



School of
Education

Out-of-field teaching, post-primary mathematics education and the Irish context

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Overview of the Irish Education System and Teacher Education

Irish Education System:

- Primary level: Approx. ages 5- 12 (8 years of schooling)
- **Post-primary:** Approx. ages 13-18/19 (5-6 years of schooling)
 - **Junior Cycle:** 3 years followed by State Examination
 - **Transition Year:** Optional 1 year in between Junior and Senior Cycle.
 - **Senior Cycle:** 2 years follow by State Examination for entry into 3rd level education.
 - Mathematics taught at **Foundation, Ordinary and Higher levels** in all cycles.
 - National curriculum for all schools. New mathematics curriculum introduced – **Project Maths** – Sept. 2010.

Post-Primary Teacher Education:

- **Concurrent programmes:** 4 years, **degree level.**
- **Consecutive route:** Completion of degree studies first and then enter postgraduate teacher education programme. As of Sept. 2014, these are **Master level programmes** (Level 9 - 2 years). Previously, 1-year Postgraduate Diploma (Level 8).
- **Very little participation in Continuous Professional Development.**

The Irish Context

- **Out-of-field teachers:** “Teachers assigned by school administrators to teach subjects which do not match their training or education” (Ingersoll, 2002, p.5).
- Requirements for teaching school subjects set out by our national **Teaching Council** – very specific requirements around maths content studied for degree and need to have an initial teacher education qualification.

Key Points – Initial National Survey (2009)

Specifically qualified maths teachers play a key role in student learning – 48% of post-primary teachers of mathematics not qualified.

Majority of these were qualified science and business studies teachers.

Unqualified primarily assigned **Junior Cycle mathematics classes** and **weaker students** ; qualified teachers primarily assigned exam years and Senior Cycle

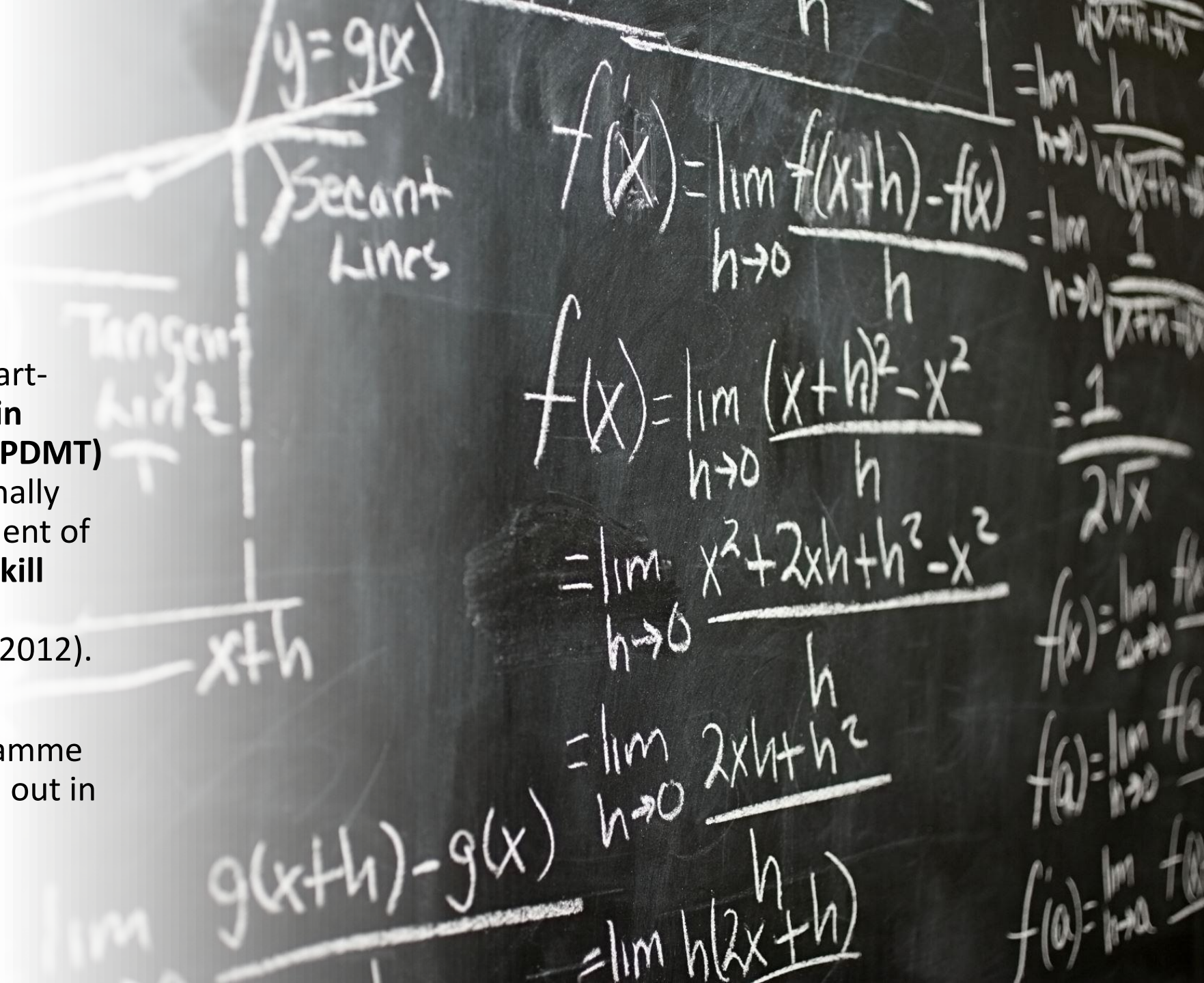
- principal's role in assigning teachers.
- need for specialist mathematics teachers at Junior Cycle – crucial for student learning and for uptake of the subject at Higher Level.

