

## MIC STEM Education Conference:

### Book of Abstracts for Day 1

#### Day 1: Friday May 22<sup>nd</sup>

| Session 1:                                    | Room 1: T213                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
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| <p><b>10.20am -</b></p> <p><b>11.30am</b></p> | <p><b>Denis Moynihan &amp; Anne Mc Murrough [Dublin City University]</b><br/> <b>Empowering the Future-Ready Classroom: Professional Learning and Robotics as Catalysts for Integrated STEM in Irish Primary Schools (iSTEM focus: T, E)</b></p> <p>As educational systems worldwide pivot toward interdisciplinary models, Ireland has recently introduced a redesigned primary curriculum framework to foster future-ready competencies. However, translating policy into classroom practice poses a challenge. Many teachers report significant hesitance regarding the implementation of integrated STEM, citing a lack of confidence and uncertainty in implementing interdisciplinary STEM approaches as a primary deterrent.</p> <p>This mixed-methods research examines the efficacy of the Building a Real-World Integrated Curriculum in STEM (BRICS) programme, a professional learning intervention designed to facilitate interdisciplinary learning in the primary classroom. Grounded in constructionist pedagogy and the Engineering Design Process (EDP), the project utilised LEGO Education programmable robotics as a primary tool for student inquiry and hands-on experimentation. The study involved a cohort of 19 teachers, 338 children (ages 9–12), and 2 Oide Professional Learning Leaders (PLLs). Data were triangulated using validated T-STEM and S-STEM instruments alongside qualitative teacher surveys and PLL interviews. While quantitative metrics indicated no statistically significant shifts in teacher self-efficacy or attitudes, qualitative evidence pointed to a marked increase in teacher confidence and a higher frequency of STEM-aligned instructional behaviours. Among the cohort of children (post-intervention n = 217), results revealed a slight but significant decrease in attitudes toward science, engineering, and technology; conversely, teachers observed substantial gains in children’s enthusiasm and collaborative proficiency.</p> <p>The study identified persistent systemic obstacles, including resource scarcity, time limitations, and classroom management complexities. A central finding highlights the pivotal role of Professional Learning Leaders in providing the mentorship and collaborative frameworks necessary for successful curriculum delivery. In light of the NCCA 2025 STEM specifications, these findings suggest that "future-ready" education requires more than access to resources; it necessitates sustained, practice-based professional development and robust school-wide support structures. This research provides a timely evidence base for policymakers and educators seeking to scale inclusive and effective integrated STEM learning both in Ireland and internationally.</p> |

**Claire Carroll [Mary Immaculate College, Limerick]**

**From Curriculum to Classroom: Enacting Computational Thinking in Primary STEM Education (iSTEM focus: T, M)**

In September 2025, Ireland introduced a new Science, Technology, Engineering, and Mathematics (STEM) curriculum for primary schools, which foregrounds computational thinking (CT) as a core competency for twenty-first-century learners. This paper examines how CT can be meaningfully integrated into interdisciplinary STEM learning, with a particular focus on the intersection of mathematics and digital technology. While CT has traditionally been associated with computing, its growing presence in educational contexts has led to a proliferation of definitions and interpretations. In the absence of a universally agreed definition, this research adopts a context-sensitive approach, drawing on Brennan and Resnick's (2012) framework, aligned with Millwood et al.'s (2018) head, hands, and heart model, to examine the development of students' computational concepts, practices, and perspectives within an Irish primary school setting. Focusing on digitally mediated learning, the study explores how programming with Scratch can support the integration of CT into primary mathematics. Classroom insights are illustrated through two examples. In one, students applied mathematical concepts such as coordinates, angles, and polygons to create geometric abstract art inspired by Kandinsky and Mondrian, combining creative expression with mathematical reasoning. In another, students were positioned as designers tasked with creating a symmetrical logo for a model-building toy company, using Scratch to investigate symmetry, rotation, and pattern through structured coding activities. Across both contexts, students engaged in structured and exploratory activities involving prediction, investigation, modification, and debugging. These experiences supported the development of spatial reasoning, problem-solving skills, and mathematical understanding, while simultaneously fostering key CT concepts, practices and perspectives. The findings highlight the potential of integrated, technology-enhanced approaches to support interdisciplinary STEM learning that is both creative and conceptually rich. This paper contributes to ongoing discussions on curriculum enactment by demonstrating how CT can be embedded within primary mathematics to cultivate future-ready competencies in line with Ireland's STEM education vision.

