NEWSLETTER AUTUMN/WINTER 2021

National Centre for STEM Education

WELCOME FROM THE NEW DIRECTOR OF EPI·STEM

DR. GERALDINE MOONEY SIMMIE

I am delighted to welcome you to our Autumn 2021 Newsletter where we share some of the highlights of the past few months and point to future directions for STEM *Research & Development* (R&D) at EPI·STEM *The National Centre for STEM Education*.

Throughout the coronavirus pandemic, the EPI·STEM team have worked diligently and on-line with local lecturers in our partner *Higher Education Institutions* (HEIs), with national policy actors and others to progress STEM policy, and in the upskilling of out-of-field mathematics teachers in the *Professional Diploma in Mathematics for Teaching* (PDMT). We are welcoming our second cohort to the PDMT programme for a start-date of January 2022 in the near future.

At the same time, throughout the coronavirus pandemic EPI·STEM continued to publish outstanding research with global reach. We share some of that research endeavour here in this issue and on our website (www.EPI·STEM.ie). The crucial importance of scientific, numeracy and critical literacies in STEM education appears beyond doubt in a contemporary world battling with climate change, the coronavirus pandemic and the need for a socially just future. A future that needs some new thinking, new ethical and political agreements for a sustainable planet and a just global world. In the UNESCO 2020 *Visioning and Framing the Future of Education* we are reminded 'this current historical juncture requires us to re-vision knowledge, and to rethink the purpose of education and the organisation of learning' (p.2). (https://en.unesco.org/futuresofeducation/).

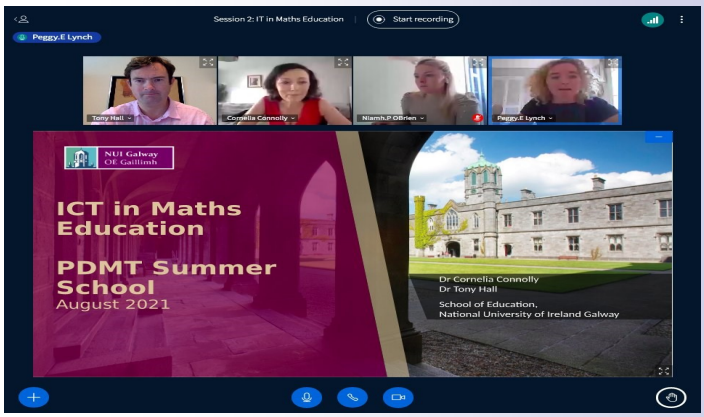
As the new Director of EPI·STEM, I am honoured to support the R&D work of the *National Centre for STEM Education* at UL. We continue to work with our former Directors, Professor Merrilyn Goos, a renowned mathematics educator who is now Professor of Education at the School of Education and Tertiary Access at the *University of the Sunshine Coast* in Queensland, Australia, Professor Sibel Erduran, a renowned science educator who is now Professor of Science Education and Director of Research at the Department of Education, *University of Oxford* in the UK and Emeritus Professor John O'Donoghue here at UL.

In EPI·STEM, we continue to build strong links with STEM teachers and their subject associations, with the *School of Education* and our partner HEIs, to make a real and lasting difference in the STEM classroom and in Irish society, to publish cutting-edge research and to attract research funding. We will shortly be announcing new STEM PhD Bursaries. We currently have Research & Development Officers developing new on-line CPD resources for all science and math teachers (HEA funded Project). We recently hosted an evening seminar in our EPI·STEM DESIGN LABORATORY with the *Engineering Technology Teachers' Association* (ETTA). We are taking part in the upcoming MathsFest Conference of the *Irish Mathematics Teachers Association* (IMTA). We are members of the *Irish Science Teachers' Association* (ISTA).

If you are interested in contributing to the imaginative, visionary and innovative R&D work at EPI·STEM, please contact us (see details on the last page) and we will gladly return your call.

