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NRICH annual report 09-10

Lynne McClure

NRICH Annual Report

For the year ending 31-8-10

NRICH team

Jennifer Piggott / Lynne McClure	Project Director
Liz Woodham	Primary Coordinator
Bernard Bagnall (PT)	Primary Teacher Associate
Charlie Gilderdale	Secondary Coordinator
Alison Kiddle	Secondary Teacher Associate
Steve Hewson (PT)	Post 16 Coordinator
Toni Beardon (PT)	KS5 Teacher Associate
Emma McCaughan (PT)	AskNRICH Teacher Associate

Consultants:

Jenny Murray	Primary
Mary Cleare	Secondary
Leo Rogers	History of Mathematics

Technical support:

Mike Pearson
Owen Smith
Ian Short /Chris Clarke (PT)
Technical staff are employed by the MMP and have duties across all the projects.

Introduction

This has been a year of both consolidation and change for the NRICH project. Our aims remain to

- enrich the experience of the mathematics curriculum for all learners
- offer challenging and engaging activities
- develop mathematical thinking and problem-solving skills
- show rich mathematics in meaningful contexts
- work in partnership with teachers, schools and other educational settings

and we have worked to ensure that the mathematics materials devised, and professional development delivered, have promoted and delivered these ideals. These activities have been undertaken in a context of three major changes:

- changes in the team personnel
- a change in our major funding
- a national context of a changing and somewhat uncertain curriculum and assessment regime

All three of these have impacted on what we have done and plan to do as this report sets out in detail.

People

The NRICH project is as strong as it is because of the high calibre of the team, and, apart from the Directorship, the team has remained constant this year. Jennifer Piggott stepped down as Project Director in May 2010 and was succeeded by Lynne McClure. A six-week handover period allowed Lynne to firstly shadow and then take responsibility for the project, an opportunity valued and enjoyed by both participants.

The primary team, led by Liz Woodham, works collaboratively to plan and deliver both the site content and an extensive portfolio of professional development activities. The additional primary expertise of Bernard Bagnall and Jenny Murray has been supplemented, on her appointment, by that of Lynne.

Charlie Gilderdale continues to lead the secondary team and a strong and fruitful partnership has developed between Alison Kiddle and Charlie as they plan lower and upper secondary activities and site content together. Since Alison has completed her probationary period she has taken responsibility for the whole range of activity, site and CPD, at upper secondary.

Steve Hewson is supported in writing the extensive post-16 content by Toni Beardon who joins us in a part time capacity. Steve also works increasingly closely with Alison, smoothing the transition between pre- and post-16 experiences.

Towards the end of the year Ian Short was replaced by Chris Clarke, as part time technical support. Chris will be working closely with Mike Pearson and Owen Smith on site development.

Funding

The funding of NRICH has been on a much more certain footing this year, thanks largely to the generous commitment of nearly £900,000 from the Templeton Foundation. This money means that the majority of the team posts are secure until 2012. We have been working to ensure that we fulfil our commitment to support exceptionally able learners, the focus of Templeton's interest, whilst ensuring that NRICH activities are accessible for the majority. (There is more detail about all of the projects mentioned in this section, and others, on page 6).

In addition, the remainder of the grant from the Clothworkers Foundation supported the balance of Liz Woodham's salary (part of which is currently funded by the Newton Trust) and funded Bernard Bagnall for this year. In June we heard that we had successfully been awarded another Clothworkers Foundation grant of £200,000 to enable us to bring STEM down into the secondary phase. This will be an additional focus of our work in 2010-12.

The second year of the Goldman Sachs funded Fast Forward Project and Teacher Inspiration Days and planning for the third and last year are completed. As indicated in the previous report, the fact that this highly successful project will not continue to be funded in future is a source of huge frustration to the team. We are actively seeking support for continuation.

