

Report to NOKUT 1 February 2015

This report is written one year following the announcement that MatRIC will receive support from NOKUT as one of three new Centres of Excellence in Education. This report summarizes what MatRIC has achieved in the last 12 months, sets out plans for 2015 and considers the challenges that lie ahead.

MatRIC's proposal was built around four work packages: Networking, Research, Innovation and Dissemination. These work packages have been integrated within the work of MatRIC to a larger extent than envisioned in the proposal. This report is structured around themes: Dissemination, Events, Working Groups, Research, Contact with schools, People and Economy. As appropriate it is indicated where each theme contributes to the four working packages.

Dissemination

In the first instance the task has been 'to be noticed', to make it known that MatRIC exists and indicate how MatRIC will contribute to the development of teaching and learning mathematics at university level. This task has been facilitated thanks to opportunities NOKUT and UiA have used or created for MatRIC to be presented at several significant events or conferences. Fourteen such events, including many outside of NOKUT's and UiA's direct influence have occurred; these are listed in annexe 1.

We have also taken the opportunity to be represented at a number of national and international meetings that focus on issues relevant to MatRIC's interests. These are listed in annexe 2.

MatRIC's visibility in these arenas has had 'spin-off' effect, such as being invited by the Higher Education Council to participate in the development of course materials to support students with mathematics as they transfer from upper secondary school to university. Also, participation in an expert group set up by the Ministry of Education to contribute towards the development of a new national strategy for science and mathematics education.

MatRIC has also been active in making personal contact with mathematics teachers in other higher education institutions and related organisations; these include university colleges in Bergen and Gjøvik, and: The Arctic University of Norway, Norwegian University of Science and Technology, Norwegian University of Life sciences, Universities of Bergen, Stavanger and Oslo.

The MatRIC pages on the UiA web-site have been developed – these carry essential information about MatRIC.

Four MatRIC Newsletters have been published (March, April, July and October); a net-based link at our embryo MatRIC web-site (matric.no) allows people to subscribe to the newsletter, so far there are over 270 subscribers. A facebook page and a Twitter account have been opened. The facebook page has already attracted over 70 subscribers and provides a means for informing what is going on within MatRIC ... as it happens. MatRIC is also on Twitter.

MatRIC was featured in the NOKUT Annual Report, and in a special magazine published by NOKUT to inform about the four Centres of Excellence in Education.

MatRIC has been featured in the UiA Research Magazine "TEFT", and in a local newspaper feature prior to one UiA based event. Press notices have been released about other events, but these have not resulted in publication.

Existing e-mail lists, the national newsletter for university mathematics teachers 'INFOMAT', and personal contacts have been used to build up the MatRIC network. MatRIC has established working contacts in many HE institutions throughout Norway. This network continues to develop and provides a basis for dissemination of MatRIC's achievements and activities.

The production of printed materials and development of the web-site has been supported by UiA Media and Communications Department. We are very grateful for their contribution – especially

in the production of early Newsletters, design and production of advertising leaflets, roll-ups and posters.

MatRIC events and research agenda have also contributed to spreading the word about MatRIC.

Events

The organisation of events has required a lot of attention. We have been helped internally with additional administrative support and externally; for the annual conference the National Centre for Mathematics Education, has taken care of registrations and initial hotel bookings. The following events have been organized:

- 12.03 Launch Conference.
- 16.06 Seminar on teaching mathematics using popular web resources 'youtube' and 'facebook' (target group: UiA mathematics teachers and visitors from other institutions).
- 18.08 Presentation by a TV personality/statistician Jo Røislien "We are all mathematicians" (target group: UiA students and upper secondary school students).
- 11-12.09 MatRIC Centre visit to Mathematics Education Centre, Loughborough.
- 23-24.10 Video production workshop in Bergen
- 27-28.11 Annual Conference in Trondheim

At the time of writing this report the feedback received from these events has been generally very favourable, we have also received some valuable constructive criticism from which we learn as activities continue.

In particular we draw attention to the fact that most of these events have been held at other locations other than Kristiansand, thus meeting the proposal intentions to develop MatRIC as a Norwegian community of mathematics educators and mathematics education researchers.