Mathematics

PDMT Summer School



The PDMT (Professional Diploma in Mathematics for Teaching) Summer School was held online on August 9th-11th 2021 inclusive. 116 students attended the three-day Summer School and enjoyed lectures from a wide range of mathematics education pedagogical experts including Professor Merrilyn Goos (University of the Sunshine Coast, Queensland, Australia); Dr. Fiona Faulkner (TUDublin), Dr. Niamh O'Meara (EPI·STEM, UL); Dr. Cornelia Connolly, Ms. Kathy O'Sullivan and Dr. Tony Hall (NUI Galway); Mr. Kieran Sweeney (Director of Limerick Education Centre); Mr. Jack Neylon (Coláiste Muire, Ennis); and Dr. Paul Grimes and Dr. Aisling Twohill (DCU). The students were introduced to cutting-edge Portfolio development for in-career teachers. They also engaged in interactive workshops in the areas of mathematical thinking, numeracy across the curriculum, IT in mathematics and the development of CBAs. The Summer School was opened by the new Director of EPI·STEM, Dr. Geraldine Mooney Simmie. The co-ordinators of the Summer School were Dr. Peggy Lynch, Dr. Niamh O'Meara and Ms. Niamh O'Brien of EPI·STEM.

New Starters to EPI·STEM

National Programme Coordinator — PDMT

Dr. Peggy E. Lynch completed a BA in Mathematics and Classical Studies in NUI Galway before continuing to DCU where she completed the MSc in Financial and Industrial Mathematics. She fell in love with teaching while tutoring undergraduate mathematics students during her time in DCU and made the decision to complete her HDipEd in TCD. She commenced teaching mathematics at second level in 2005 and loved her time in the classroom but has continued to develop her knowledge around how students learn mathematics and completed a PhD in Mathematics Education in NUIM in 2012.

Peggy lectured at the University of Adelaide from 2011 to 2013 and continued to supervise Masters and PhD students in Adelaide until 2017. On returning to Ireland in 2013, she returned to teaching mathematics in St Flannan's College, Ennis while lecturing on the pedagogy modules in the PDMT offered by EPI·STEM and it's partner institutes. She was a member of the Project Mathematics-Reflections on Practice team in 2015 & 2016. Peggy joined the EPI·STEM team in January 2020 as PDMT National Co-ordinator. Her research interests include how students learn mathematics for a deep level of understanding and the support of teachers in teaching mathematics at second level.

National Programme Administrator – PDMT

Niamh P. O'Brien completed a BA in Mathematics and English in the University of Limerick before continuing on to the Professional Masters of Education in mathematics. She qualified as a secondary school mathematics teacher in 2018. She began her teaching career in St. Flannan's College, Ennis in 2018 for two years and is now currently teaching mathematics in Pobalscoil Chorca Dhuibhne, Dingle. She is very passionate about mathematics education and is currently enrolled on the Structured PhD programme in UL to pursue this passion further under the supervision of Dr. Niamh O'Meara and Dr. Olivia Fitzmaurice. Her research interests include teaching mathematics for conceptual understanding.

Dr. Audrey O'Grady is a lecturer in Biology, in the Department of Biological Sciences, UL.

Audrey originally trained as science teacher and despite having a passion for second level teaching and learning, her interest in ecology led her to pursue a research career in entomology, with a primary focus on ants. Throughout her PhD Audrey continued to engage in teaching and ultimately combined her research and teaching by developing an outreach programme in insect ecology. Audrey's enthusiasm for STEM outreach has led to the development of many outreach programmes, where she trains undergraduate and postgraduate students in science communication, mostly aimed at primary school science. Since 2015, Audrey, in collaboration with NUIG Galway runs the UL Cell EXPLORERS programme.

Cell EXPLORERS is a science education and public engagement programme which aims to promote hands-on discovery of molecular and cellular biology. The programme is currently funded by Science Foundation Ireland. The programme is hugely successful, demonstrated by the most recent (June 2021) STEM outreach record breaker, where >300 primary school students in Limerick simultaneously extracted DNA from bananas.

Audrey has a number of teaching awards, and in 2021 was recognised as a Teaching Hero in the 2021 student-led Teaching Hero awards. Audrey also won the Science and Engineering teaching award in 2018. Her research has now evolved into STEM Education, having supervised 2 PhDs and 5 MScs in STEM Education since 2012.