In addition, single funding streams that have contributed to staff costs over the past year have included £20K from More Maths Grads and QMUL for our continuing work in Tower Hamlets (eNRICHing Mathematics Project)and other income of approximately £120K which has been earned through one-off and extended CPD projects with teachers.

Publications – particularly those produced jointly with Beam - continue to give a steady, and not insubstantial income, (approximately £3.5k last year) as well as the ongoing consultancy work for HeyMath in India (£8k).

Activities

Website

The website remains our core activity.

Towards the end of the year we lengthened the run-up time for the development of site activities, so that the initial scoping meeting for each month is now six months in advance. This extended timetable allows us to be more reflective about what we offer and in particular to work with occasional guest editors within a more reasonable timescale. Each month a different member of the team is responsible for chairing the site meetings, for the editorial control and for the common areas of the site, as well as liaising with the guest editor if there is one.

Each month takes a different theme. Sometimes this is maths content (eg Number Rules, Functions and Graphs), others are about different ways of working mathematically (eg visualising, generalising) and others take pedagogical issues as a theme (eg working collaboratively). For a full list of themes please see http://nrich.maths.org/public/themes.php .

Last year we worked with two guest editors. In March Alf Coles and Tracy Helliwell from Kingsfield School helped us to pilot a projects- based month in which we used Web 2.0 technology to promote a mathematical community and encourage student interaction with the site. This pilot NRICH Projects site (http://projects.maths.org) was successful in helping us to move forward in our thinking about how we engage more directly with our student audience, and how we facilitate their working with each other on the problems we design. In May we worked with Professor Jo Boaler in exploring her ideas about Complex Instruction and we devised a whole suite of tasks suitable for group working.

Working with guest editors is an effective way of bringing fresh ideas to the team, and increasing our knowledge and expertise, and we have planned to invite two per year to join us. We are delighted that we have already persuaded Professors David Speigelhalter, John Mason, Malcolm Swan and Tim Rowland to work with us in the future. We see this as another way of raising our profile in the academic world.

The mapping documents (http://nrich.maths.org/public/viewer.php?obj_id=5665) continue to be popular and help teachers to know how to plan to use our activities through the overt links to the curriculum. Whilst NRICH has never claimed to cover the whole curriculum, we know that it is vital that teachers can see where, when and how they can use what may often seem to them to be unrelated activities. It is often these documents that encourage teachers to try that first activity that leads them further into the site. In a time of uncertainty about the national curriculum, it is even more important that NRICH is seen to be responsive to changes but not bound by them.

In addition to the monthly themes we continue to maintain our ties with the United Kingdom Mathematics Trust (UKMT) through the publication of weekly problems taken from their extensive bank.

Our teacher registrations to the site (NRICH-SUPPORT for teachers and parents) have increased from 2000 in 2008 to 3000 in 2009 and now stand at 5227, an increase of 63% this year. NRICH-TALK (for pupils) has 1395 subscribers of which 138 have subscribed between 1st Sept 2009 and now, an increase of 12%. Much of this increase is the result of the personal contacts made by the team at various CPD events and conferences. At present visitors to the site do not have to register so the number of registrations does not necessarily correlate with the number of users. It does however indicate that a significant number are interested enough to want to receive monthly updates from us.

The statistics below indicate that the number of visits to the site continues to increase, by 4.3% this year – again this is welcome but does not tell us much about who these visitors are, or what our visitors do with what they gain from their visit. A big question for us is how we refine our information gathering so that it informs our actions.

Site visits

	Visits 2008/9	**Visits 2009/10**
Sep	209907	225020
Oct	229332	244140
Nov	239280	246178
Dec	187577	184932
Jan	238221	240375
Feb	241121	242359
Mar	280044	244808
Apr	217808	224971
May	243446	257969
Jun	221699(e)	239186
Jul	176933(e)	203028
Aug	132493	179488

Year on year (Based on Webalizer statistics – including some recalculation because of interruption in service)

Again in the summer of 2010 several undergraduate students were employed to work on the site and on the production of other support materials to help us work more effectively during the year. These

annual posts are proving an excellent idea and those who work with us often return in following years. Their mathematical, technical, and laminating expertise are put to good use!

