can form a basis for follow-up research projects. The new EU funded projects in the ongoing and upcoming research periods are again both content-related and focusing central challenges of education. A project led by the IPN is the project Marine Mammals, applying the topic of marine mammals like wales and others as a context for interdisciplinary science learning in exchange with high-end research in ocean science, supported by the existing string cooperation with the Kiel Cluster of Excellence Future Ocean and other institutions. Again, schools and out-of-school learning environments are involved. The project was approved in a large competition procedure with a success rate of less than 10 %. The accompanying research carried out by the IPN will again focus on the development and implementation of material and educational approaches, building on studies carried out in the IRRESISTIBLE project.
The new EU funded Interreg project PANaMa (PANaMa – Prospects on the Job Market in the areas of science and math) focuses on the challenges and goals of a better career orientation of the German–Danish border region. The aim of the project is to highlight regional job opportunities in professions that are related to booming fields of science and technology, like high-tech materials, renewable energies, or agricultural and nutritional science. The project also builds on former material development from EU projects like ESTABLISH on the one hand, and on basic IPN research projects like ManKobE (see Chapter 2 in this report) on the other hand.