Mathematics & Education

4th Annual Research Symposium

NUI Galway
OÉ Gaillimh

Tuesday, 31st March 2015
School of Education
NUI Galway
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<tr>
<th>Time</th>
<th>Event</th>
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<tr>
<td>09:00</td>
<td>Registration – Education Building Foyer</td>
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<td>Followed by Tea/Coffee – D102</td>
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<td>09:15</td>
<td>Opening Address – D102</td>
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<td>Dr. Máire Ní Riordáin and Dr. Aisling McCluskey</td>
<td>Joint Programme Directors, BA in Mathematics and Education</td>
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<td>09:30</td>
<td>Keynote Speaker 1 – D102</td>
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<td></td>
<td>Nevil Hopley (Head of Mathematics, George Watson’s College, Edinburgh, Scotland)</td>
<td>“Using CAS to build stronger understanding in Mathematics”</td>
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<td>09:30</td>
<td>Research Paper Presentation – D102</td>
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<td>10:15</td>
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<td>10:15</td>
<td>Showcase of Materials – D202</td>
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<td>10:15</td>
<td>Presentation of Posters – D201</td>
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<td>11:30</td>
<td>Research Paper Presentations – D102</td>
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<td>13:30</td>
<td>Research Paper Presentations – D102</td>
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<td>13:30</td>
<td>Keynote Speaker 2 – D102</td>
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<td>John McLoughlin (Professor of Mathematics Education, University of New Brunswick, Canada.)</td>
<td>“Teaching Problems: The Importance of Problem Selection”</td>
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<td>14:00</td>
<td>Closing Address – D102</td>
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<td>Dr. Ray Ryan (Head of Mathematics, NUIG) and Dr. Máire Ní Riordáin (School of Education, NUIG)</td>
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Students
We, the final year Mathematics and Education class group would like to welcome you to our Symposium. Today is a celebration of the advancements we have made throughout our four year programme. We are pleased to share our showcase, depicting not only what we have learnt in mathematics and education but their combination into mathematical teaching. Thank you for joining us and we hope you enjoy the day!

Joint Programme Directors
The BA in Mathematics and Education was established in 2008 and emerged from a vision to produce inspirational teachers of mathematics and applied mathematics, equipped with a strong honours mathematics degree. The programme has gone from strength to strength and this year's final year students have served as outstanding ambassadors for it in schools nationwide. Our students have shown unstinting commitment to the simultaneous and challenging pursuits of an honours mathematics degree and a post-primary teaching qualification. Their study of mathematics naturally and appropriately exceeds the minimal requirements for Teaching Council recognition, as befits such an aspirational programme. Their knowledge and skills in applied mathematics completes a solid mathematical education. Across the board, their undergraduate experience has emphasised depth of learning, breadth of knowledge, technological expertise, critical thinking and problem solving skills.

Our students will emerge as future leaders in a turbulent and challenging time of reform and innovation in mathematics education. Today's event, organised by our students, showcases their tremendous talent. We are very proud of them and their achievements and we are delighted to welcome you to their Symposium.

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Dr. Aisling McCluskey
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091 525700
Showcase of Materials

From 10.30am - 11.30am today, we the final year Mathematics and Education students will be showcasing various skills, knowledge and pedagogical practices obtained and developed over the four years of our studies. The materials and activities chosen represent the key aspects of our programme: Mathematics, Mathematics Education and Teaching Practice.

Mathematics
As our course is a joint honours degree in Mathematics and Education, we have also completed significant study in the fields of Mathematics and Applied Mathematics. Our study in these areas has allowed us to excel in a number of mathematical fields, and the showcase of activities will provide opportunities to demonstrate and highlight key learning and application.

Mathematics Education
A variety of contemporary educational practices, which we encountered over the four years of our degree programme, will be on display. For example, this includes the philosophical and psychological foundations of education, problem-based learning, and working as a group to plan and conduct an integrated mathematics education project.

