

The relation between storytelling, spatial ability and its gender gap: a literature review

Original

The relation between storytelling, spatial ability and its gender gap: a literature review / Duffy, Gavin; Ballatore, MARIA GIULIA. - ELETTRONICO. - (2019), pp. 16-16. (Intervento presentato al convegno Mathematical Literacy Throughout and Beyond Education tenutosi a Dublin, Ireland nel 11-12/11/2019).

Availability:

This version is available at: 11583/2980131 since: 2023-07-10T09:35:35Z

Publisher:

DCU Institute of Education

Published

DOI:

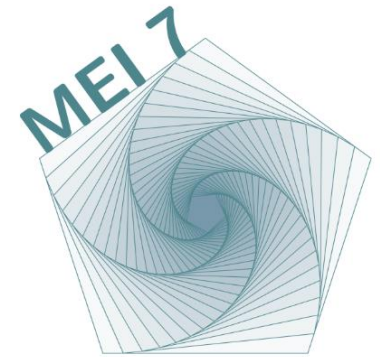
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Seventh Conference on Research in Mathematics Education in Ireland



MEI 7

BOOK OF ABSTRACTS

Research Reports
OCTOBER 11TH & 12TH | 2019

MEI 7 is kindly sponsored by the Centre for the Advancement of STEM Teaching & Learning (CASTeL) and the National Council for Curriculum and Assessment (NCCA).

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PARALLEL SESSION 1.A (E203)

UNEXPECTED CONSEQUENCES OF PROVIDING ONLINE VIDEOS IN A SERVICE MATHEMATICS MODULE: WHAT ONE LECTURER NOTICED

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University College Dublin, Ireland.

This study describes how brief-but-vivid accounts of incidents kept over three consecutive offerings of a large, first year, service mathematics module, were analysed and three unexpected consequences of making online videos available to students were identified in the BBV accounts written during the third offering of the module. It was in this offering that students, for the first time, were given the option of attending lectures or watching online videos or both. The first unexpected consequence relates to how the lecturer struggled to view poor attendance at lectures differently; the second to a difference, observed by the lecturer, in the way that students engaged with tasks during lectures; and, the third, to how the lecturer realised that videos could be used to encourage students to take more responsibility for their learning. Though these changes could be described as subtle, they have not been reported in the literature relating to the provision of online lectures as an extra resource to university students. The study also provides an example of how the Discipline of Noticing can be used as a professional development tool for those implementing initiatives in their teaching.

DILEMMAS EXPERIENCED IN LECTURING UNDERGRADUATE CALCULUS

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We consider a set of accounts written by two university lecturers describing incidents that took place during their first-year Calculus modules. Analysis of these accounts revealed that the lecturers had to make some difficult decisions while teaching. These situations sometimes involved choices between two or more alternatives each of which had disadvantages. We labelled these choices 'dilemmas'. Here we present and discuss the three most common types of dilemma evident from our data: namely, balancing good practice in teaching with students' feeling of discomfort; balancing the needs of students with different backgrounds; balancing time constraints and active participation by students.

AN INVESTIGATION INTO THE PROBLEM-SOLVING CAPACITIES OF PRE-SERVICE POST-PRIMARY MATHEMATICS TEACHERS: IMPLEMENTATION OF TAUGHT STRATEGIES

Emma Owens and Brien Nolan

Dublin City University, Ireland.

In this study, we report on the ability of nine pre-service post-primary mathematics teachers on a concurrent, initial teacher education programme in an Irish university to apply the ‘Rubric Writing’ approach to solving mathematical problems of (Mason, Burton, & Stacey, 2011). The conceptual framework of the study draws on (Chapman, 2015), who identifies different characteristics that underpin the effective teaching of mathematical problem-solving. Included here is the capacity to solve problems effectively. The participants in the study had previously received instruction on problem-solving in a formal university module, focussing on the ‘Rubric Writing’ approach. Each participant undertook two mathematical problems in a ‘Think Aloud’ manner in recorded interviews. The interviews were then analysed for evidence of implementation of the ‘Entry’ phase of this approach. We report on this analysis and on how it will be embedded in the ongoing research project.