63% of out-of-field teachers feel that they are suitably “qualified”.

Qualified teachers in this study were older and more experienced than the out-of-field teachers.

- Accordingly, a two-year part-time **Professional Diploma in Mathematics for Teaching (PDMT)** was established nationally and **funded** by the Department of Education and Skills, to **up skill these out-of-field teachers** (commenced in September 2012).

- New version of the programme in place since 2021. And roll out in other subject area.



The PDMT

Content Requirements: 60 ECTS

Participants complete 10 content modules and must pass a common exam for each.

Module Title	University level
Calculus 1	Year 1
Calculus 2	Year 1
Calculus 3	Year 2
Algebra 1 (Linear Algebra and Geometry)	Year 1
Algebra 2 (Algebra and Number Theory)	Year 1
Geometry	Year 3
Probability	Year 2
Statistics (with inference)	Year 2
Problem solving and mathematical modelling	Year 3
History of Mathematics	Year 3

The PDMT

Pedagogy Requirements: 15 ECTS

Pedagogical Studies Part 1:

Content-Specific Workshops and Portfolio of Work: 9 ECTS

- Five distinct workshops in subject-specific pedagogical studies,
- Taken concurrently with the associated content module.

Assessment: Portfolio of work, including an action research project and a lesson plan for each of the five content areas.

Pedagogical Studies Part 2:

Summer Institute in Mathematics Teaching and Learning: 6 ECTS

One-week summer Institute in Mathematics Teaching and Learning supporting participants in exploring international trends, current national/international issues, action research and recommended best practice in mathematics education.

Contribution


- Although there are several emerging international models of professional development for out-of-field teachers (e.g., Vale, McAndrew, and Krishnan 2011; Crisan and Rodd 2017; Faulkner et al. 2019), to our knowledge Ireland offers the only example of a nationally consistent, government-funded, university-accredited programme that is available to teachers throughout the country (Goos et al., 2021).
- The scale and longevity of the PDMT provide a unique opportunity to investigate its impact on the teachers who have graduated from the programme.



Conceptualising Impact (Desimone, 2009)



This model proposes the following steps linking inputs with intermediate and final outcomes:



1. Teachers experience effective professional development (characterised by content focus, active learning, coherence, sustained duration, and collective participation).
2. The professional development increases teachers' knowledge and skills and/or changes their attitudes and beliefs.
3. Teachers use their new knowledge and skills, attitudes, and beliefs to improve the content of their instruction or their approach to pedagogy, or both.
4. The instructional changes foster increased student learning.



PDMT & Research

Our own research (data collected between 2012-2018) has concentrated on analysing the critical features of the PDMT programme (Step 1 in Desimone's model; see Goos et al. 2020) and its effect on the teachers who participated in the programme (Steps 2 and 3; see Lane and Ní Ríordáin 2020; Ní Ríordáin, Paolucci, and O'Dwyer 2017; O'Meara and Faulkner 2021).