Teaching Practice
We are looking forward to sharing our experiences of teaching practice with you. An integral part of our teaching practice placements involved exploring innovative teaching strategies that can be used in second level mathematics classrooms. Some examples of these pedagogical activities and games are on display today.

Please visit our showcase of activities and share in our experiences of the BA in Mathematics and Education programme.
Dyslexia is manifested in a continuum of specific learning difficulties related to the acquisition of basic skills in reading, spelling and/or writing. This project investigated the main areas of Mathematics that caused difficulty for those with dyslexia. Throughout its duration I included into my lessons many of the published recommendations that are currently in use by second level teachers in their teaching of students with dyslexia. I found that some of the strategies worked well while others had to be manipulated depending on the students and the topic.

The Flipped Classroom was proposed in 2007 by Adam Sams and Jonathan Bergman. The idea behind it is that students watch lecture videos at home and apply that knowledge in class. Initial research in the USA was very positive; however no research had been done outside America. My project focused on whether the flipped classroom was a viable teaching strategy in Irish classrooms. My research suggests that the flipped classroom must be implemented over a long period of time as students did not adapt to the change in the teaching style and did not watch the videos.

Cognitive skills are a prerequisite of the Project Mathematics syllabus. Developing student skills is essential for progression during evaluation and student evaluation. My action research paper identifies and investigates the impact of self-assessment on the development of student cognitive skills. A number of qualitative and quantitative methods were used to gather data from the students participating in the study. These included focus groups, questionnaires, self-evaluation forms and evaluation results which were used to assess cognitive progress. The results suggest a development of students’ cognitive skills through self-assessment. However, further research would be beneficial.

Using CAS to build stronger understanding in Mathematics

Keynote Speech
In the United Kingdom, handhelds with Computer Algebra Systems are not allowed on nearly all exams. There is also no real widespread interest in using CAS to improve mathematics teaching, but this has scope to change with the growing deployment of handheld devices in classrooms. In 2009 Nevil started exploring how to use CAS handhelds to help teach mathematics to 12-17 year olds. Since then he has presented every year at International Conferences on how to raise students’ understanding through the use of CAS.

This address will explain what CAS is, why it is both relevant and appropriate to our current students, and what can be achieved through its use. No student's algebraic skills were harmed in the development of this talk - quite the opposite, in fact.

Biography
Nevil Hopley is currently Head of Mathematics at George Watson’s College, Edinburgh, Scotland. He has taught in secondary schools in both England and Scotland since 1993, delivering English GCSE and A-Level courses, Scottish CSYS, Standard Grade, Intermediate 2, Higher, and Advanced Higher courses as well as International Baccalaureate Maths Higher Level.

Nevil is also a former Convenor of the Scottish Qualification Authority’s Maths & Statistics Assessment Panel. Nevil has worked closely with Texas Instruments since 2000, piloting both TI-84 and TI-Nspire networking Software and Hardware. In addition to training Scottish, English and Irish Maths teachers in the effective use of using handheld technology in their classrooms, he has also presented multiple sessions at Texas Instruments’ International and UK Conferences since 2006.

When not creating Maths resources, Nevil likes Mountain Unicycling. Most of the other things he does are sensible.
Vicky Lockhart
vickylockhart42@gmail.com

“Real-life Applications that Influence Students’ Motivation and Enthusiasm”

A student’s interest and passion for mathematics is key to a student’s academic success, yet an understanding of the underlying motivations for students evades teachers. This project provides an account of an action research project that explored the tasks which motivate junior level mathematics students. The aim of the project was to improve my practice as an educator and more specifically to investigate methods of enhancing student performance. Evaluation of the process was done by assessing students’ ability at a question before and after they had used the online programme where there was an average increase in marks of 28.5% for the students who attempted the IXL task.

