



2016

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## Recommended Citation

Faulkner, F., Lane, C. & Smith, A. (2016) A CPD Programme for Out-of-Field Mathematics Teachers: programme outline and preliminary evaluations by participants. *Science and Mathematics Education Conference, Dublin City University, 16th-17th June 2016.*

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# **A CPD Programme for ‘out-of-field’ mathematics teachers in Ireland: Programme outline and initial evaluations by participants**

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This paper outlines an innovative Continuing Professional Development (CPD) programme established in the Republic of Ireland for out-of-field mathematics teachers in second-level education. Research on out-of-field mathematics teachers in Ireland conducted in 2009 (Ní Ríordáin & Hannigan) motivated the development of a unique two year, part time Professional Diploma in Mathematics for Teaching (PDMT). The PDMT was first offered in 2012 jointly by the University of Limerick (UL) and the National University of Ireland, Galway and currently has 550 graduates. The main research question that this project aimed to address was: Are teachers enrolled in the PDMT satisfied with the programme and what strengths and weaknesses of the programme have teachers identified? An online survey was developed by the PDMT at the National Centre for STEM Education (EPI·STEM), together with the Centre for Teaching and Learning in UL, to assess participating teachers’ evaluation of the programme. Initial findings regarding teachers’ opinions of this unique programme indicate an increasing satisfaction with the PDMT over time (52.5% of survey participants) after some preliminary technical difficulties. While the programme requires a significant time and work commitment which can be stressful for participants, the general consensus is that the programme is a positive means of achieving professional development and advancement as a mathematics teacher.

## ***INTRODUCTION***

In recent years, mathematics education in Ireland has experienced a period of change, chiefly, the introduction of a new mathematics curriculum at second-level education in 2010 entitled ‘Project Maths’. This new curriculum was introduced in an attempt to address Irish students’ poor mathematics performance (both nationally and internationally), inadequate conceptual understanding of mathematics, over-reliance on rote-learning and insufficient problem-solving skills (Conway & Sloane, 2006; Faulkner et al. 2010). There was a concern that mathematics education at second-level in Ireland focused on a didactic pedagogy with little emphasis on problem-solving (Lyons et al., 2003). The ‘Project Maths’ curriculum aims to “focus on developing students’ problem-solving skills. Assessment will reflect the different emphasis on understanding and skills in the teaching and learning of mathematics.” (Irish National Teachers Organisation, 2013, p.20). With the focus of the new mathematics curriculum being on conceptual understanding, there was a requirement to have

suitably qualified mathematics teachers who possessed the necessary content and pedagogical knowledge in order to teach mathematics for understanding.

For the purpose of this paper, out-of-field teachers are defined as “teachers assigned by school administrators to teach subjects which do not match their training or education” (Ní Ríordáin & Hannigan, 2011). In Ireland, the problem of out-of-field mathematics teaching exacerbated the difficulties experienced by teachers in adapting their teaching to the demands of the new ‘Project Maths’ curriculum. According to Ingvarson et al. (2004), content knowledge and pedagogical skills play a vital role in a teacher’s classroom practice. Ní Ríordáin and Hannigan (2009) surveyed 324 second-level mathematics teachers in Ireland and discovered that 48% of these teachers did not have a mathematics teaching qualification. The majority of out-of-field mathematics teachers were qualified science or business studies teachers, and had subsequently been assigned to also teach mathematics classes in their schools. The out-of-field mathematics teachers surveyed, primarily taught mathematics at Junior Cycle – the first three years of second-level education in Ireland (Department of Education and Skills, 2015). While qualified mathematics teachers tended to teach exam years and Senior Cycle students (the last two years of second-level education), there was clearly a need for specialized mathematics teachers at Junior Cycle, particularly crucial to improve student learning and to increase the number of students studying mathematics at higher level (Ní Ríordáin & Hannigan, 2009). The dearth of expertise in mathematics teaching at Junior Cycle may also be seen in the lack of significant change in students’ mathematics test scores between entry to second-level school and the Junior Certificate (Kenny et al, 2009).

