MatRIC Annual Report for 2016

(Red text come from NOKUT's template for annual reports from Centres for Excellence in Education)
The annual report should be a status report that assesses and analyses the progress and development in comparison to the plans described in the application and supplementary material.

The annual report should mainly document results and impact, and accentuate and analyse highlights from the centre's activity/projects.

1. Abstract

A busy year in MatRIC is reported. During 2016 MatRIC organized events focusing on computer aided assessment, flipped classroom approaches, mathematical modelling, mathematics teacher education and research as well as the annual conference. Events were spread around the country and Europe – in Newcastle and Loughborough UK, Narvik, Oslo and Kristiansand. Other MatRIC actions range from the very modest support of mathematics teachers' lunches, communications (web pages and newsletter), video tutorial development, and a teaching course, to the financially demanding provision of student learning support centres on both UiA campuses. MatRIC's five networks have been active in developing student engagement in teaching, learning and developing resources; collaboration with other universities in Norway and Europe and another Centre for Excellence; in innovation, resource development and research. MatRIC's broader research agenda has been pursued with the continued distribution of small research grants and publications. There is now a significant research group composed of 6 PhD fellows and a Post-Doctoral researcher, with other senior researchers working within MatRIC in the area of university level mathematics education. Student engagement in teaching and learning has been a priority area for development through the year and this is described in terms of MatRIC's initiation and support for student groups and their inclusion in the annual conference. Efforts towards internationalization have been made with visits to other centres in the USA and UK, and many visitors from the USA and across Europe to participate in MatRIC's events and actions. MatRIC has participated in the process of developing a new strategic plan for the University of Agder, and on a national scale to discussions around a new government white paper on education. MatRIC seeks to encourage colleagues and engage students in research and development based education with students as partners in teaching and learning. MatRIC's impact is evident in participation in and evaluations of MatRIC events, and publications from MatRIC's many projects.

Reflection on MatRIC's activity during 2016 does not expose 'failure' that leads to discontinue actions, but it does reveal where things may be improved as we continue to develop. In 2017 there will be increased effort in developing students as partners in teaching and learning, dissemination, research and peer mentoring.

All this and more is set out in brief detail in MatRIC's annual report for 2016.

Contents

2. Results compared to the application and plans

The report shall describe, assess and analyse the centre's accomplishments compared to the planned and completed activities in the period, and its impacts.

Introduction

MatRIC was awarded Centre for Excellence in Education status based on a proposal that set out goals and plans to, "*lead innovation, research and excellence in mathematics teaching and learning within higher education 'user programmes'*." Four work packages were envisaged: 1 Networking (web site, conference, regional workshops, visits to international centres); 2 Research and evaluation of teaching (survey of research evidence and efforts to improve teaching, learning and assessment, and provision of small research grants); 3 Mathematical modelling (development of workplace simulations, student modelling workshops); 4 Dissemination (Newsletter, journal publication). Minor changes to these actions have been described in previous annual reports. In 2015 there were significant additions to the original proposal – the development of MatRIC TV (a video resource to support students with mathematics as they move from upper secondary school to university); Mathematics support for students (MatRIC Drop-in support centres); induction/teaching course for newly appointed university level mathematics teachers. We also looked to create more opportunities for student engagement and contribute to the development of a new strategic plan for the University of Agder – a process that was set in motion at the beginning of 2016 with the appointment of a new senior management team leading the university.

Throughout 2016 MatRIC has been busy pursuing all of the above actions. The last annual report indicated that a less ambitious programme than 2015 would be implemented during 2016. However, as all in MatRIC have worked to develop and improve MatRIC's actions and services to teaching and learning mathematics, it will be evident from this report that during 2016 MatRIC has been busier than ever.

MatRIC's Management Board (MB) met on five occasions (January, April, September, October and December). At the beginning of the year (two meetings) MB focused on the development of MatRIC's strategy. At the end of the year MB focused on MatRIC's achievements and impact. The International Advisory Board (IAB) met once, with MB, in October. The joint meeting of IAB/MB focused on issues within MatRIC's activity that can be strengthened/improved and actions that might be taken. Both MB and IAB provide excellent support and guidance for the MatRIC leadership and team.

a. Which activities/projects have been conducted and what are the effects and results of these?

i) Which activities/projects have had the desired results?

MatRIC Events (arranged by date)

MatRIC events are organized to address several goals. They are an important part of MatRIC's approach to dissemination and sharing. In these events MatRIC's activities are presented and invitations to join in the networks are extended. The events are used to present research and development being done within Norway and Internationally; as will be seen below visiting speakers have been invited from many countries. The events also contribute to networking, not only within MatRIC, also to connect mathematics teachers at different universities and university colleges who share common interests in teaching and learning development and research. The events also aim to inspire and educate university level mathematics teachers to engage in excellent teaching and learning practices.

Computer Aided Assessment network gathering at Newcastle University, April.

This meeting was the outcome of two earlier meetings in 2015 (CAA workshop in Bergen and at the MatRIC annual conference). About 20 invited people from Norway, Netherlands and the UK met in Newcastle. MatRIC funded the participation of the Norwegians from several institutions – University of Tromsø, Bergen University, Bergen University College and University of Agder. An outcome of the meeting is a paper (yet to be published) outlining the requirements for computer aided assessment packages if they are to be of use and value in mathematics education. MatRIC will continue to support this group, which we hope will develop into an established self-sustaining European network of mathematics educators committed to the use and development of computer aided assessment in mathematics.

Flipped classroom symposium and PhD seminar on analysing video at Narvik, June.

This symposium was prompted by the widespread interest in using video in teaching. One of MatRIC's PhD fellows is researching flipped classroom approaches. Also, a mathematics teacher at the Narvik Campus University of Tromsø is in receipt of a MatRIC small research grant to explore different styles of video presentation of mathematics. The event included contributions from two visitors from the USA: a PhD fellow who spent 3,5 months with MatRIC and his supervisor who had experience of the flipped classroom approach and engaging students in inquiry based learning that can be promoted in conjunction with the use of video based instruction.

Mathematical Modelling colloquium in Kristiansand, August.

This symposium brought together speakers from Mexico, USA, Portugal, UK, the Netherlands and Norway. MatRIC's financial support was augmented by a visiting researcher fellowship awarded by the University of Agder. The symposium has initiated a teaching-learning research project that involves a mathematics teacher at UiA Grimstad Campus and a mathematics education researcher at UiA Kristiansand Campus – the developmental research initiative, cross-campus collaboration and inter-departmental activity are highly desirable outcomes from this event.

Open Lecture in Kristiansand, September.

This is an annual event open to UiA students, especially those beginning their studies at UiA, and pupils from invited upper secondary schools. The lecture was given this year by Roger Antonsen from the University of Oslo, and presented at both Kristiansand and Grimstad campuses. About 250 students and pupils were present at each of the presentations. The goal of the presentation is to motivate interest and engagement with mathematics.

MatRIC-MEC visit Loughborough UK, September.