PARALLEL SESSION 1.B (E205)

LESSON PLAY: SUPPORTING PRE-SERVICE TEACHERS TO ENVISAGE PUPILS’ SENSE-MAKING IN MATHEMATICS LESSONS

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In this paper the potential of Lesson Play in mathematics teacher education is explored. Through the process of script writing in Lesson Play, teachers imagine their own responses to classroom situations. We describe how script writing has the potential to help pre-service teachers envisage ways in which pupils make sense of mathematics, and become more aware of the teacher moves that allow pupils to articulate and modify ideas in mathematics lessons. We analyse the lesson script of one pre-service teacher with reference to Grice’s Conversational Maxims, and discuss ways in which Lesson Play can be developed to further enhance pre-service teachers’ ability to facilitate classroom discussions.

DEVELOPING MATHEMATICAL LITERACY: A REPORT OF THE POTENTIAL USE OF LESSON STUDY WITHIN ITE

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All students should have access to quality mathematics education. Given the documented impact teachers have on learning outcomes in mathematics, it is essential that initial teacher education develop the relevant knowledge and aptitudes among pre-service teachers to facilitate them to teach mathematics effectively. This paper focuses on the potential role of Lesson Study within initial teacher education in meeting this goal. In particular, we examine the various opportunities and benefits that are available to each of the ‘partners’ engaging in Lesson Study. Over a decade we have explored the benefits of Lesson Study using a three-tier teaching experiment approach (Lesh & Kelly, 2000). This approach facilitates insights into the effects of participation in Lesson Study from the perspectives of the three partners: teacher educator, the student teacher and the pupils.

THE DEVELOPMENT OF A SET OF LOW-INFERENCE CODES FOR UNCOVERING STUDENTS’ UNDERSTANDING OF LINEAR EQUATIONS: FACILITATING COMPARATIVE ANALYSIS

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In this paper, our goal is to present a methodological contribution to the analysis of students’ linear equation solving competence. While other studies have employed a variety of frameworks for analysing students’ understanding of this important topic, none have been able to distinguish between solutions based on ‘doing the same to both sides’, ‘swapping the side swapping the sign’ or both. Here we describe the development of a set of low-inference codes that facilitate not only this distinction but also the analysis of their interactions. By way of example, data derived from first year primary teacher education students from a large Swedish university are analysed. The results confirm the framework’s ease of operation and its propensity for uncovering the complex understandings students have of this important transitional topic. Some implications for cross-cultural studies of students’ equations-related knowledge are discussed.

PARALLEL SESSION 1.C (E206)

WHAT'S THE POINT: EVALUATING THE IMPACT OF THE BONUS POINTS INITIATIVE FOR MATHEMATICS

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Since 2012 mathematics has been assigned a special status within Irish post-primary education with the introduction of a Bonus Points initiative (BPI). Students are now awarded an extra 25 CAO points in their upper post-primary school state examination results if they achieve a passing grade at higher-level. These extra points will increase the likelihood of these students getting a place on the course of their choice at third level. This incentive was introduced to encourage students to study the subject at higher-level. Anecdotally there have been many mixed reviews about the success of the BPI. While the numbers taking HL mathematics have steadily increased, there have been concerns expressed that many students who are not mathematically capable of performing up to the standard required are now opting for the HL paper and that the difficulty of this examination and the marking schemes have been adjusted accordingly (Treacy, 2018). This paper reports on a national study, the first of its kind in Ireland, that was conducted to investigate teachers' perspectives (n = 266) on the BPI. The authors will investigate if the increase in the number of students studying higher-level mathematics in Ireland has occurred in tandem with an increase in the mathematical proficiency of post-primary students and will ascertain the impact of the BPI on the profile of higher-level mathematics classes. It will report on findings from a national study.