**Room 2: T214**

**Michelle Fitzpatrick, Mairéad Hourigan, Aisling Leavy, Claire Carroll, Breed Murphy, Mairéad Ryan & Anne O'Dwyer and primary teachers from Scoil Mhathair Dé [Mary Immaculate College, Limerick]**

**SPARK: Connecting Integrated STEM Learning to Real-World Societal Issues Through School–University Partnerships (iSTEM focus: S, T, M)**

STEM education plays a transformative role in shaping informed, ethical, and action-oriented responses to the 21st-century challenges. In Ireland, the introduction of the new primary STEM curriculum necessitates an urgent shift toward integrated approaches that empower learners to address real-world challenges. While connections across STEM disciplines are not new, supporting teachers to design and enact coherent, interdisciplinary learning experiences remains a significant challenge within existing structures of teacher education (Fitzpatrick et al., 2026; Wieselmann et al., 2025). The SPARK project, funded by Research Ireland, responds to this challenge through a school-university partnership involving six primary teachers, 27 preservice teachers, and STEM teacher educators. Japanese Lesson Study provides the organising framework for professional learning, selected for its

robust, research-based, and iterative process of collaborative planning, classroom implementation, guided observation, and reflection, which focuses specifically on enhancing student learning (Lewis & Takahashi, 2013). Within this framework, participants co-created STEM inquiry units, rooted in planetary health and action, focus on applying STEM knowledge to real-world environmental challenges.

A critical component of SPARK is the use of “data for the planet” where children engage with both primary and secondary datasets, including historical climate data to support evidence-based reasoning. Through mathematical modelling, scientific inquiry and digital tools, students developed early systems thinking and engaged in age-appropriate forms of informed decision-making. Such approaches align with growing emphasis on developing STEM capabilities through authentic, data-rich learning experiences (Makar et al., 2023).

This paper presents findings from the first cycle of SPARK (Spring 2026), analysing six research lessons. The analysis highlights the tensions and affordances of interdisciplinary STEM teaching for planetary health, particularly in relation to teacher decision-making, integration of data practices, and the pedagogical demands of working with young learners. Implications for initial teacher education and professional development are discussed, emphasising how collaborative, research-engaged pedagogies can bridge the gap between STEM knowledge and meaningful environmental action.

**Margaret Leahy, Cliona Murphy, Lorraine Harbison, Hamsa Venkat & Greg Smith [Dublin City University]**

**Fancy Feet: Research Insights into Collaborative Integrated STEM in Initial Teacher Education (iSTEM focus: S, T, E, M)**

Taking cognisance of the thrust towards integrated STEM (iSTEM) in the Primary STEM Education Specification (NCCA, 2025) and the need to provide high-quality iSTEM project experiences, members of the primary STEM Education team at DCU have collaborated to implement iSTEM projects with pre-service teachers (PSTs) from across the specialisms in digital learning, mathematics and science. The aim of this work is to enable students to design high-quality iSTEM projects in which they make meaningful, strong connections across mathematics, science, and digital learning. Our approach draws on the notion of distributed cognition and distributed expertise (Brown et al., 1993; Zhang et al., 2009).

As part of the BEd (Primary) degree in DCU, students are required to undertake a specialism in a specific area. Comprising four modules over three years, these specialisms are designed to deepen PSTs’ content and pedagogical knowledge and to foster leadership capacities that graduates can carry into curriculum development and innovation in schools (BEd Accreditation Document, 2012).

As part of their final specialism module, PSTs, in small, multidisciplinary groups, undertake a six-week iSTEM project on a specified topic. In 2025, for example, students engaged in a “Fancy Feet” project (English, 2019), designing and making a pair of shoes that could be modelled by a team member. The project required them to work with data handling and representation (including spreadsheets), measurement and geometry, and to conduct investigations to test properties of materials, while drawing on digital tools to support design, communication and representation.

In this session, we will share what we have learned about: (a) designing and scaffolding such projects so that PSTs make meaningful connections across mathematics, science and digital learning; and (b) the implications of this distributed expertise model for embedding high-quality iSTEM project work within initial teacher education and, ultimately, in primary classrooms.