Once again, a MatRIC team composed of leaders, network coordinators and some collaborators from other universities visited colleagues at the Mathematics Education Centre at Loughborough University, UK. The one day event focused on contributions to the 'Thematic Issue' of the Nordic Journal for Mathematics Education, NOMAD, which MatRIC is editing. The event lasted just one day and was timed to take place in the same week as two other conferences held at Loughborough University that were of interest to MatRIC. A two-day conference of 'CETL-MSOR' (Centre of Excellence in Teaching and Learning- Mathematics, Statistics and Operations Research) group. This was followed by a two-day conference of the network 'Researching, Advancing & Inspiring Student Engagement (RAISE).

Mathematics Teacher Education workshop in Kristiansand, October.

This event included a keynote presentation by a leading mathematics educator from the UK, and three Norwegian mathematics school-teachers who had received the Holmboe prize, a national award for excellence in mathematics teaching. This workshop was open to students as well as mathematics teacher educators. The level of interest in the event, over 100 registered and regular demand on space at the university meant that it was necessary to transfer the event to a local hotel.

Annual Conference, Gardermoen, Oslo, October.

The 2016 annual conference followed recommendations from MatRIC's International Advisory Board that met in 2015 and feedback from participants in the 2015 conference. The conference was disconnected from the 'November Conference of the Norwegian Centre for Mathematics Education; it was held in October, at Gardermoen (to make access easier); and it was based on the theme "*Addressing the challenges faced by teachers and learners of university level mathematics.*" The change in date did not suit all, many potential participants indicated the timing was not good for them because of teaching or overseas travel. There were just over 70 participants thus meeting the target for the event.

Mathematics teacher education research workshop, November.

MatRIC has entered a research collaboration with Arizona State University where an instrument for exploring teachers' mathematical meanings has been developed. In November, the researcher who has developed this instrument visited MatRIC and led a workshop to introduce the instrument, to share results that he had collected from the USA and South Korea, and to consider some results from using the instrument in Norway (Bergen, Kristiansand and Trondheim).

Achievements and impact:

Arranging so many events creates a very busy programme that makes great demands on MatRIC's administrative support and local organizers. The successful implementation of the events and the participation rates are ranked amongst the achievements. Most events are followed up with a web-based evaluation survey. Participants who respond to the surveys indicate high levels of satisfaction with the programmes, and that they are both likely to attend further MatRIC events and encourage colleagues to participate. The impact sought is sustained improvement in teaching and learning mathematics. A significant majority of respondents to the surveys indicate that their experience at the event will or may lead to changes in their teaching. The known impact amongst UiA colleagues is easier to document (as noted above). There is also evidence of one Norwegian participant, new to the computer aided assessment network, who participated in the April meeting in Newcastle, and is now contributing to an open-on-line collection of mathematics questions for one CAA program.

Other MatRIC actions and initiatives

Mathematics Teachers' Lunches

One modest innovation during 2016 has been the development of 'Mathematics Teachers' Lunches'. This simple idea is based on inviting mathematics teachers to organize for themselves regular lunch time meetings, MatRIC covers the cost of lunch, with only one condition – that at least ten minutes is spent talking about teaching (and learning) mathematics. These lunches are organised on both UiA campuses, they require little organisation and run at very low cost. However, the mathematics teachers take the condition very seriously and generally the discussion about teaching continues for an hour or more, with the teachers arranging presentations from amongst their number. These meetings provide a ground-level basis for dissemination, critical reflection and the initiation of

innovation. They have resulted in ideas for improving teaching and learning opportunities, which will be pursued by MatRIC in pilot projects – as indicated below.

MatRIC web-site & Newsletter

The MatRIC web-site lies at the core of MatRIC's dissemination strategy. Minor revisions to the web-site were undertaken in 2016. Notably to the MatRIC TV pages to include a LaTeX editor, and allow links to .pdf documents and other web-sites (especially related simulations and visualisations). These developments were made after discussion with the leader of the MatRIC TV production group. As yet they have not been exploited.

Four MatRIC Newsletters were distributed during 2016. The original proposal for MatRIC indicated two per year, since then we aim for 5. Thus in 2016 we did not achieve our target. There were reasons for this, not least the busy programme of activities outlined above. The Newsletter is now distributed to 384 recipients, but only about 36% open the e-mail and then only about 17% click on one of the items, which would lead to an article on the MatRIC web-page. The low response rate is a cause for concern and one that will be addressed during 2017. In 2016 the issue was addressed, for example, by sending out individually addressed invitations to MatRIC events – over 200 to the MatRIC conference. This is effective, but a highly inefficient process, it is necessary in view of the ineffectiveness of more efficient means of communication.

MatRIC TV

Production continues. There are now nearly 70 videos published on the MatRIC web-site with several more awaiting editorial control by the production group. Further production is envisaged during 2017 when we hope there to be a complete package to support the transition from school to university mathematics. The videos are gaining attention and we receive requests for the videos to be integrated within other learning packages. Provided the videos are not altered and their source acknowledged, permission is given under a Creative Commons copyright agreement.

The translation of videos bought under licence from Loughborough University has proved a very time-demanding task and has not progressed as planned. Consequently in 2017 two Media Studies students will be employed to undertake the time-demanding technical work, which should ensure the project is completed before the summer 2017.

Support Centres

The MatRIC Drop-in support centres on both Kristiansand and Grimstad Campuses are proving popular with students. They are now advertised as a point to attract new students to UiA in the university's prospectus of courses. The Centres are open for about 20 hours per week in each of the Grimstad and Kristiansand campuses. The new strategic plan for the University of Agder envisages the mathematics support being integrated within a larger study support provision. This is presented as both impact of the idea on the development of university strategy and evidence of sustainability.

Induction Teaching Course

This was started with the first cohort in 2015, and thus described in the last annual report. There were two further meetings of the course during 2016 (March and June). Seven mathematics teachers completed the course. The feedback from participants was very encouraging and a new course is proposed to run from autumn 2017 through to spring 2018. There will be several modifications (content, location and scheduling) to the course based upon feedback from the first cohort.

Participants on the course indicated that their engagement with the course will have an impact upon their practice.

MatRIC Networks

There are five networks each focusing on a theme within mathematics education. These are: Computer Aided Assessment (CAA), Video production (VP), Visualization & Simulation (V&S), Mathematical Modelling (MM), and Teacher Education (TE). Four of the networks (CAA, VP, MM, and TE) have been active in organizing events briefly described above. The Modelling, Computer Aided Assessment and Visualization and Simulation Networks had significant inputs in the annual conference – dedicated presentations, related keynote plenary lectures and several student presentations. The networks have also been busy in other actions as follows:

Computer Aided Assessment (CAA)

Students have been engaged in the developments with two of the CAA packages that are being explored by MatRIC, NUMBAS developed at Newcastle University and STACK developed by Prof. Chris Sangwin at Edinburgh University. The network coordinator and a student from the Grimstad Campus presented NUMBAS to students on the mathematics education masters programme in Kristiansand. The presentation included both an explanation of the system and practical activity developing questions within the package. Two second year students on the Grimstad campus have been developing four hour presentations of the STACK system and creating questions, and 'MAXIMA' (computer algebra software embedded within STACK) which will be used within a first-year course at Grimstad. The students, network coordinator and Prof. Sangwin will be presenting a paper on this action at the MNT Conference in Oslo, 30-31 March 2017.

