



A Study to Investigate Irish Primary School Teachers Perceptions and Approaches to
Differentiation in Mathematics.

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Declaration

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Abstract

Development in education in the 21st century has created many changes for teachers. There is a significant increase in diverse learning needs in Irish primary classrooms. Teachers are responsible for catering to these learners in line with legislation and policy implementation such as the Education Act of 1998 and the Department of Education 2017. This small-scale research study explores Irish primary school teachers perceptions and approaches to differentiation in mathematics. The main objective of the research study explores perspectives, strategies, and challenges faced by primary school teachers employing differentiation in maths in their classrooms. This research study employs a qualitative research method, through nine semi-structured interviews with Irish primary teachers contributing considerably to the research. The data was then collected, and analysis of the data was conducted using a thematical framework.

Findings from the analysis of the data revealed the increased recognition of differentiation in maths education. Teachers express the significance of differentiation and their role as teachers to cater for all learners. The findings identify mixed views on strategies such as mixed ability and ability group, withdrawal, and in-class support. It emerged that teachers believe they do not receive sufficient training in college on differentiation, particularly in the area of mathematics. This research found that a large student-teacher ratio can negatively impact a teachers ability to apply effective differentiation in maths. This resulted in the introduction of station teaching for many participants.

The findings suggest that teachers would benefit from more CPD opportunities to support teachers in the area of differentiation in maths. This potentially could be implemented through the revised curriculum as it brings opportunity for updating differentiation instruction. This research study investigates teachers lived experiences, opinions, and attitudes while building on the existing knowledge that exists from preceding studies.

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Abbreviations

BERA	British Educational Research Association
CPD	Continued Professional Development
DES	Department of Education and Skills
ESRI	Economic and Social Research Institute
ITE	Initial Teacher Education
MERC	Marino Ethics in Research Committee
NCSE	National Council for Special Education
NEPS	National Educational Psychological Service
OECD	Organisation for Economic Co-operation and Development
PD	Professional Development
PDST	Professional Development Service for Teachers
PME	Professional Master of Education
SEN	Special Educational Needs NCSE: National Council for Special Education
SET	Special Education Teacher
ZPD	Zone of Proximal Development

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Chapter 1: Introduction

This research focuses on the perceptions primary school teachers have when differentiating for maths in their classes and the approaches and challenges to successful differentiation. This chapter outlines the context, rationale, aims and objectives of the study. It demonstrates how this study will be conducted and provides a brief outline of the chapters.

Context and Rationale for the Study

As dictated by the Department of Education (DES) and legislation such as the Education Act (1998), class teachers are primarily responsible for all aspects of a child's educational experience. As a result, the strategies implemented and challenges faced by the teachers in the current study offer a wealth of insight and knowledge for other teachers and professionals.

Berry & Williams (1992) stipulate that every class is multileveled. In addition to this, teachers are responsible for effectively supporting the weaker students and assisting them in achieving their full potential while also accommodating the high-achieving students with an appropriate level of challenge. To facilitate various abilities in maths, teachers employ differentiation within the classroom.

Therefore, teachers must implement and adjust strategies across the curriculum to help children reach their full educational potential (Murray, Baker, Murray-Slutsky & Paris, 2009). By implementing such instructional strategies, results have shown improved retention and engagement in maths (Bender, 2009). This research study explores the various approaches to differentiation in maths used by primary school teachers in mixed ability classes.

Despite the enhanced educational provision for children with learning disabilities and encouraging developments in policy on inclusive education, there are numerous challenges concerned with the inclusion of children with learning difficulties in mainstream classes.

Travers et al., (2014) addresses challenges to inclusive education in mainstream classes which include teacher attitudes, insufficient training, a lack of resources and the organisation of the education system. The researcher has selected this topic due to an interest in the area of differentiation and facilitating all learners needs in mathematics. This stems from experiences during teaching practices carried out in primary schools as part of the Professional Master of Education (PME) course while observing and exploring the methods of differentiation used in maths education.