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| <p><b>Session 2:</b></p> <p><b>12.00pm -</b></p> <p><b>1.30pm</b></p> | <p><b>Room 1: T213</b></p> <p><b>Anne Marie Morrin [<i>Mary Immaculate College, Limerick</i>]</b><br/> <b>Learning Made Visible: Arts Education, STEM, and Student Self Evaluation in Initial Teacher Education. (iSTEM Focus: S, T, A, M)</b><br/> This research positions Arts Education and STEM as key drivers of holistic, learner-centred education, aligning with contemporary curriculum priorities that foreground wellbeing, interdisciplinarity, and student agency. The session presents the fourth iteration of the Data Reflection Wall; a socially engaged, arts-based reflective methodology that has been co-designed, developed, and progressively refined with student teachers during the final semester of their undergraduate initial teacher education programme.<br/> The Data Reflection Wall concept emerged through iterative studio-based practice with final-year visual art elective students and integrates Arts Education and STEM elements to support embodied learning and self-evaluation. The Art component include visual metaphor, colour psychology, pattern, composition, symbolism, participatory installation, and non-verbal modes of communication. These compliment STEM informed practices, including systematic observation, data collection, categorisation, coding systems, progression over time, spatial organisation, and data visualisation strategies. Working within an integrated STEM framework, students engaged in transdisciplinary thinking by translating lived experiences into visual data, readable both individually and collectively.<br/> The presentation outlines how this fourth iteration evolved through co-design with students, highlighting refinements to structure, visual coding, and reflective prompts that strengthened student ownership of learning, formative self-assessment, and collective sense making. Attention will be given to the potential of the Data Reflection Wall to support student-led evaluation of learning, the development of teacher identity, and embodied, reflective practice, while modelling transferable pedagogical approaches that are directly transferable to primary classroom practice and can ultimately enrich children's learning experiences in schools.<br/> By centering visual meaning-making, metaphor, and collaborative inquiry, the presentation demonstrates how arts-based STEM practices can create inclusive, responsive learning environments that support wellbeing, creativity, and professional formation in initial teacher education.</p> <p><b>June Pisaneschi [<i>Maynooth University</i>]</b><br/> <b>A Froebelian approach to curriculum integration in ITE (iSTEM focus: S, M)</b><br/> Froebelian principles emphasise the holistic nature of education, positioning 'unity and connectedness' as central to high-quality learning experiences. As Froebelian educators, we promote inquiry-based approaches in STEM to harness children's natural curiosity and enhance engagement. Particular emphasis is placed on learning in and through the natural environment.<br/> This presentation critically examines how meaningful learning in the primary classroom can be supported through an integrated, inquiry-based approach to Science, Mathematics, and Language curricula. Drawing on examples of student-generated learning resources from the B.Ed Primary Education programme at the Froebel Department of Primary and Early Childhood Education, we evaluate the extent to which ITE practices foster a commitment to child-centred, real-world learning. The implications for integrated STEM provision in ITE are also considered.</p> |
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**Edward Corry, Aisling Leavy, Mairéad Hourigan & Anne O'Dwyer [Mary Immaculate College, Limerick]**

**From STEAMing to PROTECT: The Evolution of Integrated STEAM Engagement across two Erasmus+ Projects (iSTEM focus: S, T, E, A, M)**

This presentation charts the evolution of Integrated STEAM engagement across two Erasmus+ funded projects, from initial engagement with integrated STEAM approaches to the use of integrated STEAM to explore climate action and student engagement through locally focused initiatives.

The STEAMing (STEAM: International Guidance to Best Practice, 2019-2022) sought to develop and share best practices for STEAM Education across a European wide network of education providers in Greece, Norway, Croatia, Portugal and Ireland. Within the Irish context, this involvement contributed to the development of an emergent STEAM community of practice across a regional primary school network. The project supported teachers from three local primary schools through STEAM focused CPD, strengthening their understanding of integrated STEAM education and advancing the key STEAM skills of collaboration, critical thinking, creativity, problem solving and pupil-led inquiry in classroom practice.

The Erasmus+ funded PROTECT (Pupil-led Response to the Effects of Climate Change on Their Local Communities, 2025-2028) further extends these integrated STEAM pedagogies to examine climate action and child voice from a local perspective. The project brings together partners from Ireland, Croatia, Portugal, Norway and Serbia and demonstrates integrated STEAM as a pedagogical approach to explore climate challenges from a local perspective.