Over 40 years of chemical education on campus

This year (2021) marked the 40th ChemEd-Ireland conference, held online and organised by DCU. The conference was started in Thomond College of Education by Dr Peter Childs in 1982, and the conferences continued after the merger of TCE into the University of Limerick in 1991. In all it ran for 25 years on campus until 2006. Since then, the conference has moved around different universities and returned to UL in 2009 and 2017. In 2022 it will be in Limerick again, hosted by TÚS and organised by Marie Walsh. Marie Walsh helped run the conferences with Dr Childs from 1989 to 2006. The aim of the conferences was to inform, enthuse and inspire chemistry teachers at the start of the school year, and to allow teachers to meet and hear from distinguished chemical educators from abroad.

Earlier in May 1980 Dr Childs started to produce *Chemistry in Action!* magazine, now over 40 years old. Issue #118 has just been produced and the more recent issues are available online at www.cheminaction.com. The publication costs have been supported over the years by donations from Industry and other chemistry organisations. Dr Childs has also been involved in running in-service courses for teachers and more recently, the successful Chemistry Demonstration Workshops (with Dr Sarah Hayes). Dr Childs has directed the Chemistry Education Research Group and a number of PhDs and Master's degrees have come out of the group, particularly in the last few years. Members of the group have also been involved in several EU-funded projects, which have resulted in strong international contacts.

Chemical education has a long history on campus and UL's past and continuing contribution to improving the teaching and learning of chemistry is well-known to Irish chemistry teachers. Long may it continue.

Friends of EPI·STEM (Technology and Engineering)

Dr Jason Power, School of Education and Dr David Tanner, Assistant Dean International, Science and Engineering, were awarded €277,560 to coordinate a project with partners in Germany and Sweden called 'Enhancing Digital STEM', which commenced in May 2021. As a response to the COVID pandemic, universities around the world have rapidly adopted online and blended models of teaching and learning within STEM. This has seen considerable investment in supporting systems, but has highlighted a lack of an accessible evidence base to inform educators' decisions within these systems. This KA2 project will increase the use of evidenced based practice within University STEM learning environments. It will develop a range of supporting resources including a series of systematic reviews, a synthesised evidence base, practitioner guide and digital workshops. The project will deliver a series of professional development events to support practitioners in their adoption of evidence-based practice. Ultimately, a move towards evidence-based practice will improve the learning experience of the next generation of STEM professionals. In a time where we rely increasingly on these professionals to tackle global issues, we believe that optimising their learning experience will have long term societal and economic benefits.

Engineering & Technology Teachers ' Association

On Wednesday, 20th October an evening seminar was held by the Engineering and Technology Teachers' Association (ETTA) on the topic of robotics and was hosted by EPI·STEM at the University of Limerick on Wednesday, 20th October 2021. The opening words by Dr. Niamh O'Meara, Co-Director of EPI·STEM, conveyed a welcome to all the technology teachers and shared our interest in supporting STEM teachers' professional bodies at the National Centre for STEM Education. Dr. Nicolaas Blom was in attendance and represented the technology education team in the School of Education. The focus of the seminar was on robotic control, coding and design. The photograph below shows (L to R) Niamh O'Meara (Co-Director EPI·STEM; Lecturer in Mathematics Education), Mr Barry Convey (Chair, ETTA Ireland), Mr Conor Barry (Technology & Engineering Teacher; PDST T4 Associate), Dr Niekie Blom (Lecturer in Technology Education).

Mooney Simmie, G. (2021). Teacher professional learning: a holistic and cultural endeavour imbued with transformative possibility. *Educational Review*. DOI: 10.1080/00131911.2021.1978398

UNESCO's new global initiative on the *Futures of Education* looks at 2050 and beyond and seeks to understand how education can shape the future of humanity and the planet. The initiative is catalysing a global debate on how knowledge, education and learning need to be (re)imagined in a world of increasing complexity, uncertainty, precarity, social and economic inequality.

What is clear is that the future of *Teacher Professional Learning* (TPL) will play a significant role in shaping this new future and in the (re)imagining of who are, what are the values we hold and just how inclusive and cosmopolitan do we really want to be. Critical questions of *purpose*, *content* and *relationships* that have got lost along the way in the last twenty-one years of this 21st century.