AskNRICH continues to maintain a strong audience and the work of student volunteers continues to be a key aspect of its success. There are nearly 29,000 registered users altogether of whom in the region of 1000 have logged on this year, and there have been over 12,000 posts during that time. We know however that our data can be open to different interpretations and we are hoping that Libby Jared's research (see p **) will help us to redesign our system so that we can make better use of the data we collect. Whilst Libby's research is in progress we have put on hold possible changes to the look of the site.

The Templeton Projects

The Templeton funding opens up opportunities for us to reconsider aspects of our work in a different light. Over the past few years the team has worked to ensure that the public perception of NRICH has gradually changed: originally NRICH was a site for interested and able young people to explore mathematics other than that they met at school. Over the recent years NRICH has moved to being a site mainly for teachers but also for young people, and now catering for students in the whole range of ability.

The Templeton Projects have a distinct focus on students of exceptional ability, which means that we now want to maintain our inclusive nature whilst also catering in various ways for those of exceptional mathematical ability, and their teachers and parents. We are doing this, in addition to our core work, through:

- adding in additional challenge to new problems where appropriate, and revisiting some recently written activities to do the same (see for example Plants http://nrich.maths.org/36&part=note)
- writing new and very challenging activities especially at post-16 (see for example Black Box http://nrich.maths.org/7029 which introduces university level concepts related to number theory)
- making explicit links between stage 3 and stage 4 problems to encourage exceptionally able students and their teachers to explore more challenging material, (see for example Four Coloured Lights http://nrich.maths.org/7015 and A Little Light Thinking http://nrich.maths.org/7016)
- developing weekly challenges which give short and appealing questions based on A-level content but which also link to longer problems, askNRICH and wider enrichment material (see http://nrich.maths.org/5986) A celebratory article launching this made very fruitful connections between askNRICH, where the questions were suggested, and the NRICH site itself. (http://nrich.maths.org/5986)

- developing a suite of activities to support transition to university courses in mathematical sciences (see stemNRICH below)
- working towards embedding software which will allow students to comment on problems on the NRICH site – at present students can only submit solutions – in order to promote interaction with the site through discussion
- beginning to develop a library of articles for exceptional students, their teachers and parents, on exceptional ability, transition to university and career guidance
- setting up a real and virtual network of teachers of students of exceptional ability (see http://nrich.maths.org/discus/messages/board-topics.html EMA Teacher Network)

The whole suite of activities is intended to offer opportunities both for students to work independently, and, through the accompanying teacher notes and support, for teachers to access them as suitable activities to offer their most able students. Although the Templeton Projects are focused on students above 11 years of age, we have decided to implement the project ideas throughout the whole of the site, including the primary phase.

Templeton Research

The tracking initiative, for which the Foundation has awarded a supplementary grant, has begun. A research assistant has been appointed to support the research strands led by Dr Wai Yi Feng and Mrs Libby Jared at the University of Cambridge's Faculty of Education.

Strand 1, led by Dr Wai Yi Feng, involves an accelerated longitudinal study of exceptionally gifted students. Since the appointment of the research assistant in mid-July, an extensive review of the educational literature on mathematically-gifted young people's engagement with enrichment has almost been completed, providing a vital theoretical basis for informing the development of the research for Strand 1. The review also confirmed the valuable contribution this research will be making to knowledge: to date, few studies have been carried out with a focus on investigating students' engagement with online enrichment resources over time. In this respect, this project — through drawing on mathematical and educational expertise across NRICH and the Faculty of Education — is well placed to make a lasting impact.