These events have contributed to all of the proposed working packages

Working Groups

The initial plan was for four working groups: Simulation & visualization, Video teaching & digital assessment, Mathematical modelling, Teacher education.

In January coordinators for each of the groups were identified, but within a very short time the coordinator of the Teacher education group asked to be relieved of the responsibility. The Teacher Education Group was inactive for several months until a new coordinator volunteered and group was formally re-established in October. Brief reports on the activities of each of the groups follow.

Simulation & visualization. A great deal of effort is being invested in the development of a digital simulations and visualization package, based on a concept of 'templates'. This will allow students and teachers to generate their own applications without their need to acquire extensive programming skills. It is believed that students will be led to a deeper understanding of mathematics by engaging at both interactive and programming level. Research has been done on the interactivity level for engineering students and now also for teacher education students (which will be reported at the annual conference) so it is possible to make adjustments for the different ways these kinds of digital simulation tools can be used. Simulations and visualizations are combined with video lessons, streaming, video simulations, exercises, applications and assessments. The coordinator of the group has made personal contact with others working in the field at NTNU and University of Oslo. Also the coordinator has visited Gjøvik University College and presented ideas and stimulated interest and collaboration with colleagues there. One PhD fellow, will be conducting research related to this group.

Video teaching and digital assessment: Video production was the theme of the first MatRIC workshop; it is hoped this will be the beginning of an active network of mathematics teachers developing video material for teaching and learning mathematics. MatRIC is also working with the Higher Education Council of Norway to produce mathematics video materials to support the transition from upper secondary school to university. The collaboration between the HE Council and MatRIC provides MatRIC with an important platform within the National community. The coordinator also visited Gjøvik and conducted a workshop on digital assessment. The group coordinator has established with Per Kristian Rekdal (Molde University College, HiM) a collaboration in sharing both content, videos (and more) for our students in mathematics and statistics at HiM (economy students) and UiA (engineering students) from autumn 2015.

Mathematical modelling: This working group is pursuing collaboration with another Centre of Excellence in Education, bioCEED and colleagues in the Department of Mathematics at the University of Bergen, also with the Centre for Organelle Research at University of Stavanger to produce mathematical modelling resources that support the mathematical education of students in biology, medicine, and life sciences. The intention is to provide biology students with mathematical skills and knowledge that relate to their background and suit professional needs. Another goal is to stimulate these students' interest in the acquisition of better and, hopefully, advanced knowledge of mathematics. The collaboration with both centres was initiated by MatRIC. The coordinator of the group has also visited the Norwegian University of Life Sciences, Norwegian University of Science and Technology and University of Stavanger and is building a network of contacts. The present focus on developing resources for the mathematical education of biology students will be followed by the development of related resources for other disciplines that benefit from the use of mathematical methods.

Teacher Education. As indicated above this working group had a false start. It is now being pursued with enthusiasm. It is perhaps the easiest of the groups for network building, given the well-established networks within teacher education in Norway. This group is exploring the possibility of collaboration with another Centre for Excellence in Education, ProTed, especially with the idea of arranging a joint MatRIC-ProTed workshop in the spring 2015. The contact with ProTed was initiated by MatRIC. Following an initial meeting between the two centres it was agreed to invite one of the ProTed activity leaders to make a presentation at the MatRIC annual conference. In the next section there is a brief description of the small research grants that MatRIC has made available. Attention is drawn to the fact that four out of the five grants lie within teacher education programmes, and reports on three of these projects will be presented at the annual conference.

The activities of all four working groups contribute to networking, research and dissemination in addition to their primary interest in innovation.

Research

Research is one of the four work packages in the MatRIC proposal, it forms an important part of the total MatRIC agenda. This is being pursued in the following ways:

Small research grants up to 50 000 NOK (about €6,000) were announced in the spring. Six proposals were received and after evaluation by three mathematics education professors and MatRIC Project Manager it was decided to support five of these with some modifications suggested. Reports on four of the supported projects will be presented at the annual conference. The projects include, research into so-called 'flipped classrooms', use of net-based video tutorials in teaching, use of simulations, visualisation and programming, production and use of video materials to develop relational understanding of mathematics with engineering students, engaging teacher education students in writing and presenting research papers/reports. These grants have stimulated the research agenda and helped to develop the MatRIC network, given that four of the successful grants are provided to individuals or teams at other institutions.