### ***THE PROFESSIONAL DIPLOMA IN MATHEMATICS FOR TEACHING***

Continuing professional development (CPD), previously called in-service education or training, is understood to include all forms of professional learning undertaken by teachers beyond the point of initial training (Craft, 2002). Some of the main reasons for undertaking CPD include: to improve the job performance skills of an individual teacher; to develop the professional knowledge and understanding of an individual teacher; and to enable teachers to anticipate or prepare for change (Craft, 2002). As a means of addressing the issue of out-of-field mathematics teaching in Ireland, as well as the new demands of ‘Project Maths’, the Professional Diploma in Mathematics for Teaching (PDMT) was designed and implemented by the National Centre for Excellence in Mathematics and Science Teaching and Learning (NCE-MSTL), now the National Centre for Stem Education (EPI·STEM) based in the University of Limerick (UL). This unique program was specifically designed to upskill teachers who are currently teaching mathematics, but whose teaching qualification does not include mathematics. This university accredited professional diploma (Level 8) has been delivered nationally since 2012, in a blended learning mode through local nodes in 14 associate partner institutions located throughout Ireland, in face-to-face and/or on-line modalities. The PDMT is offered through the medium of Irish and English

and is funded by the Department of Education and Skills (DES). The aims of the PDMT are to ensure that successful candidates:

- acquire the extensive and complex integrated knowledge base including mathematical and pedagogical knowledge that is necessary for effective mathematics teaching at post-primary level with special reference to ‘Project Maths’,
- demonstrate an ability to integrate this mathematics knowledge for teaching into professional practice as mathematics teachers,
- develop a high standard of practical competence in mathematics teaching as reflective practitioners during their programme of study.

There has been a trend in the field of CPD towards a greater emphasis on needs identification (prior to the CPD event) and evaluation and follow-up (after the CPD event) (Craft, 2002). The PDMT was specifically established to address the national need to upskill out-of-field mathematics teachers and for each cohort of teachers who have enrolled in the course, participants were asked to complete an online evaluation of the programme after completing their first of two years. The value and importance of evaluating CPD initiatives for international learning has been highlighted in research (Goodhall et al, 2005). In the following section, the online evaluation of the PDMT by participants is outlined.

### ***METHODOLOGY***

An online survey was developed by the PDMT, together with the Centre for Teaching and Learning in UL, to assess teachers’ evaluation of the programme under the headings of:

- Programme particulars,
- Module specifics,
- Overall satisfaction.

The survey is chiefly quantitative in nature, consisting of fixed-response, Likert-type items within each of the three headings. In completing the survey, teachers were requested to rate various elements of the programme using the scale: 1 = Strongly Disagree; 2 = Disagree; 3 = Unsure; 4 = Agree; 5 = Strongly Agree. All items were positively worded and thus, a higher score on the survey indicates greater satisfaction with the programme. The teachers’ responses to the online survey were coded and analysed using Microsoft Excel. The survey also included two open-ended items that asked teachers for any additional comments they had regarding the programme and for any advice they would offer to future participants of the programme. The responses to these open-ended items were qualitatively reviewed and trends in responses were identified using the constant comparative method of analysis.

Teachers enrolled in the PDMT were requested to complete this online survey after their first year on the programme, and to date, this constitutes three cohorts of teachers. Of these three cohorts, 65.6% completed the online survey.

The first research question that we aim to address in analyzing the data from the online survey is: “Are teachers enrolled in the PDMT satisfied with the programme and what strengths and weaknesses of the programme have teachers identified?”. The ‘teachers’ refers to those teachers enrolled in the PDMT. In attempting to address this research question, this paper focuses on teachers’ responses within the ‘Overall satisfaction’ section of the survey which includes the responses to the two open-ended items.

### ***FINDINGS***

In the ‘Overall satisfaction’ section of the online evaluation survey, participants of the PDMT were asked to rate their satisfaction with Year 1 of the Professional Diploma in Mathematics for Teaching. Of the teachers in the first three cohorts who completed the questionnaire, a significant proportion of them (33.5% on average) stated that they were unsatisfied or neutral in their opinion of the programme as a whole. In order to identify possible reasons for this dissatisfaction, qualitative responses from teachers to the open-ended items were examined. The major themes which emerged in relation to dissatisfaction with the programme include:

- Compulsory attendance was too demanding when in full time employment.
- Too demanding with regards to time and work load resulting in a lot of stress for the participants.
- Inconsistencies with regard to the teaching conducted across different centres and issues with the technology breaking down from time to time were also highlighted.

