

Enriching Mathematics: Helping All Students to SHINE



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Three cohorts

- Tower Hamlets 1: 35-40 students over 29 sessions
- Lambeth: 40 students over 15 sessions
- Tower Hamlets 2: 50 students over 22 sessions



Project aims

- To raise attainment in the areas of problem solving and mathematical thinking
- To raise students' aspirations and awareness of the subject.

The “SHINE Project”

- Six to nine month programme of maths enrichment workshops run by Cambridge University’s Nrich team
- Secondary school students in years 8, 10, 11
- Workshops after school or Saturday mornings
- Collaborative working on resources drawn from the Nrich
- Discussion guided by Nrich leaders and participating school teachers.
- Three cohorts attending the project up to July 2006 were the focus of an independent evaluation study.



The evaluation investigated:

- the impact of the project on students' problem-solving and school mathematics,
- **changes in students' aspirations and attitudes to mathematics**
- **what features of the project were influential in these effects.**



Methodology

Four main methods:

- Student questionnaires concerning attitude and enjoyment
- Teacher profiling of students concerning problem solving skills
- Compiling attainment data from SATS and GCSEs
- Observation of workshops

Hufferd-Ackles, K. et al (2004). Describing Levels and Components of a Math-Talk Learning Community, *JRME* 35 (2): 81 -116



Social background of all three cohorts

- Largely representative of the local populations in terms of ethnicity
- Slightly under-represented the under-achieving White-British/Other ethnic groups. (TH)
- Representative in terms of take-up of free school meals, a measure of social deprivation.
- School attendance is good.



Students' views about SHINE maths

Over 90% of students reported that they had improved in their problem-solving skills after SHINE;

Over 80% also agreed that this had led to some improvements in their school mathematics.

“Yes because at first in most exams, most questions I rush to do it, but this time I take time and I think of different ways to do it. When I am stuck I think of the ways I do here.”

Difference in teaching style:

“We are pushed more to join in, it's not book work at all, the teachers encourage you loads to answer problems”

It is harder and focuses on why not what”



Students' views about themselves

Students highlighted experiences of personal achievement, motivation, and social goals:

“Actually solving the problems with a solution and getting an end results.”

“Just the fact that I’m coming every week ever since I started and got on with the problem and not gave up”

“Solving problems with my friends and contributing to it”

“Yes it gives you more ways to think of things and that there is not always one right and wrong answer. It also boosts your confidence to give ideas.”



Students' views about mathematics

Extending a repertoire of mathematical skills.

“yes because I found different ways to find the solution”

“Yes because they teach us how to generalise and work systematically”

Introducing a new perception of mathematics;

“It’s like two different whole subjects [...] that’s very similar, not just the one whole maths being taught in different ways.”

“Yeah in schools we look at normal maths, symmetry or anything like that ... Here we look at overall, world-wide. Like - the cinema problem – we don’t do this stuff in school. It’s based on what we do everyday - everyday stuff.”

Views of mathematicians

Persistence:

“They try to solve the problem and if it doesn’t work they try again; if it doesn’t work then they try again, and they never give up, and they, when they really want to find the best solution to that problem then they never give up.”

Access to flexible strategies:

“What I thought before I came was - really boring people, just write all the time, never got married. [Now -] Mathematicians look at problems in a lot of different ways to how other people would do it. They take the problem more ways than other people.”



Changing Attitudes

- Over the project, students' confidence in mathematics increased. Sturman, L. and Twist, E. (2004)
- SHINE students' enjoyment of mathematics also increased.
- Students articulated awareness of different beliefs about the nature of mathematics.
- For older students "traditional" descriptions were still dominant.
- Attitudes were fragmenting rather than adapting.



Changing Aspirations

- Little change in individual students' aspirations to study mathematics at Advanced or degree level.
- They had new expectations that any future study would resemble SHINE maths.
- Students were motivated by the Cambridge connection to envisage possible university choices; and by the utility and status of mathematics in career planning.



Impact of SHINE Maths

- Giving students successful experiences of meeting challenge and overcoming difficulties;
- Enabling them to make sense of mathematical content through problems;
- Enabling them to interpret questions strategically, and to be flexible with using alternative strategies;
- Giving confidence to high attainers with low social status;
- Making students independent of the teacher.



Smith C and Piggott J S (2007) eNRICHing Mathematics: Reflections on Building a Learning Community , *Philosophy of Mathematics Education Journal*, 22 (Nov 2007)

References:

Hufferd-Ackles, K. Fuson, K. & Sherin, M. G. (2004). Describing Levels and Components of a Math-Talk Learning Community, *Journal for Research in Mathematics Education* 35 (2): 81 -116

Sturman, L. and Twist, E. (2004) Attitudes and Attainment: a trade-off? In NFER, *Annual Report 2004/05*. National Foundation for Educational Research (NFER), accessed at www.nfer.ac.uk/publications/pdfs/ar0405/05sturman.pdf