#### **Room 2: T214**

**Cliona Murphy, Denis Moynihan, Orla Kelly, Lorraine Harbison & Hsiao-Ping Hsu [Dublin City University]**

**Starting Points for iSTEM: From Disciplinary Roots to Integrated Practice (iSTEM Focus: S, T, M)**

This presentation examines the evolving nature of integrated STEM (iSTEM) education within the primary B.Ed programme in Dublin City University. The programme's first two years prioritise disciplinary learning across all curriculum areas, acknowledging that robust disciplinary and pedagogical content knowledge is essential for effective integration (Shulman, 1986; Ball, Thames & Phelps, 2008). Building on this disciplinary grounding, the third and fourth years then shift towards broader curricular integration, providing structured opportunities for students to explore connections across subjects, design integrated learning experiences, and apply their disciplinary understanding across different curriculum areas.

Within this overall programme structure, the development of STEM education follows a similar trajectory. In the first two years, STEM education is approached through the disciplinary teaching of science, mathematics and digital learning, ensuring that students develop the strong disciplinary and pedagogical content knowledge required for effective teaching of each subject. Research consistently highlights that teachers need a secure grasp of core concepts, practices and ways of knowing within each STEM discipline before they can meaningfully integrate them in ways that support conceptual coherence and authentic problem-solving (Mc Comas et al, 2020; Murphy et al., 2023). Building on this disciplinary grounding, the third and fourth years of the programme then shift towards integrated STEM (iSTEM), providing structured opportunities for students to engage with inquiry-based tasks, design challenges and collaborative planning activities that foreground the interplay between disciplinary ideas and iSTEM practices.

The presentation will illustrate two initiatives piloted with non-specialist B.Ed students. The first involves a collaborative biodiversity inquiry introduced across a first-year STEM Education module, with three distinct module components: science education, mathematics education and digital learning. The

second draws on a third-year module on integration, where students engaged with iSTEM through local studies. The presentation will discuss successes, challenges and implications for preparing future teachers to enact high-quality iSTEM education in primary classrooms, highlighting take-home insights for educators as we continue to shape what effective iSTEM practice might become.

**Mairéad Hourigan, Michelle Fitzpatrick, Mairéad Ryan, & Anne O'Dwyer [Mary Immaculate College, Limerick]**

**Collaborative Growth: Using Lesson Study to advance STEM Teacher Educators' Professional Learning (iSTEM Focus: S, M)**

The role of a Teacher Educator (TE) is complex and multifaceted, with minimal preparation and opportunities for professional development. Most TEs' professional learning is predominantly self-initiated and self-guided, taking responsibility for their own learning and professional practice (McPhail et al., 2019). Lesson Study (LS) provides a collaborative and iterative approach to professional learning. Across various education systems, adaptations have been made to LS practices that strive to strike a balance between fidelity to LS practice and the need to fit within particular cultural contexts (Vermunt et al. 2019). However, to date little is known regarding the affordances of LS in promoting professional learning among TEs (Schipper et al., 2022). In response, this study explores the potential of LS as a professional learning model for four STEM TEs. The participants (2 mathematics TEs, 2 science TEs) represent varying experiences in terms of collaboration, LS practices, and years' experience in the sector. The LS, conducted in Autumn 2025, focused on developing a science education tutorial (relating to the concept of Forces) to support the content and pedagogical knowledge development of preservice primary teachers. The TEs completed a LS cycle consisting of an iterative cycle of study, plan, implement, and reflect. Throughout the process, data were generated through planning documentation, fieldnotes, individual TE reflections, group recorded reflective discussions and focus group interview.

The findings suggest that the affordances of the LS model for TEs were multifaceted, including, the development of knowledge for teaching, the role of self-efficacy, and awakening potential opportunities for interdisciplinarity. This paper focuses on the TEs' perspectives on the viability of LS as a sustainable means of professional learning as we continue to grapple with what integrated STEM education might look like during initial teacher education.