Ciara Kelly
ciarakelly92@yahoo.com

“The Effect of Differentiated Instruction on Student Achievement”

In any given classroom one can expect to find some students with content knowledge years behind what is expected for their age group, others that are exactly where they should be academically, and some that are desperately seeking the chance to be appropriately challenged. Therefore it is more important than ever that educators utilise the need to differentiate instruction in their classrooms. This study sought to explore how differentiated teaching strategies affect the student learning process with an action research approach used in the interest of using the findings to implement positive changes to my teaching practice. The findings of the study were positive overall and showed that differentiating does improve the achievement levels of students but only when implemented correctly.

Katie Killian
katieacc@gmail.com

“Investigating the use of IXL on Students’ Mathematical Performance”

Practicing Problems is a key aspect in the learning process of a mathematics student. My paper provides an account of research on this area, to see if it can enhance students’ performance using online question sets from the website www.ixl.com. This research was done to try to improve my teaching practice and specifically to investigate methods of enhancing student performance. Evaluation of the process was done by assessing students’ ability at a question before and after they had used the online programme where there was an average increase in marks of 28.5% for the students who attempted the IXL task.

John McLoughlin

“Teaching Problems: The Importance of Problem Selection.”

Keynote Speech

Problem solving is fundamental to mathematics curricula. Often overlooked is the significance of problem selection – usually a starting point. Personal experience suggests that some problems are surprisingly rich and purposeful. Such examples are referred to as teaching problems, most of which are accidentally encountered at a moment in teaching a particular class or working with a problem in some context. Mathematicians and teachers may recognise when an insight exposes richness, which was not so apparent initially. Intellectual curiosity is awakened spurring a desire to revisit, reframe, or reimagine a problem.

The intention is to open a conversation about teaching problems suitable for second level education. My teaching problems may not be yours. Hence, aspects of my biography and philosophy as a teacher, problem solver and problem poser will figure into this talk.

Biography

John McLoughlin is a Professor in the Faculty of Education at University of New Brunswick (UNB) in Fredericton with a cross appointment to the Department of Mathematics and Statistics in the Faculty of Science. He is the 2013 recipient of the Adrien Pouliot Award for significant and sustained contributions to mathematics education in Canada. John has been honoured for his teaching at UNB. He is a regular visitor to New Brunswick classrooms and other community settings with math outreach initiatives supported by Atlantic Association for Research in the Mathematical Sciences (AARMS).

John’s teaching includes methods courses, mathematical development, and problem solving with pre- and in-service teachers though he has taught many first year math courses in different Canadian postsecondary settings. Beyond Canada he has been involved extensively in UNB’s partnerships with Bhutan, Trinidad and Tobago, and St. Lucia. John’s writing and research crosses the three areas of mathematics, education, and teaching and learning. Recent efforts have focused on problem solving, math anxiety and numeracy issues, and biography.
The Effect of Socratic Questioning on Students’ Problem Solving Skills

Socratic questioning involves asking a series of leading questions that stimulate students to analyse their understanding of the material, and come to new conclusions based on what they already know. This action research project investigated the effects of Socratic questioning on students’ problem solving. The study involved giving class tests and recording time taken by students to complete specifically designed worksheets, as well as observation of homework attempts and participation in class. This triangulation of quantitative and qualitative data enhanced the validity and reliability of the findings. My findings indicated an improvement in students’ critical thinking and problem solving skills.

The Integration of GeoGebra into the Teaching and Learning of Mathematics

In the 21st century, the ability to work with technology is becoming increasingly essential as, ‘It has become as fundamental to living a full life as being able to read, write and communicate’ (Department of Education and Science, 2008, p.xi). I chose to research GeoGebra as an educational technology for mathematics in order to improve my practice as a teacher, and to foster an environment where students can be active in their learning. The results of the research project illustrate, that among the potential benefits of integrating ICT in the classroom are improvements in student interaction, enjoyment, and meaningful learning, convincing me that GeoGebra is a valid and useful teaching aid.

Exploring the Impact of Active Learning Strategies on Students’ Engagement

The aim of my project was to find ways to get the students more involved in the classroom by creating a more student-centred environment. Two active learning strategies, previously negotiated with the students, were implemented by me regularly and the results of the intervention were observed. In advance of the implementation the class was observed by me with a purpose of creating a control baseline for the study. I used questionnaires to find out the students’ perspective. I wanted to compare my observations with their opinions and I was delighted with the final results. I was happy to see that my active learning strategies did indeed increase student engagement, performance and participation.