A post-doctoral researcher took up position at the beginning of August. This is a three years appointment. His brief is, to write and get published, first from his own recently completed

research (teaching calculus at university), then to contribute to the MatRIC research agenda through literature surveys related to the working groups and original research into one or more of the areas covered by the working groups. An external mentor has been appointed – it is believed that it will be good for the post-doctoral researcher and the MatRIC community to have the input from a researcher with deep experience within the field of teaching and learning mathematics at university level.

One PhD fellow has been appointed (mentioned above). It is expected that one or two more fellows will be appointed by the end of November. These will make a substantial contribution to MatRIC's research agenda.

The possibility of master level dissertation research has been discussed. It is expected that at least one master dissertation will be related to MatRIC activities. More will emerge. Individual projects at bachelor level are under consideration. Agreement has been reached with colleagues in the 'multi-media' programme for the production of mathematics related videos as part of the students' coursework assignment. It is hoped that this may stimulate further student activity. It is noted that the panel evaluating the MatRIC proposal suggested the creation of more opportunities for student involvement; this is an area needing further development.

Contact with schools

The panel that evaluated the proposal for Centre of Excellence, in their final report on MatRIC, suggested that MatRIC considered involvement with schools:

Issues around enjoyment and competence in mathematics do not start in higher education but have their roots earlier. The proposers already have strong links with many schools and teachers in the region. The Centre could build on these and share some of the resources it produces and its approaches with schools, running training events for teachers and "taster" events to enable school students to better engage with mathematics.

This is an area still to be developed. However, attention to the involvement with schools has been given in several events: MatRIC was presented to teachers at the local MNT Forum (see annexe 1, 26.03). For Jo Røislien's presentation "We are all mathematicians", the event advertised in the local newspaper and local upper secondary schools and many school pupils attended. The MatRIC annual conference has been organised to continue immediately after the Norwegian Centre for Mathematics Education conference – at the same location, this will make it easier for upper secondary teachers to participate. Two upper secondary teachers were invited to participate in the Video-workshop in Bergen. In addition, there are plans to invite an application engineer from MapleSoft to demonstrate the possibilities opened up by Maple simulation software for learning and doing mathematics. It is intended that this visit will be extended to include school based demonstrations and workshops. Plans to start organizing this event last August were interrupted because of teachers' strike action.

People

The busy MatRIC agenda is dependent on the combined activity of a team. Leader, Project Manager, 4 Working Group coordinators, Post-doctoral researcher, web-development consultant, mathematics education research consultants, 1-2+ PhD fellows. This, excluding the PhD fellows, amounts to about 3,5 full-time positions. It was noted above that MatRIC has enjoyed good support from the university and faculty. As the work develops, additional resources will be needed accompanied by additional appointments to the team. We feel the need for an administrative assistant, and the appointment of a person to handle communications has been suggested. All comes at a (high) cost and so far the budget has been set to use money for activities rather than personal costs

Economy

2014 started with a budget of 7 million NOK (ca. €1+ million) + PhD fellowships. With all the activities outlined above, it appears that we end the year with a substantial positive balance. This is due to several reasons: the budget covers whole year for appointments, which were taken up part way through the year, slower start-up costs – much more was spent in the autumn than in the spring, over-estimation of the cost of events (to ensure we remained within budget), the inclusion of a financial buffer, which has not been used.

MatRIC starts 2015 in a healthy position and a programme of activities is planned that will utilise the budget effectively. The budget for 2015 is based on an expected new income of 8 million NOK + PhD fellowships. This includes an additional 1 million from NOKUT as announced in the national budget, and assumes continued funding from UiA amounting to 3 million NOK. Given the surplus from 2015 a budget for 10 million NOK has been agreed by the Management Board.

matric.no

The development of the MatRIC profile and MatRIC web-site have required substantial amounts of time both for working with contracted suppliers and for testing suggested solutions. The development has been more costly and slower than anticipated; nevertheless it has been a very rich learning experience. Phase one of matric.no should be complete by the end of November, and plans are already in place for phase two, to commence early in 2015.