**Michelle Fitzpatrick, Mairéad Hourigan, Aisling Leavy, Claire Carroll & Breed Murphy [Mary Immaculate College, Limerick]**

**More Than a Supporting Actor: Mathematics in Integrated STEM (iSTEM focus: S, T, E, M)**

As we move closer to embedding a formal STEM curriculum at primary level that champions attention to both disciplinary and interdisciplinary STEM experiences, it is timely to pause and consider the role of mathematics within integrated STEM. This paper discusses the challenges and possibilities in relation to meaningful mathematics integration. literature from the field cautions that mathematics often risks becoming the 'silent M' in STEM, relegated to a subservient 'tool' role or involving content below grade-level expectations. It engages in a retrospective analysis of various STEM units inquiry, examining the role assumed by mathematics alongside potential for enhancement. The presentation showcases the immense potential to exploit and enhance mathematics integration through intentional design strategies, such as 'Mathifying STEM'. Similarly, reviewing past units of inquiry with a new, more knowledgeable lens, has highlighted further opportunities to 'STEMify mathematics'. Specifically, the research highlights how centering mathematics through authentic, sustainability-focused problems—like using real-world data to drive statistical investigations—can position mathematics as foundational and empower learners to become informed, responsible citizens.

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| <p><b>Session 3:</b></p> <p><b>2.15pm -</b></p> <p><b>3.45pm</b></p> | <p><b>Room 1: T213</b></p> <p><b>Aisling Leavy, Mairéad Hourigan, Michelle Fitzpatrick, Claire Carroll &amp; Breed Murphy and 4th year maths specialism student teachers [Mary Immaculate College, Limerick]</b></p> <p><b><i>Game-Based Approaches to Integrated STEM: Supporting Mathematical Understanding through Minecraft (iSTEM focus: T, M)</i></b></p> <p>Following sustained advocacy for integrated STEM education in policy and research across the last decade, the launch of the first primary STEM curriculum has intensified attention on how best to support future primary teachers to engage in interdisciplinary practice. This presents significant implications for STEM teacher educators, who are required to move beyond the safety of their STEM disciplines and engage in more intentional integration with STEM disciplines that may be outside of their area of expertise. This study examines the professional learning of mathematics teacher educators as they collaboratively designed, implemented, and researched an integrated STEM elective within a primary initial teacher education programme. Drawing on reflective inquiry, the study explores how the teacher educators negotiated interdisciplinary integration, designed learning experiences that connected mathematical thinking with digital technologies and problem-solving, and supported pre-service teachers in engaging with integrated STEM pedagogies. Findings highlight key features of the elective that supported pre-service teachers' understandings of integrated STEM alongside challenges experienced and potential future adaptations to address these. This research contributes to ongoing conversations surrounding the enactment of Ireland's new STEM curriculum by offering insights into the professional learning required of teacher educators to support interdisciplinary, technology-enhanced STEM education in initial teacher education contexts.</p> <p><b>Michael Mc Namara [Mary Immaculate College, Limerick]</b></p> <p><b><i>Virtually There: Exploring the Use of VR to Support and Enhance STEM Education Beyond the Classroom Walls (iSTEM focus: S, T, E, M)</i></b></p> <p>In an increasingly digital society, extended reality (XR) technologies are creating new opportunities for teachers to engage in innovative STEM education in the primary classroom. Educators are challenged to adopt pedagogical approaches that help learners use emerging technologies while also developing critical thinking, collaboration, and real-world problem-solving skills. This aligns with Ireland's Digital Strategy for Schools to 2027, which emphasises preparing students to become confident digital citizens and encourages innovative uses of technology to extend learning beyond the classroom. In this regard, virtual reality (VR) has grown in prominence due to its potential to support inclusive, pupil-centred learning. Research shows that VR can enhance conceptual understanding by enabling learners to explore complex topics through immersive and interactive experiences. While it can increase motivation and attention, its primary value lies in supporting collaborative and meaningful knowledge construction. This presentation outlines a collaborative VR research project involving the Department of STEM Education at Mary Immaculate College and the Oide Technology in Education team. The project engaged nine senior primary classes across counties Galway and Clare, exploring how the design of multi-scene VR environments could deepen understanding of ocean conservation. Pupils participated in a six-week programme, working collaboratively to create interactive VR stories which developed their research, coding, and digital content creation skills. Generative AI supported pupils in visualising solutions to environmental challenges, and all project activities were aligned the five-phase integrated STEM learning framework in the new STEM curriculum.</p> <p>The project also emphasised teacher professional learning and learner-centred design. Teachers attended initial training sessions to build confidence in</p> |
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the use of VR tools and pedagogies, followed by a shared learning event to reflect on outcomes and showcase pupil work. The research component of the project included pupil questionnaires and focus groups, teacher interviews and an Oide Professional Learning Leader focus group. Emerging findings highlight how immersive, learner-centred design can enhance engagement, deepen understanding, and support meaningful learning about real-world issues such as ocean conservation.