Cherish the Learners: Without them there would be no Learning.

I believe that students are the centre of any classroom. Mathematics in particular is undergoing a huge reform as we speak. Getting students involved in more real life scenarios is to the fore of this movement, and through this action research project I am striving to partake. I wanted to engage, motivate, and inspire. I found that when students were allowed to work collaboratively, in groups or otherwise, real true learning occurred. This learning I believe stemmed from their increased enjoyment and participation.

Exploring the Effect of 3-2-1 cards on Student Engagement in the Classroom

Engagement is a key factor in the learning process, with the more time students spend engaged in the lesson contributing directly to the more they learn (Gettner & Ball, 2007). This study was developed with the intention of improving my practice as a teacher and specifically to explore if I could successfully increase the level of active involvement within my first year mathematics lessons through the use of 3-2-1 cards. Evaluation of the study was indicative of: (i) students developing their understanding; (ii) an increase in the characteristics of engagement; (iii) the benefits of the 3-2-1 cards in voicing concerns confidentially; (iv) the greater potential the 3-2-1 cards could hold in long term use.

What’s the Problem with Problem Solving?

Problem solving is a key educational tool for conceptual understanding in mathematics. In relation to Project Maths, concerns were raised about students’ ability to cope with word-based problems, with particular reference to literacy levels. This study aimed to look at post-primary mathematics, to ask what are the issues facing students, in approaching word problems. Research would then inform improvements to my own teaching methodologies, to assist students with strategy development. Findings showed particular areas of concern that can be linked back to literacy levels and linguistic ability. Interventions demonstrated improvement in student abilities, in identified areas of concern.
Gráinne Donnelly
grainnedonnelly18@hotmail.com

“The Investigating Classroom Discussions”

The purpose of this study was to investigate if classroom discussions could improve student’s attitudes towards Mathematics and give them a greater understanding of the subject. In carrying out this study, I held two questionnaires with my 1st year Mathematics class, one at the start of the study and one when the study ended. I also held class discussions at the start of a new chapter, assigned homework and classwork daily to the students. Upon completion of the study I found that the discussions gave the students a greater insight into the importance of Mathematics in our daily lives.

Alex Foran
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“Enhancing the Student’s Perspective of Algebra through Real-life Application”

I used a mixed method approach to collect and analyse my data for this research. I began my research with a short questionnaire at the beginning and the same at the end. I maintained a record of students work throughout my research in order to see any evidence of an increase in perspective of algebra. In order to get an unbiased opinion, I asked a critical friend to make three visits. Overall this research was a success and showed that with real life application you can alter the perspective of Algebra with students.

Shannen Gill
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“Use of Questioning and Self-pacing to Differentiate for Learning”

The diverse range of abilities in schools differs from classroom to classroom, with teachers’ assumptions of “covered” curriculum impairing students. My intention was to incorporate self-pacing into my lessons, allowing the students to become more independent and assist in catering for differentiation. Moreover, preplanning my lesson questions allowed for greater critical thinking by students. My main findings were positive; the students took greater ownership of their work and my questioning skills flourished which in turn required the students to think significantly more, enhancing their learning overall.

Tomás Crosbie
tomas_crosbie@hotmail.com

& Shane Keane
shane.keane93@gmail.com

“Establishing Positive Student-Teacher Relationships”

“The most powerful weapon available to secondary school teachers who want to foster a favourable learning climate is a positive relationship with their students.” (Thompson, 1998, p. 6). Our project looks at ways to establish positive and inclusive student-teacher relationships in a learning context. The main finding of our project is that these relationships are in fact not overly difficult to establish; with a teacher showing a genuine interest in their students’ personal lives/interests along with engaging in extra-curricular activities being two of the most effective strategies to use when it comes to establishing positive relationships with their students.