Strand 2 involves a "tracking back" study analysing the mathematical learning experiences of an identified group of highly gifted students. Through a questionnaire developed by Dr Stephen Hewson we have gathered responses from over 700 University of Cambridge mathematics, science and engineering students (chosen as a pre-selected group of identifiably highly able students, having been through a rigorous University admissions selection process, from a wide range of backgrounds). The data gathering stage of this first phase of the tracking back strand closed in early June, with preliminary analysis of the data gathered starting in July. Analysis is continuing.

Strand 3, led by Libby Jared, focuses upon an analysis of usage of the AskNRICH discussion boards. Working with the NRICH technical team and the AskNRICH discussion board moderator, a database has been established for the systematic collection and tracking of data with particular reference to the two sections (Please Explain and Onwards and Upwards) that are used by participants of school age. This system goes live on September 1st 2010. Monthly accounting of the data will be ongoing from October 1st 2010 until February1st 2012. Preparation has also been completed for the detailed collection of data (also starting on September 1st) for the first of four three-month tracking foci, this one aims to explore the perceived reasons for each post being made.
We are delighted that the results of these studies will be disseminated in research papers and at research conferences and are pleased that this will further raise the research profile of NRICH amongst the academic community.

stemNRICH

stemNRICH (http://nrich.maths.org/stemnrich) is a collection of NRICH problems and articles on the broad topic of scientific mathematics, embedded within the main NRICH site and designed mostly by Steve Hewson. It aims to fill a genuine need by providing good resources at school level which combine relevant areas of school science and school mathematics, all in a real, engaging and enriching manner. Parts of stemNRICH are designed to facilitate individual student learning and discovery; other parts are designed for use in science and maths classrooms. The provision of current material is mainly based around A-level mathematics and science and now attracts page views broadly in line with the rest of the NRICH site.

Starting from a pilot in 2009 many novel and innovative resources have been developed to target the key applications of mathematics to science. The first official version of stemNRICH was released in January 2010, comprising 6 nodes covering basic applied maths, advanced applied maths, mathematical biology, mathematical chemistry, physics and engineering. stemNRICH was created with useful input from various stakeholders in STEM teaching and learning: university teaching staff gave guidance on the problems faced by undergraduates in the sciences; STEM school and college teachers provided feedback at conferences and sessions in which the material was trialled; three postgraduate project assistants, funded by DAMTP, assisted with technical and mathematical issues arising; several undergraduates across various STEM disciplines worked on the project during the holidays to help to design and test tasks, write articles and create solutions.

During 2009/10 Steve and Jenny spoke widely at various conferences and events about stemNRICH and there is clearly great enthusiasm for the concept – the need for materials of this sort seems well understood by many. The next challenge will be to support schools and colleges in embedding some of the tasks into their schemes of work and empowering teachers with the confidence to use the

materials, which might make scientific or mathematical demands outside of the teachers' present comfort zones.

Fast Forward and Teacher Inspiration Days

These two strands of the Goldman Sachs funded project are in their third and final year. A detailed description of this project was given in last year's report so suffice to say that the structure of both student and teacher days remained very similar and the evaluations were even better.

110 teachers registered for the 2009/10 Teacher Inspiration programme, although in the event 97 participants were able to take up their place, with 73% of participants attending for the full three days. The interim evaluation indicates that the programme is having a positive effect on participants' teaching: 89% of 2009/10 programme participants reported a positive impact on their students' motivation, enthusiasm, confidence and engagement with mathematics as a result of the ideas they had taken from the Teacher Inspiration days and implemented in their classrooms. The evaluation also indicates that the benefits are being cascaded to participants' teacher colleagues in schools, widening the impact of the programme further.

An independent evaluation of the impact of the Fast Forward pupil project is being undertaken by Dr. Wai Yi Feng. Responses from questionnaires and interviews to date indicate that the project is well on the way to meeting its core aims which are;

- to develop pupils' mathematical and general problem solving and reasoning skills;
- to support students' classroom mathematics;
- to increase students' academic achievement;
- to raise students' aspirations and encourage and enable students to continue into further/ higher education.