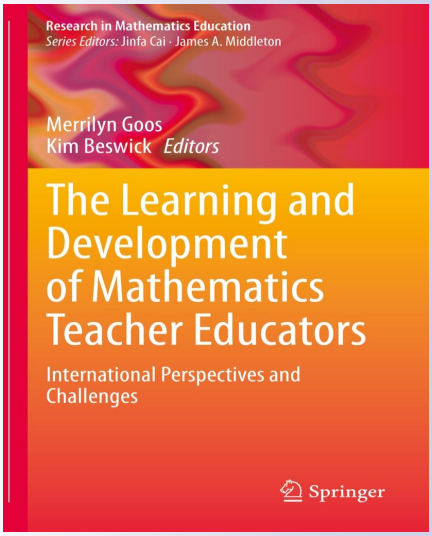
In this paper, I conduct a critical scrutiny of how best to frame TPL and to what extent the current research and policy literature provides a complete description.

My research reveals that, in the current economic and political crisis, mainstream global policy and research has reduced the multidisciplinary field of education, with expansive concepts such as *subjects, Bildung, democracy, social contract, ethics, intersectionality and culture* to a narrow theory of evaluation, and is rapidly moving toward a computational turn to learning analytics. A medicalised model of competitive individualism, each student acting as the driver of their learning dashboard, constantly nudged with personalised feedback, and reporting progress in numerical terms. A debased evaluation based on meritocracy where context, culture and access to resources are lost.

In my affirmative critique, I take a holistic, nuanced and emancipatory perspective that views education and the university classroom as important spaces for opening minds and hearts, for intellectually grappling with theory, research, policy and experience and for affordances for new thinking in how to live well, individually, in our families, in society and with others in the wider world. Education is an emancipatory practice of freedom with obligation to the greater good of humanity. An education system does not negate spontaneity, nor the human condition of plurality and does not jettison theory and problem posing, useful ways to interrupt and sap power in a hierarchical world dominated by powerful lobbyists.

Goos, M., & Beswick, K. (Eds.) (2021). *The learning and development of mathematics teacher educators: International perspectives and challenges*. Cham, Switzerland: Springer Nature.

https://www.springer.com/gp/book/9783030624071#aboutBook



Research in mathematics teacher education as a distinctive field of inquiry has grown substantially over the past 10-15 years. Within this field there is emerging interest in how mathematics teacher educators (MTEs) themselves learn and develop. Until recently there were few published studies on this topic, and the processes by which mathematics teacher educators learn, and the forms of knowledge they require for effective practice, had not been systematically investigated. However, researchers in mathematics education are now beginning to investigate the development of MTE expertise and associated issues. This volume draws on the latest research and thinking in this area and is therefore timely to stimulate future development and directions. It surveys the emerging field of inquiry in mathematics education, combining the work of established scholars with perspectives of newcomers to the field, with the aim of influencing development of the field, inviting cross-cultural comparisons in becoming a mathematics teacher educator by highlighting issues in the development of MTEs in different countries, and examining the roles of both mathematics educators and mathematicians in preparing future teachers of mathematics. The primary audience is university-based mathematics teacher educators and MTE researchers, and postgraduate research students who are seeking academic careers as MTEs. The book will also be of interest to teacher educators in disciplines other than mathematics, and education policy makers responsible for accreditation and quality control of initial teacher education programs.

Goos, M., O'Meara, N., O'Sullivan, K. & Prendergast, M. 2021. *Good Practice in Integrated and Standalone Numeracy Provisions at Level 1 – 3: Background report, guidelines and recommendations*. Dublin: SOLAS. Available: https://www.solas.ie/f/70398/x/75f591a099/solas-numeracy-report.pdf

On September 27th 2021Minister Simon Harris, on behalf of the Further Education and Training Authority (SOLAS) along with the National Adult Literacy Agency (NALA) and the Education and Training Board (ETB), launched a report entitled *"Good Practice in Integrated and Standalone Numeracy Provision at Levels 1 – 3: Background report, guidelines and recommendations"*. Prof. Merrilyn Goos (former Director of EPI·STEM); Dr Niamh O'Meara (Co-director of EPI·STEM) and Ms Kathy O'Sullivan (EPI·STEM PhD student) along with their colleague Dr Mark Prendergast (UCC) were responsible for writing this report.