Video production (VP)

The network coordinator has been working on transforming the teaching approach for mathematics in an electronic engineering course. The mathematics instruction is provided within short videos and class time is spent in problem solving and discussion (i.e. a flipped classroom approach). About 300 short videos have been produced in a small self-service studio set up for this purpose. Three courses are exposed to these materials. The approach ensures higher levels of student engagement in their learning.

Visualization & Simulation (V&S)

A student group, funded by MatRIC is developing a web-based learning platform for programming. This will be used to support mathematics courses in numerical methods. Also, it will help MatRIC to engage students in developing the V&S package SimReal. The creator of SimReal, who is the coordinator of this network has also been busily engaged in translating the software into a new programming language because of the plans of internet service providers to stop supporting the language that has been used. There are hopes that collaboration between this network and the new Centre for Excellence, Centre for Computing in Science Education, will result in effective synergy.

An international group is emerging within this network. Interest in SimReal is being expressed by colleagues at several universities: Loughborough University, UK; Vorarlberg University of Applied Sciences, Austria; and in the Czech Republic, Tomas Bata University in Zliin and the University of Ostrava.

Mathematical Modelling (MM)

This network has been collaborating with the Centre for Excellence bioCEED at Bergen University. The aim of the collaboration is to develop biologically related mathematical modelling resources for supporting the teaching of mathematics to first semester biology students. The goals are, students' increased awareness of the importance of mathematics in biology, improved motivation to study mathematics, and better performance. A MatRIC PhD fellow is engaged in this work and has conducted field work with biology students in Bergen throughout the autumn semester.

A visit to San Diego State University (see below) introduced MatRIC to a project PIC-Math (Preparation for Industrial Careers in Mathematical Sciences) funded by the Mathematical Association of America (MAA), Society for Industrial and Applied Mathematics (SIAM) and the US National Science Foundation. The project engages undergraduate students in working on real mathematical problems devolved from industrial partners. The aims and implementation of the project in terms of engaging students in meaningful research and development based education within mathematical modelling is very closely aligned with the goals of MatRIC and the MM network. The coordinator of the MM network was invited to a workshop within the PIC Math project held in Utah in May 2016. One of the directors of PIC Math was invited to Norway in October and contributed to the annual conference. During 2017 MatRIC aims to pilot a Norwegian 'PIC Math', with students as partners in the planning during spring and summer, as well as being engaged in the implementation of a PIC Math course in the autumn.

MathematicsTeacher Education (TE)

As noted above two of the networks (V&S and VP) engaged directly with the teacher education programme. In addition, two mathematics education masters students have been in receipt of the NOKUT Masters stipends. UiA regulations required that the money be used to support the research and field work, it could not be paid to the students other than for specific tasks outside normal studies. The students have been involved in piloting within Norway an instrument designed to explore teachers' mathematical meanings; the instrument was devised by Prof. Pat Thompson at Arizona State University. With Prof Thompson's permission and assistance, the instrument has been translated into Norwegian and used with Norwegian teacher education students who are on 'Lektor Utdanning [Education]', postgraduate certificate, or masters' programmes for teaching mathematics. The aim, in addition to piloting the instrument, is to see the fitness for purpose of the student teachers' mathematical knowledge after they have completed their mathematical studies. Students in Trondheim, Bergen and Kristiansand have been tested. Analysis of results is taking place during spring 2017. MatRIC invited Prof. Thompson to Kristiansand in November 2016, while here he contributed to a doctoral taught course, a research group meeting and an afternoon workshop in which he presented his instrument, the rationale and some results from its use in USA and South Korea.

Research

MatRIC Small Research Grants resulted in 5 research reports published on www.matric.no during 2016:

Using Khan Academy to support students' mathematical skill development in a physics course. Christine Lindstrøm, Oslo and Akershus University College, http://www.matric.no/articles/50

On short-video productions of a linear algebra topic for engineering students. Ragnhild Johanne Rensaa, UiT The Arctic University of Norway, Campus Narvik, http://www.matric.no/articles/52

Summary of article reporting the project "flipped classroom." Marianne Maugesten and Monica Nordbakke, Department of Teacher Education, Østfold University College. http://www.matric.no/articles/55

Evaluating Students' Perceptions of SimReal+ in Mathematics Education. Said Hadjerrouit, UiA, http://www.matric.no/articles/63

Mathematics lecturers' views on the teaching of mathematical modelling Paul Hernandez-Martinez, & Stephanie Treffert-Thomas, Loughborough University; Yuriy Rogovchenko, & Olov Viirman, University of Agder, http://www.matric.no/articles/75

Further publications arising from MatRIC research are listed in the attachment.

In 2016, 5 Small Research Grants were awarded, to researchers a Bergen University College, University College of Southeast Norway, University of Tromsø (Narvik Campus), and UiA (2).

MatRIC now has six PhD fellows and one post-doctoral researcher. Each network has a PhD fellow working in the area of the network, with one taking a wider view of approaches to teaching and learning mathematics in higher education in Norway.

The visit to the USA in in February by MatRIC Director and MM Network coordinator also initiated research activity. These are the research into mathematical meanings, described above, and a qualitative inquiry into the development of a learning community within an inquiry based classroom approach.

Student engagement

The development of student engagement is an area that MatRIC prioritised during 2016. The effects of this are evident in several actions and plans.

Student advisory groups have been set up, one on each campus. These have a remit to report on the student experience at the Drop-in mathematics support centres and offer suggestions for their improvement. The advisory group in Grimstad has also initiated a student led development project – a web-based resource for learning programming. The leader of the advisory group acts as MatRIC's 'project manager' for this student group.

The employment of student teaching assistants in the support centres has led to the development of student support during the crucial revision period before examinations at the end of the first semester. The further development of student teaching assistants will be pursued during 2017.

At the annual conference an extended session highlighting student led projects supporting teaching and learning was included. Student groups from NTNU and UiA were involved. It is intended that this session becomes a regular feature of MatRIC conferences.

As outlined above, student assistants have been involved in the development of resources for the mathematics element of the Electronics Engineering programme, and the development of computer aided assessment resources.

In September, MatRIC supported several colleagues to attend the RAISE Conference (Researching, Advancing & Inspiring Student Engagement) "'Excellence' in Student Engagement." The impact of this conference is felt in an increased awareness of what student engagement in their learning and teaching means – in depth rather than superficially.

Visiting other centres

MatRIC Director and a MatRIC Network Coordinator visited Mathematics Education Centres at San Diego State University and Arizona State University. The Coordinator also visited Brigham Young University. These visits paid off with new research and development opportunities and new ways to achieve MatRIC's goals regarding student engagement and research and development based education. The visits were financed entirely by funds from UiA Faculty of Engineering and Science. As noted above there was a further Centre visit to the Mathematics education Centre at Loughborough University in September.

Internationalisation

MatRIC is now a clearly recognised actor in the European undergraduate mathematics education community. MaRIC/UiA is a 'beneficiary' in H2020 ITN proposals led by Montpellier University, France. The first conference of the International Network for the Didactics of Undergraduate Mathematics held in France ended with MatRIC being asked to host the second in 2018. An invitation MatRIC was pleased to accept.