**Helena O' Connor [Mary Immaculate College, Limerick]**

**STEM through a playful learning approach in the junior classes (iSTEM focus: S, T, E, M)**

This presentation explores how a playful learning approach can enhance children's awareness of engineering and related STEM fields in the primary classroom. Research suggests that embedding authentic, real-life and industry contexts within STEM learning positively influences pupils' engagement, conceptual understanding, and future aspirations in STEM (Lee and Erdogan 2007). The lessons presented demonstrate how meaningful, context-based activities can connect classroom learning with experiences in the home and wider community, recognising that learning is most effective when it occurs across multiple settings (National Research Council 2015).

There is increasing evidence that opportunities to engage with STEM beyond the classroom can significantly enrich what is possible within formal schooling (NRC, 2015). Through active participation in hands-on STEM projects, children experience science, technology, engineering and mathematics as exciting, relevant, and purposeful (Macdonald, 2014; STEM Education Review Group 2016). Such approaches have been shown to deepen engagement in science while strengthening the quality of STEM education in the primary classroom (Gomes and McCauley 2013; Stocklmayer et al. 2010). The presentation highlights how real-world STEM challenges encourage creativity, collaboration, resilience, and resourceful problem-solving. By working on authentic problems, pupils develop essential scientific concepts and inquiry-based skills while increasing their interest and confidence in STEM learning (Ramirez 2013). In doing so, education moves beyond knowledge acquisition towards empowering young people to become future problem-solvers capable of creating solutions to real-world challenges (Prensky 2016; Weil 2016).

## Room 2: T214

**Ayşegül Liman Kaban [Mary Immaculate College, Limerick]**

**Tugce Aybikem Kiran [Bahcesehir University, Istanbul, Turkiye]**

**Leila Jedi Sari Biglar [Bahcesehir University, Istanbul, Turkiye]**

**Creating Interactive Learning with Mixed Reality in Primary Education (iSTEM focus: S, T, E, M)**

Mixed reality (MR) technologies are increasingly positioned as promising tools for creating interactive, collaborative, and a multimodal learning experiences in education. Despite growing interest, there remains limited evidence regarding how learners experience MR applications in authentic classroom settings, particularly in primary education. This study, conducted within the MIXAP-EU project, explored student perceptions and usability experiences of an MR-supported English as a Foreign Language (EFL) activity implemented with two learner groups in Türkiye: 13 fifth-grade primary school students and 45 university preparatory school students. The A2 level vocabulary activity was designed around collaborative gameplay and

interactive matching tasks using the MIXAP platform. Students worked in small groups and used mobile devices to scan printed question and image cards through a camera-based MIXAP interface. The activity required learners to match clues and visuals with corresponding professions while engaging in discussion and collaborative problem-solving. Following the activity, participants completed a Turkish adaptation of the System Usability Scale (SUS), a recommendation item, and three open-ended reflection questions. SUS scores were interpreted using Brooke's (1996) framework and Bangor, Kortum, and Miller's (2009) adjective rating scale, while qualitative responses were analysed through Braun and Clarke's (2006) thematic analysis approach. Results revealed a mean SUS score of 47.88 (SD=27.02), which falls within the lower edge of the "OK" usability category. However, the findings demonstrated substantial variation in learner perceptions. While a considerable proportion of participants evaluated the platform positively, others reported significant frustration linked to technical instability during simultaneous classroom use. Thematic analysis identified technical reliability as the dominant challenge, particularly in terms of loading speed, responsiveness, and connectivity under classroom conditions. At the same time, students highlighted positive aspects of the experience, including the interactive camera-based design, game-like learning structure, and collaborative group engagement. Some participants also identified language difficulty as a challenge independent of the technology itself. The findings suggest that evaluations of MR learning environments should distinguish between technical usability issues and pedagogical or language-related task difficulty. The study further highlights the importance of reliable classroom-scale infrastructure, collaborative learning design, and appropriate language scaffolding for sustainable and effective MR integration in education.