The purpose of the report was to capture and document standalone and integrated adult numeracy activity in the ETB context, in order to develop good practice guidelines and inform future development of adult numeracy policy and practice. From April to November 2019 the study mapped the provision of adult numeracy across the 16 ETBs that deliver adult further education and training (FET) in Ireland. As a result, the study provides Further Education and Training (FET) stakeholders (ETBI, SOLAS, Department of Further and Higher Education, Research, Innovation and Science, NALA) with a contemporary picture of adult numeracy activity in ETBs in Ireland against the backdrop of the FET strategy and wider related government policy.

The main findings to emerge from the study can be summarised as follows:

- Two different conceptualisations of numeracy were evident. The first sees numeracy as foundational for trades/ craft apprenticeship. The second is functional numeracy, taught in an integrated fashion to adults who are disadvantaged in everyday life by unmet numeracy needs.
- All of the ETBs provided accredited numeracy courses (generally ranging from QQI Levels 1–4), with QQI Level 2 being the most common.
- A wide range of groups are involved in adult numeracy courses. The median number of participants in such courses was 310, with more women than men generally attending. On average, 71% of learners complete the course and 70% progress to other adult learning.
- Adult numeracy is predominantly dependent on part-time numeracy tutors. Only three ETBs had full-time staff members involved in adult numeracy. By and large, there was training available for adult numeracy tutors in each ETB, with 47% of those working in adult numeracy having received training in the past year.
- Adult learners reported an array of benefits associated with attending numeracy courses provided by the ETB. The main benefit of participating in courses was the life-changing increase in confidence experienced by adult learners. Coupled with this confidence boost was the recognition by adult learners that they had developed new knowledge and understanding.
- Additional benefits included development of financial awareness and problem solving skills, and the ability to support family members in numeracy tasks, such as helping children with homework. Some participants also referred to mental health and social benefits.

These findings led to the authors making nine recommendations to further strengthen current practice and extend the many benefits experienced by adult numeracy learners. Some of the recommendations include (R1) *identify and work with a definition of numeracy underpinned by contemporary research;* (R2) *Promote the distinctness and importance of numeracy;* and (R8) *Ensure adult numeracy tutors are appropriately qualified*. In addition to these recommendations, the report set out broad guiding principles for good practice in adult numeracy that invite reflection, discussion, and interpretation in light of local needs, contexts, and resourcing of ETBs.

For those that wish to read the report in more detail it can be found at the following link: https://EPI·STEM.ie/wp-content/uploads/2021/09/NALA-Numeracy-Report.pdf

Merrilyn Goos, Máire Ní Ríordáin, Fiona Faulkner & Ciara Lane (2021) *Impact of a national professional development programme for outof-field teachers of mathematics in Ireland,* Irish Educational Studies, https://doi.org/10.1080/03323315.2021.1964569

Out-of-field teaching refers to the practice of assigning teachers to teach subjects that do not match their training or education. This paper reports on a study evaluating the impact of a national professional development programme for out-of-field teachers of post-primary school mathematics in Ireland – the Professional Diploma in Mathematics for Teaching. Evidence of impact was collected from three surveys. Two surveys evaluated changes in the prevalence of out-of-field teaching before and six years after the introduction of the programme. The third survey investigated programme graduates' beliefs about mathematics, mathematics teaching and mathematics learning, and reported changes in teaching practices. Outcomes of the programme included a reduction in out-of-field teaching of mathematics and increased opportunities for graduates to teach higher level mathematics in the senior post-primary years. These teachers also endorsed child-centred beliefs and reported teaching practices consistent with the problem-solving orientation of the new mathematics curriculum. The findings go some way towards testing a theory of teacher change in order to enhance our understanding of how professional development works to upskill out-of-field teachers.