During 2016 MatRIC has attracted visitors to contribute to MatRIC events from Arizona, California, Utah, Mexico, Portugal, The Netherlands, and the UK.

MatRIC has been a partner with three universities in the Czech Republic (Brno University of Technology, Masaryk University and Zliin University) in projects funded by EEA Norway Grants. These have included exchange of knowledge and experience with teaching and learning mathematical modelling, development of mathematics support, and hosting PhD fellows for short periods (one to six weeks). We have recently learned that the project *"Brno University of Technology - Mobility of Academic Staff (BUT-MAS)"* supported by the EEA and Norway Grants has been nominated for "outstanding mobility story" for the Czech Republic. A PhD fellow from San Diego State University spent 3,5 months with MatRIC, he contributed to MatRIC events and engaged in joint research activity with MatRIC PhD fellow developing a 'flipped classroom' approach to teaching/learning mathematics on an engineering programme.

MatRIC submitted a revised proposal to the SIU/NFR International Partnership programme (a proposal in 2015 had not been successful). The revised proposal was evaluated more highly than in 2015, achieving 'excellent' in every category. Nevertheless, the proposal was not funded. It appears that the competition is extremely strong, and the funding bodies do not prioritise didactics research.

Engagement in University strategy development

The University of Agder engaged in an extensive process to develop a new Strategic plan. MatRIC was involved in the development of the plan. Now three working groups have been established to oversee the implementation of the strategy and MatRIC has been invited to contribute to the advisory panels connected to these groups as well as being a member of the management board.

Engagement in national policy agenda

MatRIC Director was invited to The Norwegian Ministry of Education and Research to a seminar to discuss Stortingsmelding om kvalitet i høyere utdanning: Invitasjon (Government White Paper on Quality in Higher Education) 18 April 2016.

ii) Which activities/projects have not had the desired results and what are the lessons to be learnt from this?

The issue that gives most cause for concern is the level and breadth of participation in MatRIC events. Most events recruit to the intended level, but there could be greater breadth of participation, meaning it would be very good to see people who have not attended MatRIC events previously and institutions that appear to be untouched by MatRIC actions. Two notable examples are presented:

The Modelling Colloquium that was held in Kristiansand attracted a total of thirty participants. This was disappointing because we had invited speakers from many different countries as well as Norway. The most likely reason for the low participation is the timing, the week before the new semester, also the location in Kristiansand made travel more complicated. Further consideration will be given to the timing and location of events.

The annual conference attracted over 70 participants, which was pleasing, but it appeared that the conference did not attract many people or institutions who have not attended MatRIC events earlier. This was discussed at length in the International Advisory Board meeting that followed the conference. A suggestion that MatRIC should use 'envoys' or 'ambassadors' that will physically travel to other institutions and take the message about what MatRIC can offer as a resource in the development of teaching and learning mathematics – also to gather examples of excellence in practice from those institutions to feed into MatRIC events. This idea is being pursued, see below, and we hope to make MatRIC a truly national Centre that serves the whole community of Norwegian mathematics teachers and students.

iii) Which activities/projects have not been carried out? Why have they not been carried out and what are the consequences?

Apart from the decision that MatRIC will not create a new journal that was explained in the 2015 annual report, all other proposed activities and projects have been pursued. The planned 'Thematic Issue' of the Nordic Journal of Mathematics Education (NOMAD) is underway with publication due late 2017.

Dissemination

b. It should also be made clear how the centre has worked with dissemination and how the centre has involved others in its activities/projects. In particular it should be evident what the content and the message of the dissemination has been, and which target groups the dissemination work have been directed at.

MatRIC has four intertwined strands of dissemination, each serving a different purpose:
1. Awareness, 2. Understanding, 3. Action, 4. Self-generating sustainable development.

Dissemination for Awareness

MatRIC web site

Content: announcements of MatRIC events, reports of MatRIC activities, repository of MatRIC resources, source of information about MatRIC.

Message: MatRIC is a busy 'Centre', a resource that seeks to serve the Norwegian community of mathematics teachers working in higher education.

Target group: All stakeholders – mathematics teachers, students, policy makers, institutional leaders.

MatRIC Newsletter

Content: Short text pointing to recently posted announcements or articles on MatRIC web pages.

Message: Brief statements about what is new in MatRIC.

Target group: All stakeholders, distributed to those who have signed up to receive the Newsletter and anyone who has attended a MatRIC event. It is possible to 'sign-up' at www.matric.no.

Social media (Facebook)

Content: Brief announcements of what is happening.

Message: MatRIC is busy 'NOW'!

Target group: Friends of MatRIC – who we hope will forward to a wider group of 'stakeholders'.

INFOMAT (On-line Newsletter of the Norwegian Mathematical Society)

Content: Brief announcements of MatRIC's programme and events.

Message: Invitation to participate in MatRIC activities.

Target group: Mathematicians and mathematics teachers in Norwegian higher education institutions.

alle@matematikknettverket.no (e-mail list used by mathematics teacher educators in Norway)

Content: Brief announcements of MatRIC's programme and events that are relevant to mathematics teacher educators.

Message: Invitation to participate.

Target group: Mathematics teacher educators working in Norwegian institutions of higher education.

SFU Magazine

Content: Articles about SFU activity

Message: Excellent practice in teaching and learning in higher education – student engagement, student as partners in learning, research and development based education.

Target group: All stakeholders (Policy makers, leaders, teachers and students) in the Centre for Excellence programme and those who aspire to be awarded Centre for Excellence status. Also, an international readership to display a Norwegian 'flagship' educational development programme.

Personal contact

Content: Information about MatRIC events.

Message: Invitation to participate.

Target group: Mathematics teachers and others working to develop the quality of mathematics teaching and learning in higher education.

Dissemination for Understanding

Workshops, colloquiums, symposiums, seminars, conferences,

Content: Reports of Innovation, reports of research into innovation and developmental efforts carried out in Norway and internationally.

Message: Inspirational and explanatory. To stimulate research, innovation, development and networking amongst higher education mathematics teachers.

Target group: Mathematics teachers (and students) in higher education.

Journal articles

Content: Scientific research papers.

Message: New knowledge about quality of effectiveness of alternative approaches to teaching and learning mathematics at university.

Target group: Mathematics education researchers and teachers.

Mathematics Teachers' Lunches

Content: Conversation

Message: Informal reports of what is happening in colleagues' classrooms, assessment approaches etc.

Target group: Local community of mathematics teachers working on the same campus.

Dissemination for Action:

Networks' activities (other than events),

Content: Innovation and research actions.

Message: Join in partnership of activity for joint enterprise, mutual engagement and the development of a shared repertoire (based on Community of Practice Theory).

Target group: Mathematics teachers in institutions of higher education, and students.

Induction Teaching course

Content: Approaches and didactical techniques related to teaching mathematics in higher education, to large groups and as a service subject. Innovations in teaching, learning and assessment using modern and emergent technologies.

Message: Effective teaching needs to be reflective, resourceful, creative and informed by best/excellence in practice.