**John Mescal & Maureen Kenneally [Hibernia College]**

**From Elective to Practice: Pre-Service Primary Teachers' Understanding of Problem-Solving and Computational Thinking as Integrated STEM Pedagogy (iSTEM focus: S, T, M)**

Ireland's new primary STEM curriculum positions computational thinking (CT) and problem-solving as integrated, cross-curricular competencies spanning technology, mathematics, and science rather than isolated digital skills. Realising this vision depends significantly on how initial teacher education (ITE) programmes equip pre-service teachers to understand and enact CT as a transferable pedagogical approach across STEM subject boundaries. This paper reports on an ongoing small-scale qualitative study exploring how primary school student teachers who completed the PME Elective (Digital Technology – Problem-Solving and Computational Thinking) within Hibernia College's blended PME programme are understanding and applying CT across STEM subjects during their final teaching practice placement. The elective explicitly develops CT as a cross-curricular skill, linking technology with mathematics through activities such as algorithmic problem-solving and Scratch-based maths puzzles, and with science through inquiry-based design challenges. The study is guided by three questions: How is the elective shaping student teachers' understanding of CT as an integrated skill across technology, mathematics, and science? In what ways are they embedding CT and problem-solving across STEM subject areas in placement classrooms? And what enablers and barriers are they encountering in translating this integrated approach into authentic practice? Data is currently being gathered through a structured reflective survey combining Likert-scale items and open-ended questions, administered to student teachers following the completion of both the elective and teaching practice. Thematic analysis is being applied to qualitative responses, examining how student teachers are making connections between CT and STEM subjects in real classroom contexts. Early findings suggest that while the elective is strengthening student teachers' understanding of CT as a technology and mathematics-linked skill, integration with science and other STEM areas remains less confident in practice. Persistent challenges include uncertainty about curriculum alignment

across subjects, limited device access, and a tendency to treat CT as a standalone lesson rather than a cross-STEM mode of thinking. The study offers timely insights into what integrated STEM curriculum reform demands of pre-service teachers and the ITE programmes that prepare them.

**Maeve Liston & Eleanor Walsh [Mary Immaculate College, Limerick]**

**Building Strong STEAM Foundations through CRAFT: How a Model of Educational Outreach and Maker Education Supports the New Primary STE Curriculum (iSTEM focus: S, T, E, M)**

Ireland's redeveloped Primary Curriculum Framework positions STEM as an integrated, inquiry-driven learning experience that promotes learner agency, experiential and play-based exploration, and authentic problem solving. The new Science, Technology & Engineering (STE) specification strengthens this further by embedding engineering design, computational thinking, project-based learning, data use, and creative technologies as core, everyday practices in the primary classroom. These shifts position primary teachers, and those who support them, as central to shaping children's early experiences of STEM and STEAM learning.

The work of the CRAFT Maker Space at Mary Immaculate College demonstrates how high-quality primary STEAM learning can be enabled through design-thinking routines, maker education practices, low-cost prototyping, accessible digital tools, micro:bit simulator challenges, and sustainability-focused integrated STEM tasks. Examples illustrate how children develop confidence with iteration, communication, collaboration, creativity, and evidence-based reasoning, competencies that underpin strong STEAM foundations.

CRAFT's outreach model also supports primary teachers through CPD, co-designed activities, and partnerships with industry and community organisations. These practical structures provide teachers with adaptable, inclusive, and meaningful approaches to implementing the STE specification.

The session will share replicable models from CRAFT that strengthen both teacher practice and pupil engagement, illustrating how a maker-centred approach can build strong STEAM foundations across the primary years.

### Room 3: T314

**Sowparnika Kulandaivel [Mary Immaculate College, Limerick]**

**Culturally Responsive Engineering Design Process (CREDP) for Science Technology Engineering and Mathematics (STEM) education Equity: A Comparative Literature Review of Ireland and Tamil Nadu, India (iSTEM focus: S, T, E, M)**

