

## Research Briefing N° 31

# Science and Mathematics Teachers' Understanding of Risk

This research promotes and supports the teaching of risk in mathematics and science.

**Key words:** risk; mathematics education; science education; socio-scientific issues

## Key findings

The findings summarised below might together inform a coherent theory for the teaching of risk:



- risk is a multi-disciplinary topic that can be addressed within conventional school structures, with mathematics teachers focusing on calculating likelihood and science teachers on the risks in socio-scientific issues;
- risk is multi-faceted, including the chance of a hazard happening; the harm that might accrue; and personal values, including ethical considerations. Teachers' appreciation of risk can be stimulated when they engage with scenarios designed to raise discussion about these facets;
- modelling approaches can support recognition of and discussion about the specific dimensions of socio-scientific issues and how these dimensions affect decisions about such issues;
- tools which incorporate teachers' values and priorities can be designed to support the difficult process of coordinating the dimensions of risk.

---

## What we did

Risk is regarded in the mathematics curriculum as an application of probability, and as a key element of the science curriculum in areas such as nuclear physics, genetics, obesity and immunisation. This study, funded by the Wellcome Trust over 2009-2010 with a budget of £250k, aimed to provide mathematics teachers with inspirational contexts for teaching probability, and science teachers with themes that would require risk as a powerful explanatory tool.

## How we did it

The approach was based on an assumption arising from past research: the importance for teacher development i.e. of engaging teachers in the co-design of student learning opportunities. This might include building and evaluating computer-based models, encouraging reflection, discussion and evaluation. The teachers were asked to engage in discussions, both in their pairs and as a whole group, of the mathematical and scientific ideas that underpin a range of socio-scientific issues. By doing this, they understood the connection between the two, and reported that they were empowered to use similar approaches in the classroom. At the same time, we monitored how teachers used risk as an explanatory tool for socio-scientific issues. By designing an environment that made this possible, we produced a means by which teachers began to interrogate through modelling activity their own knowledge of risk.

We worked directly with four pairs of mathematics and science teachers, from the same schools, recruited from the Institute of Education's (IOE) teacher training partnerships. We developed a scenario about a fictitious woman, Deborah, who suffered from a spinal condition. She could have an operation that might cure the problem, but might also bring about various side-effects. The teachers examined information about the condition, the success rate of the operation, the possible side-effects and their likelihoods, and Deborah's lifestyle. We provided the teachers with computer-based tools with which they could model what might happen to Deborah were she to have the operation, and the impact on her lifestyle were she not to have the operation. We asked the teachers to use their models to consider what might be the best option for Deborah, about whom they discussed vicariously. The transcripts of their discussions and actions on the computer were analysed using qualitative methods to gain insights into their knowledge about risk and the factors in the tool design that seemed to impact on their understanding.

## Further information

[Levinson, R., Kent, P., Pratt, D., Kapadia, R., and Yogui, C. \(2011\). Developing a pedagogy of risk in socio-scientific issues. \*Journal of Biological Education\* 45\(3\), 136-142.](#)

[Pratt, D., Ainley, J., Kent, P., Levinson, R., Yogui, C., and Kapadia, R. \(2011\). Role of context in risk-based reasoning. \*Mathematical Thinking and Learning\* 13\(4\), 322-345.](#)

[Levinson, R., Kent, P., Pratt, D., Kapadia, R., and Yogui, C. \(2012\). Risk-based decision making in a scientific issue: A study of teachers discussing a dilemma through a microworld. \*Science Education\* 96\(2\), 212-233.](#)

[Pratt, D., Levinson, R., Kent, P., Kapadia, R., and Yogui, C. \(2012\). A Pedagogic Appraisal of the Priority Heuristic. \*ZDM - The International Journal on Mathematics Education\* \(online first, 27 June 2012\), DOI: 10.1007/s11858-012-0440-z.](#)

See link to the Teachers' Understanding of Risk in Socio-Scientific (TURS) project: [www.riskatioe.org](http://www.riskatioe.org)

## Contact

**Principal Investigator:** Professor Dave Pratt, Department of Curriculum, Pedagogy and Assessment, Institute of Education, University of London

**Email:** [d.pratt@ioe.ac.uk](mailto:d.pratt@ioe.ac.uk)

**Phone:** +44 (0)20 7612 6655

**Other team members:** Ralph Levinson (Co-investigator), Philip Kent (main researcher), Ramesh Kapadia and Cristina Yogui (Institute of Education)