Target group: Newly appointed teachers of mathematics in higher education institutions.

Dissemination for self-generating sustainable development:

MatRIC small research grants,

Content: Open, for proposers to define their own research and development actions within their own practice.

Message: Research is fundamental to innovation and development in teaching. It is necessary to understand what is happening in teaching and learning actions, the dissemination of knowledge through reporting is essential to take the field forward. Didactical research is within the grasp of all teachers and an essential part of regular practice.

Target group: Mathematics teachers in higher education.

Support for innovation and collaboration.

Content: Open, for teachers and students to define their own research and development actions within their own practice.

Message: Innovation in teaching, learning and assessment is at the heart of educational practice that seeks to achieve 'excellence'.

Target group: Colleagues and students within the University of Agder. The outcomes of the innovative practice to be reported at MatRIC and other events.

Summary comment

MatRIC sets out to involve mathematics teachers from other higher education institutions within Norway and to network these, with international experts in a community that is determined to work for excellence in teaching and learning mathematics. MatRIC aims to make participation accessible by covering accommodation costs and locating events around Norway. The channels of communication briefly outlined above set out the efforts taken during 2016. It is understood that the volume of the outward message in insufficient alone to reach the target audience and get the desired

message across. The most effective form of dissemination is personal contact. Further, communication needs to be a two-way process, MatRIC needs to listen and respond as well as announce and invite a response. MatRIC events and actions in the networks and opportunities such as the small research grants must be adjusted to align with the target groups. In 2017 MatRIC will be extending the dissemination effort by the appointment of 'envoys/ambassadors' who will visit other higher education institutions, both to take the message MatRIC wants to convey and bring back the information MatRIC needs to hear.

3. R&D based education and integrated models

The SFU scheme is intended especially to promote, reward and stimulate excellent R&D-based education and integrated models.

a. *How does the centre work with student-active learning methods in connection with R&D-based education and/or education based on artistic developmental work? How does the centre develop and enhance this? What is the added value of R&D-based education when it comes to learning outcomes and relevance? How does the centre operate structurally to develop R&D-based education?*

Mathematics teaching is a very conservative practice; for many university teachers, exposition supported by chalk and chalkboard are argued to be the best and only technologies appropriate for teaching higher mathematics. Very large mixed classes in universities, especially in the early years of study, where a group of several hundred students composed from several different programmes of study are both reinforcing the opinions of the most conservative and leading those teachers more open to change to seek alternative approaches that will enhance student participation, engagement, motivation, enjoyment, learning and performance. MatRIC seeks to work with the latter to develop examples of excellent and effective practice that will convince the former group.

An additional challenge faced by MatRIC is that traditional methods of assessment in mathematics tend to favour the development of instrumental process skills, which are quickly learned and as quickly forgotten after an examination. Deeper conceptual understanding is more difficult and generally costs much more to assess. MatRIC seeks to support students' fluency in basic processes *and* their underlying conceptual understanding. We seek effective measures for the effectiveness of MatRIC actions in this respect. Related to this is the recognised importance of effective feedback to students, this too is challenging given the very large classes and the use of student assistants with minimal if any didactical training for the task. MatRIC is taking on this challenge through the CAA network and the development of training programmes for student teaching assistants.

MatRIC is embedded in a Department of Mathematical Sciences, but serves within the university mathematics teaching across the Faculty of Engineering and Science. Further, MatRIC's mission is to be a resource for excellence for mathematics teachers working in higher education institutions throughout Norway. MatRIC's actions are in support of pilot projects that can be demonstrated to be effective and thus adopted by teachers and supported as regular activities by their respective departments.

During 2016, MatRIC has promoted student engagement in research and development based education in several of the events outlined above, in particular: The flipped classroom symposium in Narvik, the mathematical modelling colloquium and mathematics teacher education workshop in Kristiansand, and the annual conference at Gardermoen, Oslo. Altogether, these events reached about two hundred participants; feedback surveys following the events reveal a high proportion of participants admitting that they would be making changes, or considering changes to their practice as an outcome of their participation.

A new inclusion in the annual conference in 2016 was an extended session devoted to students' activity in the development of teaching and learning. One student group from NTNU and several student groups from UiA presented different applications of technology that they were developing to meet the challenges of learning mathematics. The UiA groups are directly supported by MatRIC. The direct engagement of MatRIC with student groups has been a welcome development of MatRIC's

actions during 2016, this is an area that we intend to develop through 2017 and beyond (see below – plan for 2017).

Radical changes to teaching and learning approaches must be taken with care. An approach that has been taken by one teacher in one context and that has proved to be successful will not necessarily work in another context by another teacher. Innovation requires careful preparation, by and of the teacher and the resources that are needed. The MatRIC coordinator of the video production and computer aided assessment networks is using his long and deep experience of using technology in his practice to transform the teaching and learning approach in the mathematics course for students on the electrical engineering programme at UiA. This has been described briefly within the reports from these networks above. Feedback from students and performance in the examinations suggest the innovation is highly successful.

The collaboration with bioCEED, reported above within the activities of the mathematical modelling network has also received very positive feedback from the biology students who have participated. Given these are students in their first semester, and a small unrepresentative group it is impossible to demonstrate any statistical significance in improved performance arising from the activity. Even if this were possible it would be impossible to argue that it was the 'nature' of the intervention rather than just that it took place and gave the students additional exposure to mathematics that was effective.

b. How has the centre's development and enhancement of integrated models affected the students' learning outcomes?

Improved performance, better progression, higher retention and lower drop-out are the student's learning outcomes that we seek, in addition to improved motivation and attitudes towards studying mathematics. However, given the challenges outlined in the foregoing it is very difficult to attribute any changes in these indicators directly to MatRIC actions. Further, MatRIC's engagement in the provision of mathematics support through the Drop-in centres can easily mask the impact of the R&D based education that engages students as partners in teaching and learning which lie at the core of MatRIC's activity.

One approach is to trust teachers' judgements, they work closely with students and if the teachers are convinced of the benefits to their students, then the innovation must be effective. Unfortunately, this approach is not sound scientifically and resonates with the same reasoning that led to about 35,000 prefrontal leucotomies being carried out in the USA between 1936 and 1978 … with "no net arguable therapeutic benefit … and [severe] side effects.[1]"

MatRIC's approach to this problem is to support research that explores the nature of teaching and learning within different settings, innovative and so called 'traditional'. Six PhD fellows and a Post-Doctoral fellow are engaged in researching university mathematics education, we hope to expand this group. Elsewhere in this report and the attachments can be found descriptions of other actions such as MatRIC small research grants and engaging in the international research community, and publications from MatRIC supported actions. MatRIC seeks a sound scientific basis for the claims made about improvements in student outcomes.

[1] Greenfield, S. (1997). The human brain. P. 20. London Weidenfeld & Nicolson.

4. Plan for 2017

In light of the results and evaluation of 2016, is there a need for adjustments of the centre's plans?

MatRIC will continue the busy agenda that builds on the foregoing. More attention will be given to the planned impact of events. The intention being that there is a clear expectation of how the event will be followed up – in networking, practice or other activity. Events must be more than a 'happening' followed by an evaluation which reveals participants' satisfaction and intention to work on their practice. This may mean fewer, but more strategically planned events.