On average 52.5% of the participants either agreed or strongly agreed that they were satisfied with the programme as a whole, with the largest proportion of students agreeing with this statement coming from the latter years of the programme’s implementation. Again, the open-ended items provided further insight into the strengths of the PDMT according to its participants. The major themes which emerged in terms of positive comments about the programme include:

- Support for the tutorial structure and comments on how helpful it was to engage with the tutors and other participants within this context.
- Participants envisaged the course positioning them well for career advancement.
- Many participants detailed the improvements in their self confidence in mathematics stating that they found the course both beneficial and enjoyable.

### **Advice to Future Participants**

As mentioned previously, teachers were asked to provide advice for future participants of the PDMT. The main themes which emerged from teachers’ responses are as follows:

- Potential participants should make themselves aware of the high level of pre-requisite mathematical knowledge that is required for the programme. Current participants also felt that consideration should be given when applying for the programme due to the high level of commitment combined with having a full time job and potentially a family.

- Another piece of advice that came through as a theme was an emphasis to future participants of the importance of attending tutorials (as they were found to be very helpful) and encouragement was given to read lecture notes prior to attending lectures.
- The final theme that emerged was a positive one and was evident throughout all cohorts' comments, and this was the assertion that the programme was an advantageous career move.

Overall, the advice given highlighted the substantial commitment which the teachers felt this demanding course required and that this should be given due consideration prior to signing up for the programme. In spite of this, the programme was still something that they felt was worth undertaking and something which was good for your career going forward.

## ***DISCUSSION***

### **Are teachers enrolled on the PDMT satisfied with the programme?**

Findings from the online survey indicate that while there were some issues in the initial years of the PDMT, participant satisfaction with this unique programme has increased over time, particularly as preliminary technical difficulties were overcome. That a majority of teachers reported satisfaction with the PDMT is an acceptable outcome as given the blended-learning modality of the programme, there is the potential for an increased drop-out rate. Research has highlighted higher participant withdrawals for online or distance learning courses compared with traditional face-to-face courses ([Nash, 2005](#); [Wojciechowski and Palmer, 2005](#)).

### **What strengths and weaknesses of the programme have teachers identified?**

While the programme requires a significant time and work commitment, which can be stressful for participants as they are also teaching full-time, the general consensus is that the programme is a positive means of achieving professional development and advancement as a mathematics teacher. Similar difficulties in completing distance-learning courses, i.e. in terms of time and workload have been found by other researchers ([Nash, 2005](#)). The tutorial aspects of delivery were found to be of most benefit, as were the availability of lecture notes online prior to lectures. In examining the methods that students of distance-learning courses were most willing to try to improve their success, Nash (2005) found that tutoring was the one method that the majority of students were favourable towards. The tutorial system employed on the PDMT is evidently advantageous in terms of participant satisfaction. Technological glitches were one of the greatest deficiencies of the programme in its infancy, but the majority of these issues have been addressed as the programme developed. Perhaps one of the greatest strengths identified in the PDMT, is the increase in teachers' self-confidence. Philippou and Christou (1998) acknowledge that teachers' beliefs and conceptions about mathematics are a vital factor in the process of teaching and learning, and an essential aspect of teachers' beliefs or conceptions is the teacher's self-confidence or self-efficacy. According to [Bandura \(1992\)](#), efficacy beliefs play a central role in the effort made in the pursuit of one's personal goals, in persistence when faced with adversity, and the ability to rebound from temporary setbacks. Thus, increased confidence in their mathematics ability is a key step in teachers' future mathematics teaching success.



## **CONCLUSION**

This paper presents some initial evaluation of the Professional Diploma in Mathematics for Teaching in terms of participating teachers' satisfaction and identified strengths and weaknesses. The increase in programme satisfaction in more recent cohorts is an indication of the PDMT's development (particularly with regards to technology) and the acknowledged strengths may well have played a significant role in the success of 528 teachers in graduating from the PDMT to date. Currently, various aspects of the PDMT are being investigated, not only in terms of CPD, but also with regards to blended-learning, mathematical content knowledge, mathematics pedagogy, action research and teacher identity. As this programme is a novel initiative, it has the potential to provide the education community with invaluable information and feedback that could be of benefit not only in Ireland, but on an international level.

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