skills increased, with some pupils taking the initiative and working much beyond the point that was required for the set tasks. These pupils were asked to take part in Master Classes for younger pupils and from this experience gained even more satisfaction and confidence. This can be seen from the students now actively seeking to participate in projects and Master Classes with younger students. Currently this group consists of 12 pupils.

Research Methods

The information and data collected and analysed for this project came from:

- previous academic studies of the benefits of teaching and learning mathematics in historical context;
- examples of similar projects done around the world, and in particular in the US and Canada (see also the website which promotes this approach, supported by the Mathematical Association of America at http://www.joma.org/convergence/1/); and
- information from primary and secondary resources on mathematical topics to include on the website.

In addition information was collected in the classroom through:

- observation of what pupils used from the available resources;
- observation of what they learnt better; and
- discussion with students and questionnaires.

Observation of pupils' reactions began at the start of the project. Selected classes (five in total) were observed, with two classes observed more closely. In the second year of the project, a new intake of Y7 was given questionnaires at the beginning of the school year, and then at the end of each term.

Conclusion

The teaching and learning of mathematics should be an enjoyable pursuit for both pupils and teachers. This approach offers a flexible framework within which it is possible to achieve good results even with the most challenging classes. I would like to be able to conduct a wider survey/study of how attitudes of both pupils and teachers change when they start learning about maths in historical context and will be seeking further funding to enable me to do this.

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http://www.standards.gov.uk/innovation-unit

National Teacher Research Panel
engaging teacher expertise

The project has led me to conclude that there are also some implications for professional development which have come out of this project: story telling is an important part of all teachers' repertoire as it helps them develop skills of communication, empathy, understanding and above all subject knowledge. Learning about the innumerable examples from the history of mathematics gives a teacher an opportunity for constant and on-going professional development.

Suggestions for further reading

The main project website which contains materials and resources for the teaching and learning of mathematics in historical context is at www.mathsisgoodforyou.com

See also
http://www.dcs.warwick.ac.uk/bshm/resources.html#education

Some of the findings of the project have been disseminated through the Gatsby Teacher Fellowships website, which can be seen at http://www.gtf.org.uk/projects0405ma.htm

The main website attracted more than 45 000 hits during the six months (July-December 2005). Majority of the users of www.mathsisgoodforyou.com come from Great Britain, US, Canada, Australia and New Zealand.

The electronic journal of the Mathematical Association of America, promoting the use of history in the teaching and learning of mathematics can be seen at http://www.joma.org/convergence/1/.

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Maths is good for you: Teaching Mathematics in a historical context

National Teacher Research Panel
engaging teacher expertise

This summary was commissioned by the National Teacher Research Panel for the Teacher Research Conference 2006, which explored and celebrated teacher engagement in and with research. All conference materials are available at www.standards.dfes.gov.uk/ntrp

Aims of the project

The prevailing modern view of mathematical ability is one which includes creativity and transcends the more limited concept of technical ability. There is, however, little widely available material which, in a simple and accessible way, introduces secondary school age children to the world of 'creative' mathematics. This project's main aim was to bridge this gap. It sought to do so through the development of a base of knowledge and resources to initiate the teaching and learning of mathematics at Key Stages 3 and 4 in a context of the historical development of mathematical sciences.

The project aimed to:

- increase pupils' motivation in learning mathematics through 'story-telling';
- improve pupils' understanding of the subject through contextual learning; and
- enable pupils to gain skills in structuring their knowledge and linking different mathematical concepts through their increased knowledge of the development of mathematical concepts.

Dimensions of the Study

The project began during the 2004/5 academic year, as part of the Gatsby Fellowship in Mathematics, held by the author. During 2004/5 the project involved one of the classes from each year at KS3 and KS4. During the current academic year (2005/6), the findings of the project, as well as the resources, have been incorporated into the schemes of work for all KS3 and KS4 classes of the Maths Department of St. Edmund's. The aim is to have full schemes of work for all sets for the forthcoming year with historical context – i.e. the historical development of mathematics will be part of teaching and learning at all levels of KS3 and KS4 in the school. These will be available from the www.mathsisgoodforyou.com by the end of August 2006.

Summary of Main Findings

- Pupils' motivation increased steadily throughout the project.
- Pupils began undertaking their own investigation.
- Pupils improved their communications skills.
- Children and adults did not always find the same topics interesting - the favourite pages and worksheets for pupils seemed to be those that described excesses in some way.
- Cohesion of a class influenced the extent to which the pupils were enthusiastic in taking part in this project.

Background and context

Having started to introduce historical context to my teaching of mathematics, I realised that my pupils gained many benefits from this approach:

- Pupils seemed to remember the mathematical skill and its application better when they learnt about the context in which the skills were first used.
- The acquisition of mathematical skills became more meaningful when they knew the historical background.
- The pupils started making links between mathematical concepts between the historical developments and personalities they learnt about.
- They were able to identify with the role models and gained greater motivation for the learning of the subject.

I therefore aimed to produce an ICT resource base in the history of mathematics with worksheets and practical guidance to place Key Stages 3 and 4 mathematics topics into a wider historical context. The intention was to reinvigorate the interest in the subject not only for my pupils but to disseminate these through the free-access website.