WHAT PISA MAY TELL US ABOUT MATHEMATICAL LITERACY IN AN ERA OF DATA SCIENCE

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The demands of mathematical literacy are responsive to the context in which they are used. For many decades, this context has remained largely stable, especially for classroom mathematical practices. Increasingly, changes in science and engineering have begun to redefine mathematical literacy – changes that are most evident in the emerging field of data science. This paper reviews emerging definitions of data science, and their implications for the workplace and scientific research and development. It will use a report on Junior Cycle Project Maths (viewed through the lens of PISA 2016) as an approximate indicator of where Irish students stand on certain elements of data science.

INVESTIGATING THE LONGITUDINAL IMPACT OF PARTICIPATING IN SCHOOL-BASED LESSON STUDY ON MATHEMATICS TEACHERS' PROFESSIONAL COMMUNITY

Emily Lewanowski-Breen, Aoibhinn Ní Shúilleabháin and Maria Meehan

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Teacher professional communities have recently figured among the most influential factors for supporting teachers in their learning and in enacting educational change in schools. While lesson study has been documented as a means to support the development of such communities, previous studies have not addressed the sustainability of the professional communities which emerge. In this study, we follow-up with six mathematics teachers from two post-primary schools in the Republic of Ireland, who engaged in school-based lesson study in 2012/13, in order to investigate the long-term impact on their teacher professional community. Our findings indicate that the mathematics teachers in both schools had developed a predominantly mature professional community during their participation in lesson study in 2012/13. Moreover, we find that six years on, the community has been sustained in one school and further strengthened in the other. These findings suggest that lesson study may be a viable model to develop and sustain mathematics teachers' professional communities in the long-term.

PARALLEL SESSION 2.A (E203)

INVESTIGATING COGNITIVE DEMAND OF HIGHER-LEVEL LEAVING CERTIFICATE MATHEMATICS EXAMINATION TASKS PRE- AND POST- CURRICULUM REFORM

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In 2010 the phased introduction of the new Project Maths curriculum began in post-primary schools in Ireland. This new curriculum aimed to enable students to develop problem-solving skills by providing relevant, contextual applications of mathematics, while simultaneously increasing the levels of cognitive demand required of students. This research aims to investigate whether the levels of cognitive demand required to complete tasks in the Leaving Certificate Higher-level mathematics examinations changed as a result of the curriculum reform. The methodology of this research includes the systematic analysis of Leaving Certificate examination tasks, from 2007 to 2017, using an adaptation of the Stein and Smith (1998) task analysis framework. Using this framework, tasks were classified as being of high-level or low-level cognitive demand. Analysis of the data collected suggests that a statistically significant increase in the levels of high-cognitive demand tasks did occur following the curriculum reform. Our findings are discussed in relation to two recent studies that used different frameworks to examine the cognitive demand of tasks in post-primary mathematics.

"MODERN MATHS" AND "PROJECT MATHS": POLAR OPPOSITES OR MIRROR IMAGES?

Elizabeth Oldham

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The “Project Maths” curriculum initiative, affecting post-primary mathematics education in Ireland from 2008 and fully established only by 2018, has attracted much attention. Unlike reforms in the preceding 30 years, it involved a fundamental critique of the nature and purpose of mathematics education and addressed both junior cycle and senior cycle at the same time. The resulting curriculum has been contrasted with that reflecting so-called “Modern Maths”, introduced in Ireland in the 1960s and 1970s. However, in this paper, it is argued that the two initiatives (while differing in some key respects) had many features in common, and that the vision and excitement around the earlier development has been lost – and its purpose misunderstood – over the intervening years. As well as aiming to re-establish the historical narrative, the paper addresses the issue of faithfully implementing curricula, especially those infused by a vision of their subject area not necessarily shared by teachers.

HIGH ACHIEVING STUDENTS IN LEAVING CERTIFICATE MATHEMATICS: WHY HAS THE GENDER GAP WIDENED?

Aidan Roche

Technological University of Dublin, Ireland.