In 2017 additional actions will be undertaken to address issues arising from the evaluation of the 2016 programme.

Student Engagement and partnership in learning

The development of student engagement and partners in teaching and learning is an important area for development. MatRIC seeks not just to develop students' involvement in the Centre's activities, but to have a positive influence across the university. The development of teaching assistants' competencies is part of this effort. Within MatRIC, attention will be placed on the development of the PIC Math course that has been described above. Students will be involved as both partners in planning and later researcher/learners in the implementation.

MatRIC is also coordinating a 'Change Institute' proposal for the 2nd International Summer Institute on 'Students as Partners', to be held in Canada in May.

MatRIC Envoys/Ambassadors

This has been noted in the foregoing. Three people who are very well known within the community of Norwegian higher education mathematics teachers have been asked to visit universities and university colleges around Norway with a three-fold message: 1. To tell what MatRIC is doing and encourage participation in MatRIC events and activities; 2. To present MatRIC as a resource for developing excellence in teaching and learning mathematics and ask how MatRIC might serve the community better; 3. To inquire into excellent practices at other institutions so that these might be presented within MatRIC events, thus contributing to the dissemination of excellence.

MatRIC Research Coordinator

As from the beginning of 2017, MatRIC has appointed Prof. Barbara Jaworski as Research Coordinator. This will be equivalent to a 10% position. Within this role Prof. Jaworski will stimulate peer-research of teaching and learning as mathematics teachers inquire into each other's practice; lead the process of distributing MatRIC Small Research Grants; stimulate the development of the MatRIC community of researchers (PhD fellows, post-doc, and others). Prof. Jaworski is full time employed at Loughborough University, one of the UK's leading centres for mathematics education research, she is also a member of MatRIC's International Advisory Board.

Development programme for teaching assistants

The aim is to improve the quality of peer assisted learning amongst students. MatRIC already employs students within the Drop-in support centres, also at the end of 2016, MatRIC enabled a major effort to support mathematics revision amongst first year engineering students – for five days within one week just before the examination the canteen at the Grimstad campus was transformed into a huge Mathematics Support Drop-in with a team of ten teaching assistants and mathematics teachers on hand. About 150 students turned up each evening between 16:00 and 18:00.

MatRIC seeks to develop the quality of support given by teaching assistants, within MatRIC'd Drop-in provision and the routine deployment of teaching assistants in courses. MatRIC will be organizing training programmes for mathematics teachers (who are assisted by students) and the student teaching assistants. A short summer camp is being planned to precede the start of the autumn semester. Also, a mathematics teacher from Arizona State University who has invested in the development of teaching assistants will visit in June.

Collaboration with other Centres for Excellence in Education

MatRIC has benefited from the sustained collaboration with bioCEED. Our work together has been an important part of the activity of the MM network, and the context for the field work of a MatRIC PhD fellow. More than this, the collaboration is inspirational, in that we gain new ideas, and enjoyable as we develop new friendships. We hope this collaboration will continue.

In the past, we have hoped for greater collaboration with ProTed. We hope that during 2017 this hope will be transformed into something tangible with collaboration between MatRIC's TE network and ProTed, as a first step a joint event is being planned for March.

The new Centre for Excellence CCSE invited the coordinator of the V&S Network to share in their celebrations following the award of CfEE status. We hope this initial contact will mature into sustained collaboration between the groups. MatRIC is also looking for points of collaboration with the other Centres for Excellence.

Simon Goodchild
Professor, Director of MatRIC, Centre for Research, Innovation and Coordination of Mathematics Teaching.
January 2017.

Attachments
Personnel
Financial accounts
Publications

Attachment to MatRIC Centre for Research, Innovation and Coordination of Mathematics Teaching Annual Report for 2016 for The Norwegian Agency for Quality Assurance in Education.

Personnel:

The salary costs in MatRIC can be seen in the financial statements attached to this report. In 2016 these persons have contributed to the work of MatRIC (proportion of full-time position shown as % in parentheses):

- Simon Goodchild, Centre Leader, (50%).
- Line Eielsen Malde, project Manager, (100% April 2014 – July 2016)
- Lillian Egelandsaa, Project Manager, (70% October 2016 -)
- Morten Brekke, Coordinator for the video and digital assessment network, (20%).
- Per Henrik Hogstad, Coordinator for the Simulation and visualization network, (20%).
- Yuriy Rogovchenko, Coordinator for the Modelling network, (20%).
- Claire Vaugelade Berg, Coordinator for the Teacher Education network, (20%).
- Anne Berit Fuglestad, Leader MatRIC Drop-in mathematics Support, Kristiansand (20%)
- Svitlana Rogovchenko, Leader MatRIC Drop-in mathematics Support Grimstad & teaching course (30%)
- Elisabeth Rasmussen, Adminstrative support (10%)
- Ninni Marie Hogstad, Conference support (20% from 01 May 2016)
- Post-doctoral Research Fellow Olov Viirman, (100%).
- Personnel working in the drop in Centre – hourly payment.
- PHD research fellows in MatRIC (these are not paid from the MatRIC budget):
    - Ninni Marie Hogstad started August 2014
    - John Liakos, started August 2015
    - Helge Fredriksen, started August 2015
    - Shaista Kanwal – August 2016
    - Henrik Aadland Kjelsrud – August 2016
    - Eivind Rudjord Hillesund – January 2017

In addition to this some more colleagues have been paid on an hourly rate.

The Financial statements

MatRIC's expenditure for 2016 resulted in a small positive balance (122K NOK) from the income received for the same year. Simply interpreted the plans for the year and budget set were well aligned with the income.

Again, MatRIC carries forward a large positive balance, mostly carried over from 2015. We had planned to reduce this balance and this would have occurred except for circumstances unforeseen at the beginning of 2016. MatRIC's Project Manager resigned leaving the post unfilled for two months. The new Project Manager has been appointed with only 70% work within MatRIC. Without this the amount carried forward would have been reduced.

Further there needs to be some balance carried forward, Funding for the post-doctoral position follows the calendar year, but the position is occupied from 01.08.2014-31.07.2017. Therefore, it is

necessary to carry 7 months' salary into the new financial year. Also, Ninni Marie Hogstad is a PhD fellow who has been appointed since May 2016 on a 20% position, this is especially to help prepare for an important international conference that MatRIC will host in 2018. MatRIC's contribution takes the form of extending her stipend period by about ten-twelve weeks rather than concurrent payments.

MatRIC's plans and budget for 2017 will reduce the amount carried forward from 2017 to 2018, but for the reasons given above will not eliminate it completely.