Aims and Objectives of the Study

This research study aims to focus on how children's diverse learning needs are differentiated for in maths education in mainstream classes and any inherent challenges. This study focusses explicitly on the perceptions, strategies and challenges faced by primary school teachers employing differentiation in maths education in their classrooms. Through this exploration, teachers perceptions of differentiation in maths, both the strategies implemented and the challenges teachers face is acknowledged and explored to offer a suitable, applicable and informative piece of research for teachers and professionals who incorporate differentiation in maths in their classrooms.

Outline of Chapters

This dissertation is divided into five chapters. Chapter one presents an introduction to the research study while highlighting the aims and discussing the rationale. Chapter two examines and reviews the literature in the field of study, the rationale and background will also be explored. Chapter three outlines the research approach employed in the study. It details the rationale for the research design selected, methods used for data collection, analysis, sampling procedure and selection, validity and reliability, ethical considerations and limitations of the study. Chapter four presents the findings, analysis and discussion of the themes that emerged from the interviews carried out for this study. These findings are then explored in relation to

relevant literature in chapter two. Chapter five concludes the study. It summaries the key findings and recommendations based on the finding that emerged.

Chapter 2: Review of the Pertinent Literature

Introduction

Teachers have a responsibility to cater for all student needs within the classroom. In society, teachers face increasing school diversity and experience a broad range of differences in children's academic abilities. Differentiation has become a greater priority due to increased student diversity (Gaitas & Martins, 2017). This research study explores Irish primary school teachers perceptions and approaches to differentiation in mathematics.

From the review of relevant literature, common issues and concepts regarding the significance of efficient differentiation within mixed-ability classes are identified. As a result, the following themes emerged, the historical context and the move from tradition methods, the significance of differentiation, the role of the teacher, continuum of support, forms of differentiation and challenges for differentiation in practice, which is explored through relevant literature.

Historical Context and the Move from Traditional Methods

The earliest form of teaching employed an institutionalised education system known as the didactic model (McCarthy, 2011). A core ideology regarding didactic epistemology is to consider each student to be “on the same page” and not regarding diversity, differentiation or implementing any concessions (McCarthy, 2011). The idea of flexibility and adaptation in pedagogical practice to accommodate individual student's unique learning needs were ignored.

The move away from a didactic model of traditional teaching methods and the development from The Primary School Curriculum published in 1971 and 1999 highlight children to be at the centre of the learning and permit teachers to cater for diversity in the classroom, as teaching methods adapted to a modern or constructivist approach (Walsh, 2016; Kalantzis, 2005). The National Council for Curriculum and Assessment (NCCA) (1999) celebrates the uniqueness of children with the aim to flourish them in all dimensions. This is a

shift in perspective and purpose from the previous iteration of the curriculum and is continuing to be adapted with the introduction of the revised curriculum currently being processed (NCCA, 2020). The allocation model for Special Education Teachers (SET) provides schools with additional teaching support guided by students individual learning needs, compared to a diagnosis of disability (DES, 2017). This demonstrates how our education system aims to cater to the needs of all children and how differentiation is now valued.

The National Council for Special Education (NCSE) reported in DES (2017) that there is a spectrum of ability and disability among categories of special educational needs (SEN) and may require greater support than another student with the same SEN (DES, 2017). This supports inclusion, assistance with learning difficulties and early intervention. This also supports schools in developing whole-school policies and practices to differentiate levels of support for those who need it most (Fine, 2003).

The Significance of Differentiation

Heacox (2002) defines differentiation as a change in the pace, level or type of instruction provided to support individual learners. Similarly, Tomlinson agrees that “differentiating instructions means 'shaking up' what goes on in the classroom so that students have multiple options for taking in information, making sense of ideas and expressing what they learn” (2005 p. 1). Differentiation in its most basic form involves customising teaching to attend to a specific student’s learning needs (VanTassel-Baska, 2012). The author would define differentiation as methods teachers incorporate into their teaching to cater to students learning, often through resources and strategies to support students accessing the curriculum and successfully learning.