Research has identified a gender gap in the mathematical attainment of post-primary students around the world, favouring male students. In Ireland, following a review of the outcomes of a high-stakes examination taken by students at the end of post-primary schooling over an 18-year period, a similar such gap has been identified here and is widening. Data are presented to show that this gender gap widened with the introduction of a revised post-primary mathematics curriculum, colloquially known as Project Maths. This paper explores potential reasons behind the widening gap. Problem solving appears to be the pivotal issue and spatial ability may be a contributory factor. Addressing students’ spatial ability is explored as a way to address the gender gap and enable students to reach their full mathematical potential.

PARALLEL SESSION 2.B (E205)

MATHEMATICAL IDENTITY OF SCIENCE AND ENGINEERING STUDENTS IN AN IRISH UNIVERSITY

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This paper presents the initial findings of my PhD study investigating science and engineering undergraduates' relationship with mathematics and the contexts that inform this relationship. Thirty-two students completed an online questionnaire consisting of three open-ended questions. The data were analysed using thematic analysis with both inductive (data-driven) and deductive (theoretical) coding. A summary of the background, theoretical perspective and conceptual framework will be presented followed by some initial results. Student responses illustrating two emergent themes will be described.

CURRENT ISSUES IN PRE-SERVICE PRIMARY TEACHERS' PREPAREDNESS FOR TEACHING MATH: A DISCUSSION ON GEOMETRY AND SPATIAL SKILLS AND RELATED ANXIETIES

Rachel Harding and Brian Bowe

Technological University Dublin, Ireland.

This paper gives an overview of studies that investigate the relationship between the cognitive skills of geometry and spatial ability in pre-service primary teachers. These studies then extend to cover the affective factors of math and spatial anxiety in pre-service teachers, and how both these cognitive and affective factors influence their teaching practice. Finally, intervention style studies are discussed as a possible solution to building and developing these cognitive skills and reducing the effects of anxiety in teaching math and related STEM (Science, Technology, Engineering and Mathematics) subjects. Recommendations for further work and possible implications for teacher preparedness and teacher training is discussed.

ESCALATING INTERVENTIONS TO IMPROVE BEHAVIOUR AND PERFORMANCE IN AN UNDERGRADUATE STATISTICS MODULE

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In this study, we present the implementation of an early warning system in a large introductory statistics module which is escalated over four semester offerings. An early warning system identifies students who are at risk of failing or dropping out of a module, and provides them with supporting interventions. While familiar undergraduate mathematics supports include formative assessment and peer-assisted learning, our interventions tried to encourage student engagement through personalised emails which detailed supports and how students were progressing in the module. In later escalations, at-risk students received weekly

emails encouraging them to use the Maths Support Centre. We believe our module-based interventions had limited impact upon the at-risk students. In hindsight, we believe these students needed programme-level interventions. Overall, this study provides insights for others into implementing learning analytics interventions.

PARALLEL SESSION 2.C (E206)

BEING ABLE TO DO MATHS BUT YET FEELING KIND OF FREE: USING THE FLAGWAY GAME TO LEARN MATHEMATICS

Majella Dempsey and Ann O'Shea

Maynooth University, Ireland.

Over a two-year period in 2016 and 2017 a team led by Bob Moses worked with teachers in Ireland on a project called The Algebra Project. This paper reports on the implementation of the Flagway Game in two primary schools in Ireland as part of this initiative. Data from teacher interviews and student focus groups are analysed using the theoretical framework of Engeström's activity theory (1987). The findings show that both the physical and mental tools developed by Moses and colleagues do function to develop mathematical thinking and improve enjoyment in learning mathematics. Challenges exist in the form of rules that mitigate against devoting the time needed for this kind of engagement and physical infrastructure to support social learning through physical activity.