Regnskap for MatRIC pr 31.12.2016

Prosjektnummer 98435

Inntekter:		
Inngående balanse pr 1.1.2016	**98435**	**-1,737,306**
Inntekter fra NOKUT	98435	-4,050,000
Egeninnsats fra UiA	98435	-4,000,000
Sum inntekter 2016		**-9,787,306**
Kostnader:		
Lønn	98435	5,415,872
Reiser	98435	1,017,088
Andre driftskostnader	98435	1,494,756
Sum kostnader 2016		**7,927,716**
Ubrukte midler fra 2016 bevilgningen	98435	-122,284
Inngående beholdning pr 1.1.2016	98435	-1,737,306
Utgående balanse pr 31.12.2016 - Overføres til 2017	**98435**	**-1,859,591**

Publications 2016

Note: some 2015 publications are included as they were not listed in the last annual report. Forthcoming publications in 2017 are also included. (MSRG after entry indicates the report originates from work supported by a MatRIC Small Research Grant).

Peer reviewed journal papers

Hauge, K.H. & Barwell, R. (accepted 2017). Post-normal science and mathematics education in uncertain times: educating future citizens for extended peer communities. Sluijs, J.v.d., & Dankel, D.J. (Eds.) *Special Issue: Post-Normal Science in Practice. Futures.* (MSRG)

Vethe.T.I., Sørngård, M.A., Hagen, A.A., Bringeland, T.A., Sumstad, M.S., & Hauge, K.H. (submitted). Kritiske refleksjoner rundt den globale temperaturutviklingen. Submitted manuscript to *Tangenten.* Bergen: Caspar forlag. (MSRG)

Viirman, O. (2015). Explanation, motivation and question posing routines in university mathematics teachers' pedagogical discourse: a commognitive analysis. *International Journal of Mathematical Education in Science and Technology, 46*(8), 1165-1181.

Treffert-Thomas, S., Viirman, O., Hernandez-Martinez, P. & Rogovchenko, Y. (2017, Accepted, minor revisions required). *Mathematics lecturer's views on the teaching of mathematical modelling. Nordic Studies in Mathematics Education, NOMAD*. (MSRG)

Peer-reviewed chapters in edited book

Hauge, K.H. (2016). Usikkerhet i temperaturprognoser. In T.E. Rangnes & H. Alrø (Eds.), *Matematikklæring for framtida – Festskrift til Marit Johnsen-Høines* (217 – 240). Bergen, Norway: Caspar Forlag AS. (MSRG)

Peer reviewed conference presentation with publication of full paper in proceedings

Brekke, M. (2016). New way of teaching and integrating Mathematics for engineering students in Electronics, *18th SEFI Mathematics Working Group Seminar, 27.06.16 - 29.06.16, Chalmers University of Technology, Gothenburg, Sweden.* Pp. 63 – 68, Publisher: European Society for Engineering Education (SEFI), Brussels ISBN: 978-2-87352-013-7 http://sefi.htw-aalen.de/

Peer reviewed conference presentation

Brekke, M. (2016). Modern Mathematics teaching: "It's all digital", *OEB Berlin 2016 Shaping the future of learning, 30.11.16 - 02.12.16*, Berlin. https://online-educa.com/programme

Brekke, M. (2016). Using CAA to set grades in mathematics courses for engineering students in electronics, EAMS Conference *"E-Assessment in Mathematical Sciences", 13.09.16 - 14.09.16,* University of Newcastle, Newcastle. http://eams.ncl.ac.uk/session/using-caa-to-set-grades-in-engineering/

Fredriksen, H., Hadjerrouit, S., Monaghan, J., & Rensaa, R. J. (2017 - Accepted paper). Exploring Tensions in a Mathematical Course for Engineers utilizing a Flipped Classroom Approach. CERME10, Dublin, 1 – 5 February 2017.

Hadjerrouit, S. (2016). Mapping and Evaluating Pedagogical Opportunities Provided by SimReal+: A Case Study in Mathematics Education. *Proceedings of the Conference of the International Journal of Arts and Sciences 9(3)*, pp. 157-162. (MSRG)

Hadjerrouit, S. (2017). Assessing the Affordances of SimReal+ and their Applicability to Support the Learning of Mathematics in Teacher Education. Accepted for publication in *InSITE 2017 (Informing Science + IT Education Conference)*. Informing Science Institute. (MSRG)

Hauge, K.H., & Barwell, R. (2015). Uncertainty in texts about climate change: A critical mathematics education perspective. In S. Mukhopadhyay & B. Greer (Eds.) *Proceedings of the Eighth International Mathematics Education and Society Conference*, pp. 582-595. Portland, OR: Portland State University. (MSRG)

Hauge, K. H., Sørngård, M.A., Vethe, T.I., Bringeland, T.A., Hagen, A.A., & Sumstad, M.S. (2015) Critical reflections on temperature change. In K. Krainer & N. Vondrová (Eds.) *Proceedings of the Ninth Conference of the European Society for Research in Mathematics Education (CERME9, 4-8 February 2015)* (pp. 1577-1583). Prague, Czech Republic: Charles University in Prague, Faculty of Education and ERME. (MSRG)

Hogstad, N. M., Isabwe, G. M. N., & Vos, P. (2016). Engineering students' use of visualizations to communicate about representations and applications in a technological environment. In E. Nardi, C. Winsløw, & T. Hausberger (Eds.), *Proceedings of the First Conference of the International Network for Didactic Research in University Mathematics* (pp. 211-220). Montpellier, France: University of Montpellier and INDRUM. Can be accessed at: https://hal.archives-ouvertes.fr/INDRUM2016/

Hogstad, N. M., Viirman, O. (2017). An exploration of students' discourse using Sim2Bil within group work: A commognitive perspective. Preliminary Research Report for the *RUME Conference to be held in San Diego, 23-25th of February, 2017.*

Hogstad, N. M., Isabwe, G. M. N., & Vos, P. (2017). A digital tool for applying integrals in a kinematic simulation: A perspective on instrumental genesis, epistemic value and semiotic potential. Paper accepted for *CERME10 Conference to be held in Dublin1-5 February 2017* (http://cerme10.org/).

Liakos, I. E. (2017). Mathematical Modelling and Mathematical Competencies: The case of Biology students. Preliminary Report accepted for *RUME Conference to be held in San Diego, 23-25th of February, 2017.*

Maugesten, M.; Nordbakke, M. (2016). Flipped classroom in the education of teacher students in mathematics. *European Conference on Education Research (ECER), 2016; Dublin, 23-26 August 2016*. http://www.eera-ecer.de/ecer-2016-dublin/ (MSRG)

Viirman, O. (2016). The development of the mathematical discourse of biology students working with mathematical modelling. *Poster presented at INDRUM 2016: First conference of the International Network for Didactic Research in University Mathematics*, Montpellier, France.

Viirman, O., Goodchild, S., & Rogovchenko, Y. (2016a). Using mathematical modelling activities to motivate biology students to learn mathematics. In C. Csíkos, A. Rausch & J. Szitányi (Eds.). *Proceedings of the 40th Conference of the International Group for the Psychology of Mathematics Education*, Vol. 1 (p. 262). Szeged, Hungary: PME.

Viirman, O., Goodchild, S., & Rogovchenko, Y. (2016b). Using mathematical modelling activities to motivate biology students to learn mathematics. *Short presentation at MADIF 10: The 10th Swedish Mathematics Education Research Seminar (Proceedings yet to be published), Karlstad, Sweden.*

Viirman, O. (2015). The role of mathematics in the design of engineering programs – a case study of two Scandinavian universities. In R. Göller, R. Biehler, R. Hochmuth, & H.-G. Rück (Eds.), *Didactics of Mathematics in Higher Education as a Scientific Discipline. Proceedings of the KHDM 2015 conference*. (508-512). Kassel: KHDM.