As mentioned previously, the significant success of this programme means that we are keen to continue and expand it, and we are actively seeking further funding to support a continuation and development of the programme beyond the end of the generous grant given by the Goldman Sachs Foundation in August 2011.

The eNRICHing Mathematics Project had a successful seventh year. Alison took over from the rest of the team and has been responsible for working with 45 Year 8 students from schools in Tower Hamlets, and some of their teachers during weekly sessions over two terms of the year. The local authority and schools were keen for this project to continue and we have managed to secure some funding for its extension into an eighth year.

Other key activities

The team receive many requests for CPD sessions and input to conferences, both here and abroad. This is of course a measure of our success but we are aware that some CPD sessions are more successful than others – notably that projects involving one-off sessions are less likely to make an

impact than those where we make repeat visits, or sustain contact with teachers over a period of time. Wherever possible now we try to ensure we accept these types of engagement rather than single visits. It is encouraging that we have developed several longstanding relationships with teachers in some local authorities.

Primary

Liz has been involved with **Haringey LA** for the third year running. Two teachers from each of eleven primary schools participated in five face-to-face days over the course of the academic year 2009/10, embedding resources which support using and applying mathematics in their schemes of work and reflecting on their changed practice.

"*I have changed and adapted my general outlook on what my purpose is as a teacher. In particular what I hope to achieve when teaching Mathematics. As a year six teacher it can be very easy to focus on levels and enabling pupils to be able to pass a test. I have tried to maintain a focus that maths teaching and learning can be so much more to those in my care! It has become a primary focus that in my maths teaching, I provide a platform for motivating and engaging pupils and it is an aim that more children develop a love of maths and problem solving."* Haringey teacher

Maths and Creativity Project in Bristol. This involves three primary schools, is funded by Creative Partnerships and includes a research aspect with UWE. The project is ongoing into 2010/11

Cockermouth, Cumbria The Rayne Foundation funded this single school project to make mathematics more creative and exciting. Liz's input included INSET sessions, working with the children, taking staff meetings and speaking at a parents' evening.

Liz and Lynne worked with teachers and their primary pupils over a period of a term, at the **Scottish Centre for Able Pupils** in Glasgow, linking enrichment materials into the new Curriculum for Excellence.

Lynne worked with 8 schools in **Brighton and Hove** over a period of six months, helping them to embed rich tasks into their teaching. The results of the work were commented on very favourably by Ofsted and as a result another 16 Brighton and Hove schools have signed up for a repeat project with Lynne and Liz in 2010/11

Post 16

With funding from DAMTP, Steve has completed a project to provide an intervention/preparation strategy which better equips students to access the mathematical aspects of their NST course at Cambridge. This has been done through updating the existing NST workbook and linking it online to the general mathematical advice on stemNRICH, and other areas of NRICH generally, and developing new, innovative and high-level problems designed to promote mathematical thinking as needed by NST students.

Needless to say, NRICH are very grateful for both the financial input and the chance to work more

closely with DAMTP. Furthermore, the additional funding and support from student project assistants has allowed very significant improvements in the final version of the stemNRICH site.

Other events and conferences

In addition to these projects, the team have undertaken over 2500 contact hours with teacher and/or pupils at various events throughout the country, and have spoken at numerous conferences, either as keynote speakers or as workshop leaders. Other national associations we have worked with in this capacity include: NCETM, MA, ATM, NANAMIC, NAMA, AMET, UKMT, BEAM, STEMNET, JMC, and the RI.

International work

We have been delighted to host visiting academics from Spain, Sweden and South Africa. The work with colleagues in Sweden, Spain and others in France has resulted in a pilot version of activities translated into these other languages (http://nrich.maths.org/public/leg.php?codesearch=french Charlie has continued to undertake consultancy work for CIE, this time in Chennai and Ahmedabad on Learner-Centred Mathematics Education.

