

levels in solving real-world problems in science, technology, and science communication. These programs engage students in fields that otherwise may not hold interest for them, and often place them into situations that allow the development of extended relationships with accomplished scientists. Showcasing the products of these programs in a science festival schedule can provide an added urgency and meaning to these projects.

MASS EXPERIMENTS SOLVING REAL-WORLD PROBLEMS

Mikkel Bohm, Danish Science Communication, Copenhagen

Mass experiments (25,000+ pupils participating) in collaboration between schools and researchers have been carried out in Denmark for the last four years during the annual Danish Science Week. The mass experiments are designed in a close collaboration between scientists and teachers and must follow a number of rules. Firstly, the subject matter of the experiment must be a real research problem. Usually the unknown factor will have to do with mapping of data — and the pupils should help the scientists do this mapping. Secondly, the experiment should always be about real-world problems that has a direct relevance to the children's lives. Thirdly, the experiment should fit into the school curriculum and thus be easy for the teachers to adapt into their planning. The experiment is open to all K12 levels and teacher's material is carefully designed to follow the different levels. Every class will receive an experiment kit along with a manual. It is free for the schools to participate, but they must promise to report their data into the mass experiment website. Currently we scale the experiment to include a maximum of 1,300 classes (app. 30,000 pupils) and there are always waiting lists to participate. We have so far carried out the following experiments:

2007: analysis of water quality in the school drinking water as well as in the children's own water bottles. It turned out that there was a significant amount of bacteria growing in the water bottles

2008: analysis of taste preferences. It turned out that boys have a slight preference towards sweet taste, that girls taste better (!) than boys and that children love fish!

2009: analysis of indoor climate in the classroom. It turned out that more than 50% of the classrooms had a CO₂ level above the recommended threshold

2010: analysis of acoustics in the classroom. It turned out that the acoustics in the classrooms are fine for traditional teaching but bad for modern project-oriented work in groups

In the September 2011 experiment 30,000 pupils will map children's skin cancer risk in collaboration with the Danish Cancer society and leading researchers. They will look at the skin colour of the pupils and investigate the effects of sunscreen. The mass experiments are very popular. We try to make science relevant to the children by using real-world challenges and also teaching them scientific methods. It adds extra value that the results usually gets quite good media attention and that you contribute to a collective body of data. Also some children learn that knowledge is powerful, for instance when you approach your local headmaster with data that proves that the indoor climate is bad. Of course, there are also challenges. One challenge is to extend the experiments from "recipe science" where you blindly follow an experiment design, to also include inquiry based teaching, where the pupils design their own experimental methods. Another challenge is the obvious challenge of validity. Data collected by little kids cannot be 100% valid, but the size of the experiment does give indicators of trends.

Teaching Science Through Language

Organized by: Anne Lobeck, Western Washington University, Bellingham

There is a need for highly effective science education and for more successful ways to teach scientific inquiry. Work on language can play an important role in developing the concepts and skills necessary for understanding how science works. Language provides a wealth of data available from the students themselves — data with questions that beg to be asked, making everyday phenomena surprisingly unfamiliar and requiring explanation. Linguistics is at the core of cognitive science, offering incomparable ways to understand the nature of the human mind. The biological capacity for language appears to be shaped in part by genetic information and in part by information gained through childhood experience. Scientists have sought to tease that information apart, and this work has yielded good explanations in some domains and a body of understanding that can be made accessible to middle school

and high school students. This symposium presents examples of linguistic puzzles that can be integrated into existing school curricula and that enable all children to understand elements of scientific work quite generally and to discover their own intuitive knowledge of language. (For example, how do we know that *greebies* is a noun in *The greebies snarfed granflons*, but a verb in *Lulu greebies me*?) All of this can be done without labs or expensive equipment by involving experimentation, observation, and testing of hypotheses.

LANGUAGE PUZZLES: WHAT THEY TELL US ABOUT BIOLOGY, EXPERIENCE, AND EXPLANATION

David Lightfoot, Georgetown University, Washington, DC

The biological capacity for language appears to be shaped by both genetics and childhood experience. Scientists have sought to tease these two aspects apart, yielding good explanations that can be made accessible to students. This talk explores some of the puzzles and explanations at the core of language science. For example, why can him not refer to John in John likes him but his can in John hurt his nose? Such puzzles and their explanations form the foundation for teaching science through language.

TWO LINGUISTS, A TEACHER, AND SOME MIDDLE-SCHOOL STUDENTS WALK INTO A ROOM

Wayne O'Neil, MIT, Cambridge, MA

This presentation surveys a decade of thinking linguistically with Seattle middle-school students and their teacher, during which time mysteries that inevitably arise about language and its growth and development yielded problems for which hypotheses were formulated, tested, and reformulated. In this on-going relationship among two linguists, dozens of students, and their teacher, the students and their teacher become linguistically literate, while the linguists become middle-school literate.

TEACHING TEACHERS TO TEACH SCIENTIFICALLY

Kristin Denham, Western Washington University, Bellingham, WA

This presentation outlines how the study of linguistics improves teachers' understanding and practice of scientific inquiry. Introducing linguistics to teachers is no easy task, given assessment pressures and the pervasiveness of traditional approaches to language. We show, however, that the scientific method allows teachers to discover grammatical categories and clause structure, and that teachers are then able to model and teach the scientific method in both the language classroom and beyond.

Excellence Gaps in K-12 Education: Race, Gender, and Poverty and High Achievement

Organized by: Jonathan A. Plucker and David J. Rutkowski, Center for Evaluation and Education Policy, Bloomington, IN

Equity and excellence in education are often treated as competing goals: to achieve one, we must neglect the other. But education systems that fail to harness the potential of students from every background can make claims to neither quality nor equality. This is the problem of the excellence gap: historically underprivileged groups make up a disproportionately small share of top educational performers. The consequences of this gap are enormous, with the loss of educational talents and intellectual contributions from millions of students around the globe each year. Ignoring gaps seriously inhibits societies' ability to produce the scientific and technological talent needed to solve increasingly complicated problems. Although education is generally thought of as a nation-specific activity, the major issues today (e.g., terrorism, global warming, pollution, poverty) cross borders and require contributions from dozens of countries. This symposium explores the nature of excellence gaps in the United States and internationally, with papers presenting new data on excellence gaps within the United States, across the globe using data from the major international assessments, and within the United States on the recently released science data from the National Assessment of Educational Progress. The symposium will conclude with a discussion of possible interventions to reverse the growth of excellence gaps nationally and internationally, including both education and policy initiatives.