OPPORTUNITIES FOR YEAR ONE CHILDREN TO ACQUIRE FOUNDATIONAL NUMBER SENSE: COMPARING ENGLISH AND SWEDISH ADAPTATIONS OF THE SAME SINGAPORE TEXTBOOK

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We compare adaptations of a Singaporean year-one mathematics textbook for use in England and Sweden respectively. The texts were analysed in two different ways against the eight dimensions of Foundational Number Sense (FoNS), a set of core competences that the literature has shown to be necessary for year-one children's later mathematical learning. The first analysis, based on frequencies, showed that neither adaptation incorporated any opportunities for children to acquire the two FoNS competence relating to estimation and number patterns respectively. They also showed that the English adaptation comprised significantly more tasks than the Swedish, particularly with respect to systematic counting, where the former comprised 26% more tasks than the latter. The second analysis, based on moving averages, showed that across five of the six FoNS categories for which there were data, the temporal location and emphases of FoNS-related learning were comparable, with, in particular, no such opportunities after the mid-point of the school year in either book. However, the English adaptation's presentation of systematic counting, occurring at various points throughout the school year, was substantially different from the Swedish adaptation, highlighting differences due, we speculate, to interpretations of local didactical traditions.

THE INFLUENCE OF HOME FACTORS ON MATHEMATICS OUTCOMES IN MULTIGRADE CLASSROOMS

Breed Murphy and Aisling Leavy

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Multigrade classrooms are a significant feature of the Irish educational landscape in primary schools, particularly in rural settings. Conflicting results are reported from studies analysing academic achievements of students in multigrade classrooms. While it is widely reported that students in single-grade and multigrade classes achieve similar results in academic achievement tests, recent research has suggested that this is not true in all situations. It has been noted that longitudinal studies have revealed unstable outcomes in student achievement. The aim of this study is to explore the academic outcomes for children in multigrade settings in small schools in Ireland drawing on data from two waves of the ‘Growing Up in Ireland’ (GUI) study. In 2007, the first wave involved a nationally representative sample of 8568 nine-year old children, 1,250 of whom were being educated in multigrade classrooms in small schools. Four years later, over 1100 of these multigrade children participated in the second wave of the study. In this paper, measures of mathematics norm-referenced tests undertaken by the children at age 9 and age 13 are analysed. In addition, home factors are also explored. The outcomes for children in multigrade classes in small schools are compared with their single-grade counterparts. The data provide significant insight into the academic achievements of the students involved in the study as well as home factors which influence their achievement.

PARALLEL SESSION 3.A (E203)

COOPERATIVE LEARNING IN INCLUSIVE SETTINGS IN PRIMARY MATHEMATICS – CONNECTING TASK DESIGN AND STUDENTS’ SOLUTION STRATEGIES

Nina Flottmann

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As a primary teacher I find myself in an area of conflict between the heterogeneity of the primary students – irrespective of their specific intellectual, physical and social-emotional capacities, the design of tasks and learning environments and the aim to allow for cooperative learning, which plays an important role for motivation, development of social skills and social integration in school. Hence, the design-based research project that forms the basis of this paper seeks to investigate cooperative learning processes in inclusive classroom settings. Two crucial aspects of the study are the task design and the monitoring and documentation of children’s solution strategies in cooperative settings.

SUPPORTING MATHEMATICAL LITERACY IN POST-PRIMARY SCHOOLING: ISSUES TO CONSIDER WHEN USING A CO-TEACHING APPROACH

Audrey Carty and Ann Marie Farrell

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This paper reports on the evaluation of co-teaching as a model for supporting mathematical learning from the student perspective. Research instruments included student surveys and focus group interview, along with semi-structured observations of lessons. The findings indicated consensus from students, both with and without SEN, that co-teaching was a favourable way of delivering mathematics lessons. Benefits included increased opportunities to get a teacher's attention; being more comfortable asking questions; greater range of learning experiences; and, the availability of assistance in a discreet way. These benefits afforded by the use of co-teaching provide learning contexts for developing mathematical literacy skills.