In this presentation, examine the impact of the PDMT on teachers' beliefs and pedagogical approaches as key elements in Desimone's (2009) model of teacher change. Given the well-known challenges of empirically measuring out-of-field teaching (Ingersoll 2019), suggest that it is also important to track changes in the prevalence of out-of-field teaching of mathematics in Irish post-primary schools since the introduction of the PDMT.


The Study

The findings reported in this presentation come from three surveys (Survey 1, Survey 1R, and Survey 2) of post-primary mathematics teachers in Ireland, which form part of our larger research programme investigating the impact of the PDMT.


- Survey 1 was the baseline study of out-of-field teaching of mathematics in Ireland, conducted by Ní Ríordáin and Hannigan (2009).
- Survey 1R re-evaluated the prevalence of out-of-field teaching of mathematics in 2018, several years after the PDMT was first offered in 2012.
- Survey 2, also conducted in 2018, was sent only to graduates of the PDMT and investigated their perceptions and experiences of teaching mathematics since completing the programme.

Surveys 1 and 1R

The aims of Surveys 1 (conducted in 2009) and 1R (conducted in 2018) were to determine the prevalence of out-of-field teaching of post-primary mathematics, not only in terms of teacher qualifications but also the deployment of out-of-field and fully qualified teachers of mathematics.



Both surveys sought information on teachers' undergraduate and postgraduate qualifications, number of years of experience in teaching mathematics and other subject areas, and the year group(s) and level of mathematics (Higher, Ordinary, Foundation) being taught by the teacher.



Full details of the design of Survey 1 (and hence Survey 1R, which is an identical instrument) are provided in the report by Ní Ríordáin and Hannigan (2009).

Survey 2



Examined the perceptions and experiences of teachers of mathematics since graduating from the PDMT. As well as collecting information about graduates' personal and professional backgrounds, the survey explored perceptions of their preparedness for teaching mathematics, development of their identity as a teacher of mathematics, beliefs, classroom practices, and perceptions of the effectiveness of the PDMT programme.



The survey section investigating epistemological and pedagogical beliefs was taken from the study of Perry, Howard, and Tracey (1999) and consisted of 20 items examining teachers' beliefs about mathematics, mathematics learning, and mathematics teaching.



Two sections of Survey 2 investigated teachers' perceptions of their classroom practices. In addition, the survey included two open-ended questions inviting teachers to describe their approach to mathematics teaching before and since completing the PDMT pedagogy workshops.



In November 2018, an invitation email was sent to the four graduated cohorts of the PDMT from 2014, 2015, 2016 and 2017, with two follow-up email reminders. Included in the email was a URL for the online survey, which was developed using SurveyMonkey. A total of 218 (27% response rate) completed responses to the online survey were received.