Equitable STEM education represents a critical policy imperative internationally, including Ireland and Tamil Nadu State, India which is the focus of this study. In Ireland, the non DEIS schools have higher uptake than DEIS schools in every key STEM area. Ireland's STEM Education Policy Statement 2017-2026 prioritises teacher capacity building and equitable learner engagement (Department of Education and Science, 2017). In India, students from minority background and students from tribal background comprise lower percentage points of STEM enrolment compared to their general peers. Tamil Nadu's State Education Policy (2024) emphasises STEAM education and equitable, socially just education (Government of Tamil Nadu, 2024). This Conference presentation will outline the literature review on culturally responsive pedagogy (CRP) fostering equity and diversity in STEM education, for

this emerging qualitative comparative case study between a primary school (class 5) in Tamil Nadu, India and Limerick, Ireland. This comparison will also build inclusive understanding of CRP and design-based STEM pedagogy - learning beyond Eurocentric models. Based on the policy analysis and literature review, the findings indicate that both countries' policies prioritise equity yet reveal stark disparities in STEM participation, achievement and access across marginalised students. Ireland shows DEIS students score less in Science and Math and face subject-choice gaps, while India expands higher education yet faces low school achievement and regional inequalities. From the findings, Ladson-Billings, G. (1995b) CRP emerge as a tool for operationalising equity commitments and academic achievements in STEM learning for marginalised students through Culturally Responsive Engineering Design Process (CREDP) (Manuel et al., 2023). Research demonstrates that culturally responsive engineering design teaching leads to improved learning outcomes particularly for marginalised students. Globally, teachers value culturally responsive STEM pedagogies but face systemic preparation barriers. Unaddressed deficit beliefs among teachers about marginalised students' capacity remain persistent barriers to meaningful STEM participation both in India and Ireland.

**Clodagh Cleary [Mary Immaculate College, Limerick]**

**Broadening Students' Conceptions of STEM Beyond Subject Boundaries (iSTEM focus: S, E, M)**

A persistent challenge in STEM education is that students often conceptualise the STEM disciplines as discrete, subject-bound domains. This study examines how participation in integrated, design-based STEM tasks was associated with shifts in primary students' representations and understandings of STEM.

Using a mixed-methods design, data were collected from an intervention group and two comparison groups through student drawings, focus groups, and observational data. Prior to the intervention, students' representations of STEM were narrow and highly subject-bound, with many expressing uncertainty or depicting routine classroom practices such as mathematics worksheets. These patterns reflect limited prior exposure to integrated STEM within the primary curriculum.

Following a 10-week intervention involving contextualised, hands-on design challenges, students' representations shifted toward active, applied forms of STEM engagement. Drawings and focus group responses increasingly depicted hands-on problem-solving, collaboration, and design-based activity. Comparisons with control groups suggest that these shifts were associated with sustained engagement in integrated STEM tasks, as students without such exposure continued to rely on mathematics-focused representations.

While these changes reflect emerging rather than fully developed understandings, the findings suggest that experiential engagement in integrated STEM can broaden how students conceptualise STEM beyond traditional subject boundaries. The study highlights the role of sustained, design-based experiences in supporting students to recognise STEM as an interdisciplinary and applied form of activity, with implications for curriculum design and classroom practice in primary education.

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**STEM for All: Promoting Meaningful Integrated STEM Learning Through Parental Involvement (iSTEM focus: S, E)**

The past decade has seen notably advancement in STEM education, characterised by significant policy and curricular reform. In particular, the introduction of the new STEM curriculum launched in September 2025 has placed an emphasis on STEM education within the Irish primary school context. Given the central role parents play in shaping children's early science experiences (Crowley et al. 2001), and the significant influence of parental involvement on children's STEM learning (Zucker et al. 2024), the primary focus of this research project is to investigate children's STEM education experiences through meaningful integrated STEM learning in an Irish DEIS (Delivering Equality of Opportunity in Schools) Band 1 school, with parental involvement.

The research employs a case study approach in a DEIS primary school over several months. This study adopts qualitative research methods, drawing on semi structured focus group interviews, interviews, questionnaires, observations, visual methods, and reflective diary entries as data collection methods. It also incorporates action-based research cycles to guide the iterative design and refinement of the integrated STEM lessons. The intervention consists of six integrated learning activities based on real-world STEM challenges, delivered as a family learning session involving one classroom and their parents as part of a single-case study design. The planning of subsequent integrated STEM lessons followed the Action Research Cycles (Kemmis and McTaggart 1988). Observations, researcher reflections, and visual artefacts- such as collaborative family designs, photographs, and work samples informing ongoing adaptations to subsequent lessons. As the intervention is currently in its initial phases, the presentation will focus on the research design and outline three examples from the completed integrated STEM lessons.