STEM FOR FUN

Mairéad Holden

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STEM education has become a hot topic, to the point where it has been described as an area of “universal preoccupation” (English, 2016). However, equality of access to STEM Education and STEM careers is not universal. Lack of access to STEM Education and careers is especially challenging for struggling learners in DEIS settings. The STEM for Fun project explored the effectiveness of a small-group DEIS-centric programme designed to develop primary pupils' engagement, critical thinking skills and language using STEM-based activities over a six-week period. This paper reports on one of the aspects of the STEM for FUN project: pupils' engagement. The project was undertaken in a DEIS Band 2 Urban primary school in North County Dublin with three 4th class pupils, all of whom were categorised as “struggling learners” according to their performance in standardised Maths and English tests. Analysis of data suggests that the STEM for Fun intervention had a positive effect on participants' engagement in STEM learning and that the STEM for Fun tasks also supported the development of positive learning dispositions.

PARALLEL SESSION 3.B (E205)

PLANNING FOR TEACHING EARLY MATHEMATICS: NEGOTIATION OF SHARED INTENTIONS

Siún Nic Mhuiri¹, Thérèse Farrell¹, Córa Gillic^{1,2} and Mary Kingston¹

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This paper uses thematic analysis to investigate how shared intentions for the Maths4all project were negotiated. Individuals or pairs prepared seven mathematical activity guides for preschool and primary school groups. These plans were then reviewed in team meetings using the Teaching for Robust Understanding framework (Schoenfeld, 2013) as a conversation guide. Thematic analysis of field notes taken at these meetings shows that the framework acted as a catalyst for discussions in which the ideological focus of the project became more defined. Other key themes that informed this development included looking across primary and preschool contexts; consideration of teacher interpretation of project output; the curricular context; and interrogation of frequently used language.

CONSULTING CHILDREN: MATHS AND ME

Marie Brennan

Department of Education and Skills, Ireland.

This paper examines what teaching and learning mathematics 'looked like' and how it was experienced by children across eight Irish primary classrooms at second (7 and 8 years old) and fifth (10 and 11 years old) class level. Children are at the heart of the learning process and can provide important views of the curriculum and of the teaching and learning. Exploring children's experiences of teaching and learning provide insights into the difficulties and challenges children experience in their learning. A total of twenty four mathematics lessons were observed, while eighteen mathematics lessons were video recorded. Focus group interview with children, child questionnaires and drawings were also employed in the data collection. For the majority of children in this study mathematics is little more than calculation and number work. Despite the Primary Mathematics curriculum advocating mathematical processes such as problem solving, developing logic and reasoning, and communicating mathematical ideas, in this study few children talked about mathematics in this way. Children's beliefs about mathematics are determined by the mathematics they encounter, the tasks in which they encounter it and their disposition towards mathematics as a result of previous encounters.

THE RELATION BETWEEN STORYTELLING, SPATIAL ABILITY AND ITS GENDER GAP: A LITERATURE REVIEW

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Spatial ability is a good predictor of STEMM career, but how can it be developed in early childhood? The role of storytelling in early education has been found to be a good example of thorough integrated learning, also in relation to spatial thinking. The aim of this literature review is to identify the impact that this methodology has on spatial thinking development in relation to mathematics content. First, the spatial ability characteristics are defined, and the emerging sex differences identified. Then the narrative approach is introduced both in general terms and in an early education context by considering in particular geometry storybooks. Finally, concurrent development of literacy skills through storytelling are also discussed.