Key Findings

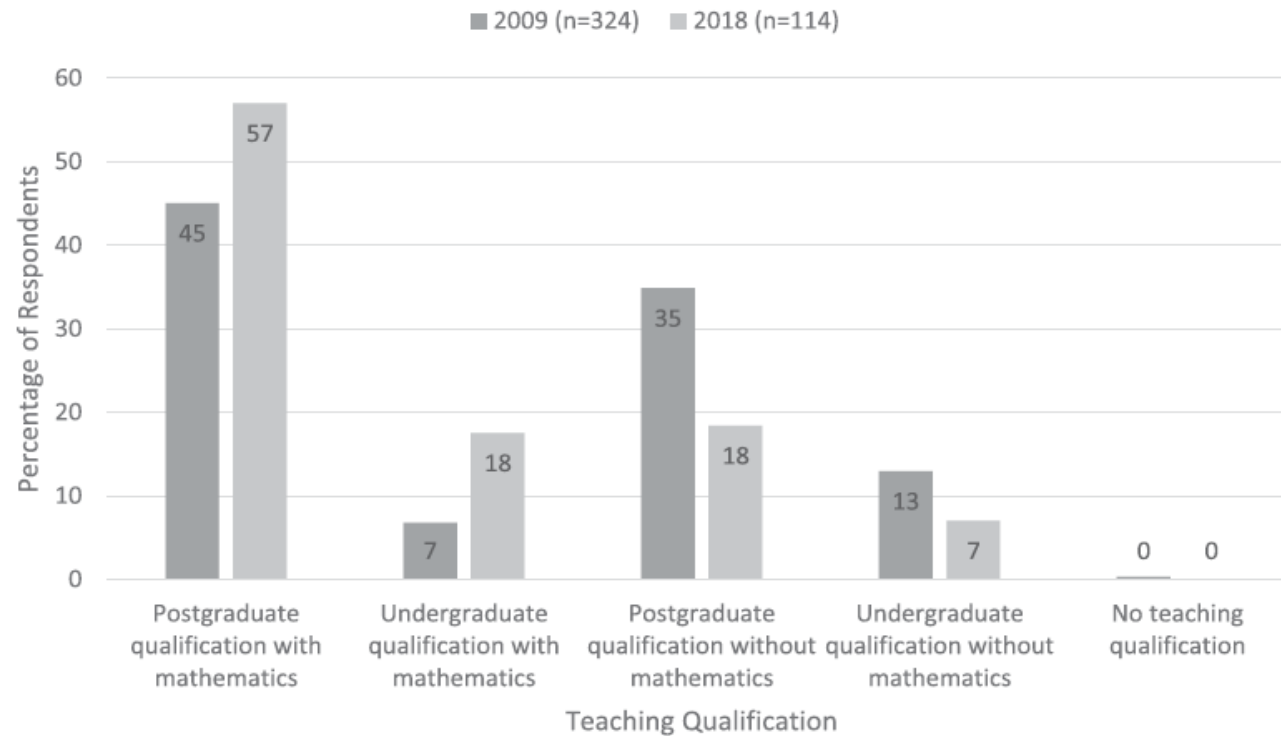


Figure 1. Teaching qualifications of respondents to Surveys 1 and 1R.

Overall, in 2009, 48% of respondents were teaching mathematics without adequate qualifications while by 2018 the proportion had fallen to 25% of respondents.

This finding is most likely explained by the upskilling effect of the PDMT on teachers who were formerly teaching mathematics out-of-field.

Key Findings

Responses to the 2009 survey revealed that out-of-field teachers were more likely than fully qualified teachers to be assigned to teach across year levels of the Junior and Senior Cycles in which there were no external examinations (first, second, and fifth years).

This general pattern had not changed a great deal in 2018. In 2009, it was rare to find out-of-field teachers assigned to Higher Level mathematics classes. However, by 2018 somewhat, with slightly less than one-third of the out-of-field respondents reporting that they were teaching a Higher-Level mathematics class in Junior Cycle.

A different perspective on the deployment of teachers comes from Survey 2, which asked PDMT graduates to indicate the year groups and level of mathematics that they taught before and after completing the programme.

While there was very little change in individual teachers' class assignment from first to fourth year classes, a 32% decrease was observed in the proportion of teachers assigned to Ordinary Level mathematics in fifth year (Senior Cycle) and a corresponding large (35%) increase in teaching Higher Level mathematics for this year group.

Table 6 Percentage Distribution of PDMT Graduates Who Engage in Various Classroom Practices.

Classroom Practice	Every/ almost every lesson	About half of lessons	Some lessons	Never
Relate the lesson to students' daily lives	40	27	32	2
Ask students to explain their answers	58	25	16	<1
Ask students to complete challenging exercises that require them to go beyond the instruction	20	33	40	7
Encourage classroom discussion among students	36	32	30	3
Link new content to students' prior knowledge	80	13	7	0
Ask students to decide their own problem solving procedures	23	29	45	3
Encourage students to express their ideas in class	59	23	17	2

Key Findings

- PDMT graduates suggests that they perceived a substantial change in their mathematics teaching practices, shifting from transmission towards more child-centred approaches.
- They also reported a profile of teaching practices emphasising links to students' prior knowledge and encouraging student explanation and discussion.

Table 7. Percentage Distribution of PDMT Graduates' Descriptions of Mathematics Teaching Approaches Before and After Completing Pedagogy Workshops.

Teaching Approach	Before PDMT	After PDMT
Transmission	56	5
Child-centred	23	51
Mixed	9	11
No change	9	26
Other	3	7

Conclusion – Caution!



Although we cast our findings in a largely positive light, we acknowledge that caution is needed in interpreting evidence of teacher change resulting from their participation in a professional development programme.



We have tackled the internationally documented challenges of measuring out-of-field teaching (Ingersoll 2019) by applying a consistent survey methodology and definition of 'out-of-field'.



The most important challenge for future research will be to design longitudinal evaluations capable of linking teachers' participation in professional development with changes in their pedagogical approach and student achievement.



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Thank You/Go Raibh Míle Maith Agaibh

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