Viirman, O. (2015). The constitution of the nature of mathematics in the lecturing practices of three university mathematics teachers. In K. Krainer & N. Vondrova (Eds.), *Proceedings of the ninth congress of the European mathematical society for research in mathematics education.* (2263-2269). Prague: ERME.

Viirman, O. & Nardi, E. (2017 –Accepted.) From ritual to exploration: The evolution of Biology students' mathematical discourse through Mathematical Modelling activities. *CERME10*.

Peer reviewed poster presentations

Fredriksen, H., & Voigt, M. (2017 - Accepted Poster presentation). Designing a Richer Flipped Classroom Calculus Experience. *RUME conference, February 23 - 25, 2017*, San Diego, CA.

Fredriksen, H., & Hadjerrouit, S. (2016). Using the Flipped Classroom Model of Instruction to explore teaching and learning activities in mathematical education for engineers: An activity theory perspective. INDRUM 2016 conference, March 31– April 2, 2016, Montepellier.

Liakos, I. E. (2017). Introducing Mathematical Modeling to Biology Students: Studying the Competence Profile of the student. Poster accepted for *CERME10 Conference to be held in Dublin1-5 February 2017* (http://cerme10.org/)

Rogovchenko, S., Rogovchenko, Y., Treffert-Thomas, S. (2017). Individual and Group Work with Nonstandard Problems in an Ordinary Differential Equations Course for Engineering Students. Poster presentation at RUME, February 24-26, 2017 in San Diego, CA

Non-peer reviewed conference presentations & Invited presentations

Brekke, M. (2016). Digital Assessment, an overview of suitable Tools, (invited) *at Syd Dansk Universitet (SDU) 13.06.16, Creative Break - Assessment og feedback som støtte i matematik undervisningen*

Goodchild, S. (2016). Knowledge transfer: From R&D to sustainable, self-generating change in practice. (Invited) The Association of Danish University Colleges. Kolding 12 May 2016.

Rebenda, J., & Rogovchenko, Y. (2016). Presentation "Personality, Learning Approaches and Teaching Styles in Undergraduate Mathematics: Project PLATSUM" at the Closing Conference within Scholarship Programme EEA and Norway Grants (CZ07) in Prague

Rogovchenko, Y. (2016). PIC-MATH program: preparing undergraduates for a successful career in industry. At the conference "Math meets industry" in Trondheim, September 22-23.

Presentation at MatRIC Events

Brekke, M. (2016). Use of CAA at University of Agder, At *MatRIC / UK Joint Colloquium Information, 26.04.16 - 28.04.16, Arrangør University of Newcastle/MatRIC-University of Agder. University of Newcastle*, UK http://www.mas.ncl.ac.uk/events/matric16/

Fuglestad, A. B., & Rogovchenko, S. (2016). Experience with running mathematics support centre at UiA. Presentation about MatRIC Drop-in, *Seminar at Brno University of Technology, 3.02.2016*

Hernandez-Martinez, P., Rogovchenko, Y., Thomas, S., & Viirman, O. (2016)., Mathematics lecturers' views on the teaching of mathematical modelling. At MatRIC Mathematical Modelling Colloquium Kristiansand, Norway, August 9-11, 2016. (MSRG)

Hernandez-Martinez, P., Rogovchenko, Y., Thomas, S., & Viirman, O. (2016)., Mathematics lecturers' views on the teaching of mathematical modelling. at MEC/MatRIC Symposium, Lougborough, September 5, 2016. (MSRG)

Viirman, O. (2016). From ritual to exploration: Biology students' mathematical discourse when engaging in mathematical modelling activities. *Presentation at the Third annual MatRIC conference*, Oslo, Norway.

Presentations at various MatRIC events: MEC-MatRIC conference 2014 & 2015; Video Tutorial Workshop 2014; Mathematical Modelling Colloquium 2015 & 2016; Flipped Classroom Seminar, 2016

MatRIC research report:

Hernandez-Martinez, P., Treffert-Thomas, S., Rogovchenko, Y. & Viirman, O. (2016). Mathematics lecturers' views on the teaching of mathematical modelling. *MatRIC small research grant. Available at matric.no.* (MSRG)

Other

Frediksen, H., & Voigt, M. (2016). http://www.uia.no/forskning/forskningsnyheter/snur-opp-ned-paa-matteundervisinga - published in SFU Magazine, NOKUT. http://www.nokut.no/Documents/NOKUT/Artikkelbibliotek/UA-enhet/SFU/2016/SFU_Magasinet_02_16.pdf

Hogstad, N. M. (2016). On the potential of visualization and simulation tools in open and distance e-learning of mathematics at university level. Presentation at *Annual Research Workshop on Distance Education Leapfrogging Project (DELP2016) at Makerere University, Kampala, Uganda*, 2nd of May 2016.

Hogstad, N. M. & Hogstad, P. H. (2016). Simulation and Visualization in Mathematics. Presentation at the ADILA Symposium (D-TEL2016), Kristiansand, 8-9 Dec 2016. http://adila.no/

Maugesten, M.; Nordbakke, M. (2015). Omvendt undervisning og studenters egen oppfatning av hva som påvirker læring. SKuL - Skole-Kunnskap-Lærerutdanning; Seminar at Høgskolen i Østfold 16 December 2015. (MSRG)

Viirman, O. (2016). MatRIC and teaching mathematics to non-mathematics specialists. Presentation at *TMnM@UEA (Teaching Mathematics to Non-Mathematicians at UEA Network) meeting*, University of East Anglia, UK.

Viirman, O. (2016). Research seminar focused on commognitive data analysis, RME group, University of East Anglia, UK.

MatRIC presentations at local, national and international events:

29.01.16 Matthias Uwe Pätzold from UiA attends a workshop in Germany on how to design examinations. Arranged by the German Association of University Professors and Lecturers.

10-12.02.16 Workshop at Mathematical Sciences Research Institute, Berkeley, CA.

01-04.02.16 Workshop "**Challenges in teaching mathematics to future engineers"** in BRNO. This is part of our joint METMAS project with Brno University of Technology.

16.02.16 Meeting with NOKUT and the Minister of Education and research. Theme: The way ahead for the teacher education.

31.03-02.04.16 INDRUM Conference : International Network for Didactic Research in University Mathematics.

12.05.16 The Association of Danish University Colleges. Kolding.

13.06.16 Syd Dansk Universitet (SDU).

27-29.06.2016 Conference of the SEFI (European Society for Engineering Education) Mathematics Working Group (MWG) at Göteborg.

05.09.16 Centre visit to MEC Loughborough.

13-14.09.16 EAMS Conference "E-Assessment in Mathematical Sciences" Newcastle, UK

29-30.11.16 NSMO Annual conference, Trondheim

30.11-02.12.16 OEB Berlin 2016 Shaping the future of learning