PARALLEL SESSION 3.C

TIPPING THE SCALES: AN EXAMINATION OF TEXTBOOK TASKS IN THE CONTEXT OF CURRICULUM REFORM

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This paper is concerned with the analysis of mathematical textbook tasks at second level in Ireland, in the context of the introduction of the revised curriculum initiative entitled ‘Project Maths’. A total of 7635 tasks on the topics of Pattern, Sequences and Series and Differential Calculus contained in three textbook series for senior cycle, in editions available before and those available after the curriculum change, were analysed. The analysis presented here was informed by the use of a framework: Usiskin’s multidimensional model of mathematical understanding (Usiskin, 2012). The research question considered is: what kind of understanding (using Usiskin’s dimensions) is being promoted in the tasks analysed? The use of high-quality tasks that promote understanding helps to maintain a high level of mathematical literacy. My findings suggest that the post-‘Project Maths’ textbook tasks offer greater opportunities in the area of mathematical understanding when compared to those in the older textbooks, but that there is still scope for further development. Based on my analysis, it would appear that all three textbook series have neglected important aspects like reasoning-and-proving and real life applications. Furthermore, the findings indicate that there is a need for more balance in tasks to ensure greater proficiency in mathematical literacy.

DEVELOPING A PROBLEM-SOLVING MODULE IN MATHEMATICS FOR HIGHLY-ABLE POST-PRIMARY SCHOOL STUDENTS

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Even with the introduction of a new mathematics syllabus at post-primary-level in Ireland, there has been ongoing doubt raised as to the effectiveness of our mathematics education for highly-able students. Prior research has indicated the use of problem-solving and open-ended questioning as important tools in students' mathematical development. This paper discusses the design of a module for post-primary students using these methods.

THE “N” FRAMEWORK – A POTENTIAL SOLUTION TO NUMERACY ACROSS THE CURRICULUM

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Numeracy is often referred to as an essential skill that all people should possess in order to engage fully in society. Governments and policymakers around the world are encouraging teachers to teach numeracy across the curriculum. This paper proposes a theoretical framework of teacher knowledge for the integration of numeracy across the curriculum in post-primary schools in Ireland. Teacher knowledge is complex and consists of many different facets of knowledge. The proposed framework integrates theories from existing models of general teacher knowledge (Shulman, 1986), with models of subject specific teacher knowledge (Ball, Thames and Phelps, 2008), and with a numeracy model developed by Goos, Geiger and Forgasz (2014). This enabled the authors to develop an integrated framework of numeracy knowledge and skills, subject-specific knowledge and pedagogical content knowledge which are all essential components of knowledge for teaching in the 21st century. Teachers need to have a deep understanding of these different types of knowledge to teach students effectively in any subject across all subjects.

PARALLEL SESSION 4.A (E203)

INVESTIGATING THE EFFECTS OF SHARED PICTURE BOOK READING ON PARENTAL INVOLVEMENT IN MATHEMATICS

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The intervention described in this paper facilitated mathematical discussions between parents and children within the context of picture books. Parental involvement has been shown to have the potential to impact significantly on a child's attainment in school (Epstein, 1995; Anthony & Walshaw, 2007). The intervention took place in a rural school in County Kildare and lasted for three weeks. The research focus encompassing the intervention was the parents'

involvement with their children's mathematical learning. Data collection included parent interviews and a reflective journal maintained by the teacher-researcher. Findings indicated that the majority of parents felt they were more involved in their child's learning of mathematics through the intervention. Furthermore, the participants noticed a number of benefits when using the picture books, including a greater understanding in children's mathematics, the children having a greater motivation to do mathematics, and an increase in mathematical discussions.

FACILITATING MATHEMATICAL DISCUSSION THROUGH THE USE OF PICTURE BOOKS IN AN IRISH SENIOR INFANT CLASSROOM

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This study explored how mathematical discussion could be facilitated through the use of picture books in a senior infant classroom. A qualitative inquiry was conducted over a three-and-a-half-week period in a large urban disadvantaged junior primary school in Ireland. Data comprised of observations of the children as they engaged in small groups during mathematics lessons. The data was collated by the methods of observations in situ, video recordings and extended fieldnotes. The findings of this research indicated that children's participation in a mathematical discussion can support the development and use of mathematical language and also support their mathematical literacy. Evidence revealed that mathematical discussion also supports children's mathematical thinking through the engagement in mathematical processes such as problem-solving, reasoning and connecting. The findings of this research have implications for early childhood mathematics policy and curriculum which advocate the need for increased opportunities for children to engage in mathematical discussion. One effective pedagogy to facilitate mathematical discussion is the use of picture books which support young children's overall mathematical proficiency.