Tomlinson (2005) explains differentiated instruction to be more qualitative than quantitative. Often, teachers mistakenly implement differentiation instruction by giving

children more work or less work. While this method may have some justification, it is frequently ineffective for students learning (Westwood, 2001). According to Tomlinson (2005), if a task is too easy for an advanced learner, doubling the workload on the same task is unlikely to resolve the problem and may seem like punishment for the learner. Merely adopting the quantity of a task can result in less effective outcomes. However, modifying the task's nature to support the children's learning needs can result in beneficial learning outcomes for the student (Tomlinson, 2005).

Differentiation is not the superficial resolution of the traditional 'one size fits all' approach (Westwood, 2001). The Universal Design for Learning (UDL) approach is gaining traction in academic research and practice on the ground. This approach is used to change instruction or the classroom environment to make it more accessible for everyone. Although this may not explicitly be differentiation, it holds the same goals in the hope of making learning more accessible. Tomlinson (2002) also highlights that one-sized clothing does not fit all, which is equivalent in relation to student learning. As a result, teachers play a significant role in accommodating differentiation.

The Role of the Teacher

From the review of department circulars, teachers are responsible for differentiating on a practical level (DES, 2005). Differentiation consists of adapting the level of the curriculum content to the child's ability. Placing less emphasis on adapting the teacher's level or form of work to incorporate UDL, creating changes to facilitate a child's results in a better outcome for all individuals (PDST, n.d.). Educators are responsible for supporting and efficiently responding to children's needs within the classroom including high achieving students and those that require support (DES, 2017). The Education Act of 1998 states the teacher is responsible for their student's education and personal development. They hold the

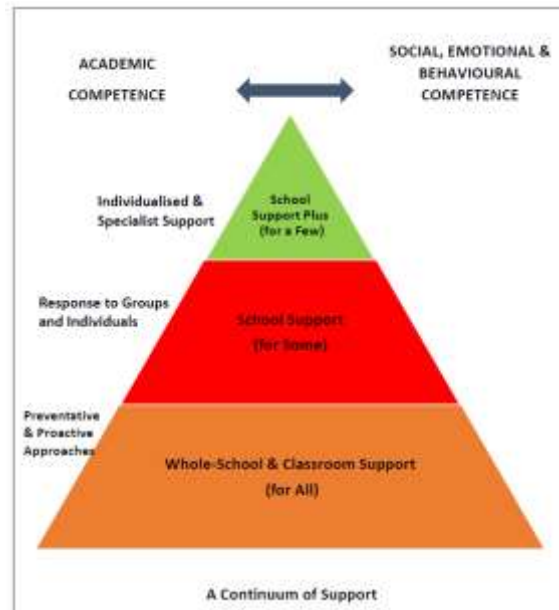
responsibility of creating a stimulating and supportive classroom environment where all students feel equal and valued (DES, 2017).

Teachers accomplish this by examining the children and the learning and make an adaption to provide better learning outcomes. However, Westwood (2018) expresses how this is a challenge for teachers with mixed-ability classes and large student- teacher ratios. Still, Tomlinson states that “every hour of teaching, every day in the classroom can reveal one more way to make the classroom a better match for its learners” (Tomlinson, 2005, p.5). Tomlinson and Westwood express the significance of differentiation in practice. However, they also highlight the significant role, responsibility and challenges teachers face when applying effective differentiation methods for their learners which this research study seeks to explore.

The ‘Growing Up in Ireland’ data reveals that the Economic and Social Research Institute (ESRI) expresses how SEN fluctuates throughout social and income groups. Findings indicate that the percentage of students informed by teachers to have SEN was substantially greater for those in schools in disadvantaged areas. This demonstrates how prevalent differentiation is for teachers and the necessity to be well-informed of differentiation strategies.