Plans for 2015

Major activities include:

- Workshops for each of the four working groups will be organized.
- The seminar programme “How I teach mathematics (to university level students)” will be developed, three seminars during the year is the target.
- The annual conference will take place (as in 2014)
- The Centre visit with MEC, Loughborough colleagues is planned.

New ventures (enabled by the budget increase)

- The development of mathematics support centres (one in Grimstad, one in Kristiansand)
- The development of a ‘graduate school’ for PhD fellows, their supervisors and post-doctoral researchers who are researching on teaching and learning mathematics in higher education.
- The development of a course for new university level mathematics teachers and teaching assistants.

MatRIC web-site (matric.no) develops into phase 2 and, possibly, into phase 3.

Improved communications – Newsletter, etc.

The production of an agenda that exposes evidence of impact.

Perceived challenges

Balancing between organization and planning activities, and making time for setting goals, deciding strategy, and team building.

Extending the MatRIC network. It seemed a daunting prospect to build a network from ground level. However, about 70 attended the launch, the target of 30 for the video workshop was achieved and it seems that the target of 100 at the annual conference has been met. There will be ten research/innovation reports at the conference in addition to the three workshops that are planned to ‘showcase’ MatRIC activities. There are over 270 subscribers to the Newsletter and 77 signed up to the MatRIC facebook page. However, the dissemination strategy depends upon the continued growth and doubling the level of interest within a year seems both very modest and very challenging!

Developing and streamlining administrative systems that will reduce the burden of organization in relation to MatRIC events.

Sustaining a MatRIC agenda that is fresh, alive and attractive.

Annexes

Annexe 1. MatRIC presentations at local, national and international events

- 28.01 Kristiansand: Agder Conference – Grimstad: Prime Minister at UiA
- 24.02 Kristiansand, Seminar on future Teaching and Learning, Agder Digital Learning Arena (ADILA)
- 10.03 Parliamentary committee for Church, Education and Research at UiA
- 25.03 Network for Mathematics in Teacher Education
- 26.03 Mathematics, Science & Technology Forum (local school & HE teachers) at UiA
- 26-27.03 London, The 12th e-Assessment Question Conference hosted by @assessment tomorrow.
- 14.05 National Faculties of Science Meeting
- 19.05 Holmboe memorial prize award ceremony in Oslo
- 22-23.05 Gjøvik University College – presentation of two MatRIC working groups
- 27.05 Presentation of MatRIC and working groups at UiA Grimstad campus
- 3-6.06 NORMA14 Conference, Turku Finland
- 10-13.06 EDEN (European Distance & e-Learning Network) annual conference Zagreb, Croatia
- 20.06 Higher Education Council – Working group, R & D based education
- 14.08 Arendalsuka (a large national meeting of politicians, administrators and business leaders)
- 09.09 National Mathematics, Science & Technology Study Administrators conference
- 02.10 Professional development conference (on board ‘Hurtigruten’ coastal cruise ship/ferry)
- 20.10 “Research Days” – in Grimstad
- 3-4.11 Oslo, 10 year anniversary conference, Norway Opening Universities
- 17.11 Trondheim, Seminar on paperless exam, Norway Opening Universities
- 3-5.12 Berlin, Online Education.
- 6-12.12 Mathematics in Undergraduate Study Programs: Challenges for Research and for the Dialogue between Mathematics and Didactics of Mathematics Workshop at the Mathematics Research Institute, Oberwolfach, Germany.

Annexe 2. Meetings, conferences, etc. in which MatRIC has taken part, but without a presentation.

- 14.01 Research Council of Norway – introducing new education research programme (FINNUT)
- 08.04 Ministry of Education meeting about the future needs for engineering competence.
- 23-25.06 SEFI Mathematics Working Group seminar in Dublin
- 08.09 NOKUT breakfast meeting. Focus on quality in teaching.