Other related activities

In 2009-10 we had our second Faculty of Education – NRICH joint meeting. We are well represented in the STEM academic group and this will be strengthened when Steve and Alison begin their Masters programmes at the Faculty in October 2010. The team contribute to PGCE programmes and we are beginning to be invited to do this at other HEIs, though progress is still slower than we would like.

All members of the team are active in one or more subject associations and we see this as an important part of our work. Lynne and Liz are both post holders of the MA/ATM primary sub-committee, both sit on the ATM General Council and Liz sits on the MA CPD committee. Lynne also sits on the MA council and edits the MA Primary Mathematics journal, as well as sitting on ACME in a private capacity. Steve is a member of the joint MA/NAMA post 16 group. Lynne and Liz were awarded C.Math.Teach status in 2010 and now sit on the awarding panel. So NRICH is well represented.

We continue to support the very successful STIMULUS Project http://mmp.maths.org/local in which undergraduates are placed for school experience with local primary and secondary schools. We also continue to support the AIMSSEC project in South Africa and are hoping that many of the NRICH problems will be available through text messaging (BSMRT) onto mobile phones for learners in disadvantaged areas of South Africa. This pilot will be evaluated in October 2010.

Publications

We continue to publish beyond the website.

Woodham.L Devon Teachers Enriching NRICH: An Action Research Project /Primary Mathematics/, Volume 13. Issue 3 (2009) Leicester: Mathematical Association.

Woodham. L Devon Teachers Enriching NRICH: An Action Research Project Part 2 */Primary Mathematics/, Volume 14. Issue 1 (2010) Leicester: Mathematical Association.

Woodham. L and Piggott J. More for Less One Hundred with Jennifer Piggott/Equals/, Volume 15. Number 3 (2009) Leicester: Mathematical Association.

McClure L (2010) Nurturing giftedness and creativity in mathematics Paper for Kingdom of Saudi Arabia Mawhiba Project

McClure et al (2010) Heinemann Active Maths (fully resourced schemes for primary schools in Scotland)

Marketing and Publicity

We have begun a more vigorous publicity campaign and now have a live and much more vibrant Facebook account. Team members have NRICH blogs and nearly all 'tweet' about NRICH and we know already that by linking in to this technology we are becoming much more widely known in the tweeting community! Whether this will translate into more site hits is not yet known. We also continue to publicise ourselves though the very popular postcards and posters, and have now secured a presence on the CMS electronic screens to publicise visits and events that we hold.

Into the future

Much of our future planning has been hinted at above. The Templeton projects will be in the forefront of much of what we do, and we envisage a step change in our website design and functionality. Thanks to funding from the Clothworkers Foundation, who were impressed with the first phase of stemNRICH, we will be continuing to develop stemNRICH over the next 2 years to provide resources directly targetted at the KS3/4 levels. We are delighted that Jenny Gage from the Motivate project will be working on this project with us. Together with other MMP colleagues we have also received funding from the Nuffield Foundation for a Maths and Sport project which will tie in with preparation for the Olympics here in 2012 and we are hoping to link this into stemNRICH as well. This planned Maths and Sport project has been awarded the Inspire Mark, the badge of the London 2012 Inspire programme, which recognises exceptional and innovative projects directly inspired by the London 2012 Games.

Our guest editors are all set up so we are looking forward to some challenging planning and preparation days with them. Steve and Alison are going to set up regular lunchtime briefings on their

work on the Masters programme so that we can share what they have been doing and they can benefit from the team's expertise too. We will continue to work closely with Yi and Libby and are sure that the relationship between NRICH and the Faculty will continue to become closer and mutually beneficial.

This report has been written by Lynne McClure, the current NRICH project Director. I am hugely indebted to Jennifer Piggott, the outgoing Director, whose insight and planning resulted in many of the year's successes.

Lynne McClure

NRICH Project Director

1-09-10