Aidan Walsh
walshajp@gmail.com

“A Gambling Awareness Programme”

The Gambling industry has become a greater threat to the youth in our society than ever before. Smartphones, tablets and other such devices allow youths to gamble anonymously from the comforts of their home. My action research project examined the need for a programme to be introduced into the secondary schools in Ireland, breaking down the mathematics, psychology of addiction and marketing that is the foundation of the gambling industry. The results of my study show that there is a need and desire for such an educational programme to be introduced in second level education.

Aoife O’Leary
aoife99a@gmail.com

“The Impact of ICT in Teaching on the Affective Domain in the Classroom”

This action research project explored the role of ICT in teaching to the affective domain in the mathematics classroom. This is proposed as a potential strategy to address what is commonly referred to as “The Maths Problem”. The aim of this project was to explore different strategies one could use to make it easier for students to engage with mathematics. Evaluation of the study consisted of personal reflections and observations of a critical friend, and surveys and focus groups with the students themselves. All of the aforementioned evaluations were indicative of the benefits of technology based challenges and discussions in teaching to the affective domain in the mathematics classroom.
Action Research Project
As part of our final year teaching placement, we all embarked on developing our research skills by conducting and analysing an action research project. This project provided us as student teachers of mathematics an opportunity to improve our professional education as mathematics teachers through independent study into some area of interest by adding depth to, or expanding on our academic and/or practitioner knowledge and by developing relevant research skills.

Through conducting our projects while on teaching placement, we have not only developed our knowledge and research skills, but moreover we have gained a greater appreciation of the role played by research as part of our professional practice as a teacher.

We will all present our results from our projects in the form of an oral poster presentation. Our individual project outlines have been included addressing the focus of our study and main findings.

Please visit our posters and allow us to share our experiences of action research within a mathematics classroom.

Megan Bateman
megbateman@hotmail.com

“The Impact of Visual Teaching and Learning Strategies on Students’ Learning”

My research project aimed to highlight visual learning within the classroom, and in doing so observe the impact it had on the students’ learning. I encouraged student involvement within the classroom and allowed students to work actively to learn the topics being taught, while allowing students to approach the interactive board/whiteboard. I found that students enjoyed the subject more when they had visual aids; it allowed them to absorb the material more effectively.

Sinéad Black
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“The Use of Supportive Teaching to Foster a Positive Student-Centered Learning Environment”

Our students need to be at the centre of our teaching philosophy. Their input is important and develops pivotal relationships in the class. Through my research I wanted to determine the benefits to being a supportive teacher. I aimed to prove to myself that I could work towards being the teacher I have always desired to be. I carried out my investigation by introducing journal writing to my first year mathematics class in order to discover their perceptions of a supportive teacher and to evaluate aspects of my methodology and pedagogy. As a whole I found that feedback and support go hand in hand towards improving a learning environment.

Michael Burke
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“Identifying the Areas of Mathematics that cause difficulty for those with Dyslexia”

Dyslexia comes under the umbrella term of “learning disability”. I learned that those undiagnosed at an early age did not receive the support and resources that would have given them a solid platform for mathematics engagement in secondary school. Therefore my aim in researching this topic was to educate myself on current practices that would further my personal and professional development as a teacher in the area of learning disability. I found that it is important to implement strategies that support the development of dyslexic students’ use of symbols and sequencing, as well as supporting their reading development.

Edel Corcoran
edelmarycorcoran@gmail.com

“Use of Cooperative Learning to Improve Students’ Attitude to Mathematics”

Group work and peer assessment can play a crucial role in education. The aim of this project was to discover the main factors which contribute to students developing a negative attitude to mathematics and to investigate whether group work could help improve attitudes. I also explored how I might improve the educational value of group work carried out in class. Co-operative group work sessions were integrated into lessons with varied activities including as much real life problems as possible in line with research from Robyn & Kaye (2006). I discovered that the perceptions of mathematics held by students was a key factor leading to negative attitudes and that pair work helped alleviate this problem.