PARALLEL SESSION 4.B (E205)

THE MKT AND BELIEFS ON PROBLEM SOLVING OF IN-SERVICE TEACHERS

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The research involved nine teachers of primary school and one teacher of secondary school, first grade. The teachers have been interviewed twice on issues relating the Mathematical Knowledge for Teaching (MKT) and on their beliefs about mathematics, its teaching and its learning. The interviews on the MKT were based on nine hypothetical scenarios where teachers have to interpret and remediate to students' errors or to help students in difficulty. In this article we focused on one of the nine scenarios that can best investigate mathematical literacy of three teachers chosen in relation to their beliefs of mathematics as problem solving.

POST-PRIMARY TEACHERS' MOTIVATIONS FOR FLIPPING, AND CONTINUING TO FLIP, THE MATHEMATICS CLASSROOM

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The “flipped classroom” model is being implemented in educational settings internationally. In this model, the in-class and out-of-class activities of the traditional classroom are “flipped” – students might watch videos out of class, and work on tasks in class. Despite its popularity, research is mainly focused at higher education, and little is done in the Irish context. In this study, through one-to-one interviews with six post-primary teachers who have flipped their mathematics classrooms, we explore their initial motivations for doing so, and examine what motivates them to continue or discontinue the practice. Anticipated benefits, external factors, and being inspired by another, were given as motivations for initially flipping, while an improved classroom culture and perceived pedagogical benefits were reasons given for continuing the practice. Lack of time was a factor in teachers’ decisions to discontinue. For the four who continue to “flip”, their practice has evolved in a number of ways: a transition from using others’ videos to making one’s own; a decrease in frequency of flipping; and, an increase in the use of active learning in class. The teachers express a desire to belong to a community of flipped classroom practitioners, in order to share experiences and resources, particularly mathematical tasks.

PARALLEL SESSION 4.C (E206)

MATHS WEEK IRELAND: PROMOTING MATHEMATICAL LITERACY, THROUGHOUT AND BEYOND EDUCATION

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Maths Week Ireland is an annual festival to promote maths and its applications. Particular effort is made to highlight maths for life, for careers and as part of our culture. The core message is “maths for all”, with activities inside and outside the educational system for all ages, and all abilities.

In 2018, an estimated 400,000 people participated in Maths Week Ireland. A wide range of events and activities take place, and this paper outlines these and will focus on a specific programme designed to develop pupils’ confidence in problem solving. The STEMreach Problem Solving Programme is a Transition Year programme in which the pupils work with primary pupils or first years from their own schools.

SCRATCH AND COMPUTATIONAL THINKING: A COMPUTER PROGRAMMING INITIATIVE IN A GIRLS PRIMARY SCHOOL

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In recent years there has been an unprecedented push to improve the quality of education, and revitalise interest, in STEM. In this context, Computational Thinking has emerged as an essential twenty-first century competence, as fundamental as reading, writing and arithmetic (Wing, 2006). Mathematics has been identified as a field which can foster the development of computational thinking and the NCCA have committed to embedding computational thinking in the new primary curriculum. Educators and researchers have adopted two main approaches to teaching computational thinking: plugged activities (programming) and unplugged activities (without technology). The aim of this research is to assess what benefits, particularly in relation to computational thinking, can be gained from the use of a visual programming language, Scratch, in a girls primary school. Brennan and Resnick (2012) developed a computational thinking framework that examines three key dimensions of computational thinking: computational concepts, computational practices, and computational perspectives. Using this framework, this study examined the development of students' computational thinking skills during a ten week programming initiative. Data were collected from Project Portfolios Analysis, Design Scenarios and Participant Observation. This paper describes the findings of this research study in relation to one of the key dimensions of computational thinking: computational concepts, developed by the participants as a result of engaging in the programming initiative.