Tangents Podcast with Dr. Niamh O'Meara

Junior Cycle Talks is a podcast channel provided by the Junior Cycle for Teachers (JCT) support service. The podcasts explore a variety of issues, themes and topics that may be of interest to all teachers, students, parents and school leaders. Housed on this channel is the podcast *Tangents* which is the JCT's mathematics team's podcast. It explores a number of issues in relation to the effective teaching and learning of mathematics at Junior Cycle in Ireland.

In the eighth episode of this podcast series the JCT team interviewed EPI·STEM's Co-director and lecturer in mathematics education, Dr. Niamh O'Mara. In the podcast Niamh discusses the importance of teaching for understanding and describes ways that teachers can help develop students' procedural fluency and conceptual understanding. She also talks about how striking a balance between the two is critical. Niamh then goes onto discuss the role of the teacher in the transition from primary to post-primary mathematics education and how we as a society need to help foster more positive attitudes towards mathematics and move away from current narratives that portray mathematics as difficult, boring and only needed by certain individuals or in certain professions.

A link to the podcast can be found here: https://soundcloud.com/user-65250337/tangents-episode-8-with-dr-niamh-o-meara but it can also be found wherever you source your podcasts (Spotify, Apple podcasts)

PDMT Past Students

The PDMT has seen over 1000 graduates since its inception in 2012. Over the course of the next number of newsletters we will talk with some graduates of this innovative CPD programme to get some insights into their experience of the PDMT and to see the opportunities that the PDMT has provided them with.

My name is Philip Ryan. Having worked in industry for over ten years, I was relatively late coming to teaching. I had an undergraduate degree in Business and an MBA but I was only qualified to teach Business. I felt this greatly limited my employability, so I sought out ways of adding another subject to my teaching profile.

I decided to complete the Professional Diploma in Mathematics for Teaching in the University of Limerick. Having completed my undergraduate studies in UL, I knew the standard of the lecturers and tutors was exceptional and I knew it would be a positive experience. I was not let down. The course is very professionally run, with an emphasis of maximizing the benefit of each contact hour. It was amazing how much the lecturers and tutors could get through in each lecture and impart the required knowledge to the students. While the content on the course was challenging, each class, whether it be in person or online, made the content very accessible and therefore the exams became very achievable.

I cannot speak highly enough about how professionally the course is run and how exceptional the lecturers and tutors are. Thanks to them, I have now added mathematics as a second subject but more importantly I have a true understanding of all facets of mathematics which has equipped me to effectively teach my students.

My name is Martina Brennan. I teach mathematics, science and chemistry in St. Flannan's College in Ennis, Co. Clare. I was a student of the first cohort of the PDMT in 2012. I enjoyed teaching mathematics but was aware of being an out of field mathematics teacher. I was grateful for the chance to avail of the course so I could increase my mathematical knowledge and be able to teach mathematics effectively. Completing the course allowed me to upskill in a flexible way and secured a permanent teaching post in my school.

The most valuable part of the course in relation to my teaching practices were the pedagogy workshops and summer school. They provided an opportunity for like-minded teachers to share ideas relating to teaching and learning strategies in mathematics. The mathematical knowledge I gained from the course enabled me to make cross curricular links to my other teaching subjects. It gave me the confidence to teach mathematics and gain recognition from colleagues.

CONTACT US AT EPI·STEM

Contact us using the email lists below:

Director of EPI·STEM: Dr. Geraldine Mooney Simmie, Senior Lecturer, School of Education

Co-Director EPI·STEM: Dr. Niamh O'Meara, Lecturer in Mathematics Education, School of Education

National Programme Coordinator of PDMT: Dr. Peggy E. Lynch: pdmt@ul.ie

National Programme Administrator (PDMT): Niamh. P. O'Brien: pdmt@ul.ie

Executive Administrator EPI·STEM: Helen Fitzgerald: EPI·STEM@ul.ie

Administrator EPI·STEM: Martina Ryan: EPI·STEM@ul.ie

Twitter: EPI·STEM (@EPI·STEM_UL) / Twitter Facebook: EPI-STEM - Home | Facebook Website: www.EPI·STEM.ie