Apart from the project's main goals, I aimed to incorporate the following into the project:

- an international dimension to mathematics through teaching and learning about its history;
- an understanding of and comparison with different cultural approaches;
- an interdisciplinary approach, in particular in relation to visual and literary arts;
- to demonstrate mathematics as one of the most creative human activities;
- the study of 'old masters' (offering a safe environment for self-discovery and self-identification in the context of the history of mathematics);
- nurturing intellectual fascination with mathematical concepts;
- an understanding of progress in mathematical science;s
- the promotion of mathematics as one of the most fascinating of human pursuits; and
- part of the cultural heritage of all societies.

Teaching processes and strategies

During the first year of the project I concentrated on finding out what strategies I could best employ in order to teach mathematics in its historical context. I found that three strategies were most easily applied in every-day teaching:

- learning a skill through worksheets which explained skills in their historical context;
- story telling about mathematicians, the geography of mathematical discoveries, and about great national and international collaborations or competitions between mathematicians; and
- through research-based activities in whole-class teaching and through themed homeworks – finding about a skill, mathematician, or the meaning of a mathematical term.

I also made an effort to increase my own subject-knowledge through learning about historical developments in mathematics, while at the same time developing my IT skills to enable me to disseminate the project findings and resources through the website and downloadable material.

Some of the strategies which have so far been incorporated in my teaching are based on following principles:

- Mathematics, as well as any other human activity, is partly dependent on story-telling. This gives mathematicians a context in which to work, as it entails a social as well as a personal platform whereby mathematics is both related to and helps explain other human activities. The more sophisticated the society is, the more complex the story-telling becomes, but the primal need for understanding the simple, archetypal stories remains strong nevertheless. This need is strongest In children as they strive to understand the world around them.

Example: *a project to understand the meaning of 'proof' begins by showing the importance Greeks gave to the development of geometry. This leads to exploring famous mathematicians, and famous places. We start from talking about Euclid and his Elements, show the first edition of the Elements (which was the first pop-up book in English) and talk about Alexandria (which is where Euclid lived) and some other famous mathematicians who lived there. Euclid's Elements can then be looked at again, and some theorems investigated, before closer examination of Pythagoras' theorem – (47th Theorem Book I). This can lead to the life of Pythagoras, his school of mathematics, and his travels to Egypt… Pupils are asked to map their understanding of proof by finding more about Euclid, Alexandria and its famous mathematicians, Pythagoras, his school, and the origin of his theorem.*

- Familiarity with a topic need not finish with the work on the topic. By taking possession of it, students were able to pass the message on to younger pupils, therefore doing the right thing twice over: the first time when they strove to understand the topic themselves through the historical context and then by teaching (and thereby learning more about it) the same topic to the next generation of students. Practical tasks, such as the logistical questions, provided pupils with more opportunities for taking ownership of a particular topic.

Example: *a project with Y7 pupils was recreated in the Master Class for Y5 pupils who visited St. Edmund's in July 2005. Y7 pupils who completed the project some months earlier, were invited to help Y5 pupils. This was a project which linked, through an introduction to Egyptian mathematics, three topics: numerals, geometry (building pyramids from given nets) and fractions. Egyptian fractions and the Eye of Horus fractions were thus linked with experimental building of shapes with paper pyramids, and finding the fraction of the volume of the shape through counting pyramids.*

- Rather than a large number of projects, the students were better off with a limited number to cope with during the year. This gave them opportunities to explore topics in depth and in relation to all the principles of the project as previously listed. For KS3 pupils projects aimed to link more than one topic and lead to an investigative task. KS4 pupils were given projects as preparation for their GCSE investigative work: for statistics coursework they participated in the Cryptography project; and for the number coursework they had two projects to choose from - Numerals and The Development of Algebra and Algebraic Symbols.

The Findings

The overwhelming impression from the observations is that:

- cohesion of a class influenced the extent to which the pupils were enthusiastic in taking part in this project – if a class worked well as a whole, the projects were more successful and pupils were happy to pass their experience to other classes and pupils through the series of Master Classes; and
- pupils found some topics more interesting than others – what adults seemed to find more interesting is not always what the children did. For example, the favourite pages and worksheets seemed to be those that describe excesses in some way – the largest prime, the many thousands of decimal places of irrational numbers, as well as the more gory details about personal stories of mathematicians' lives. However trivial this may sound, there are now many more pupils in our school who know what Pi is and where it is used than before the project began.

The project also showed that there is a necessary lapse of time between the introduction of this approach to the benefits both in terms of increased pupil understanding and improved achievement. Questionnaires and interviews showed that the motivation of the pupils who participated in this project constantly increased. Pupils found it easier and more interesting to complete work at home than before because they took greater responsibility but also found more enjoyment in their learning. Pupils began undertaking their own investigations and producing material which showed a constant rise in their confidence in mathematics and in understanding the topics they were learning about.

For the majority of investigation based projects pupils were asked to show the class what they found, and to discuss their findings. Thus their communication