Continuum of Support Process

To support teachers and students, the continuum of support is established to assist in supporting learners. It is a process that schools and teachers follow to identify and cater to individual students SEN (DES, 2007). The process comprises three specific based methods: classroom support, school support and school plus support.

Figure 1: *Continuum of Support*

Classroom support is the starting point that involves a problem-solving process of identifying and addressing the needs of a student who may need modifications within the classroom environment to support their learning. Classroom-based interventions for specific needs is created by the teacher and revised every eight weeks. This supports Weir, Moran & O'Flaherty (2014) variations of support and demonstrates how classroom practice must be differentiated in the first instance to support pupils.

The second phase, 'school support,' intensifies the problem-solving approach, utilises information gathered by the teacher through their interventions. The SET will become involved in co-ordination where appropriate (DES, 2007). The final stage of the process, 'school support plus' involves an external professional to analyse the problem in detail to support the student with their complex needs (DES, 2007). This new process of supporting students demonstrates how schools support students at each of these levels with differentiated support.

While DES (2007) suggests a staged approach to support and identify children with SEN. It is stated in the literature that this policy should be reinforced further "with earlier

identification of children's learning difficulties by the second term in Junior Infants" (McCarthy, 2011. p. 50). In the UK, the Williams Report (2008) also advocated early intervention for primary children expressing difficulties in mathematics.

The Content, Process and Product of Differentiation

This section explores how differentiation occurs in classrooms and schools. For differentiation to be implemented in practice, recent literature has identified that differentiation occurs through a model of instruction that consists of three elements, "content—the "what" of instruction; process—the "how" of instruction; and product—the "evidence" of instruction" (Taylor, 2015, p.14). Dixon, Yssel, Mc Connell & Hardin (2014) argues that differentiated teaching involves practice. Teachers experiences and skills in modifying curricula to satisfy students learning needs are vital to effectively applying teaching and learning frameworks such as differentiation (Dixon et al., 2014).

Each stage of the model is significant to the method of effective differentiation outcomes. Differentiating instruction primarily provides a means to systematically plan the curriculum and instructions that accommodate children's diverse academic needs, supporting access to the curriculum and develop their learning capabilities (Tomlinson & Eidson, 2003).

The element of content is the subject matter of a lesson. This often highlights information and skills overlooking important ideas and components that support children's understanding of the topic manner (Tomlinson & Strickland, 2005). Therefore, the teacher is the most significant component in deciding the content and the source of synthesis for the standards, texts and guides (Tomlinson & Strickland, 2005).

This process is the method of teaching utilised by the teacher. It concentrates on how children understand information depending on their interest, prior experience, level of competence and motivation (Levy, 2008; Leroux & Paré, 2016). "A worthwhile activity is one

that snags students interest so that they persist as it, even when the task is difficult" (Tomlinson & Strickland, 2005, p.8). Hertzog (1998) argues that employing open-ended activities to differentiate instruction enhances student's learning and supports gifted students identification. Therefore Hertzog (1998) suggests that open-ended activities aid students development.

The product is how students express their understanding of the content learned (Levy, 2008). Product assessments must support student's development, be transparent, challenging and stipulated criteria for success (Tomlinson & Strickland, 2005). With the implementation of the instruction model discussed, students are exposed to supportive means of learning at their academic level, benefiting their self-esteem and academic achievements. Through this study, the researcher poses to explore the strategies of differentiation instruction used by teachers in mathematics.

Forms of Differentiation

The concept of differentiated instruction provides many benefits for students learning when developed, designed, and integrated into mathematics by the teacher (Bender, 2009). Instructional strategies may result in more significant learning impacts, engagement and increase retention over time (Bender, 2009). Bender (2009) suggests that many textbooks today provide various instructional activities based on multiple intelligences, which offers a viable differentiation instruction in mathematics to accommodate student's needs.

Dowker's (2004) argues in favour of interventions to support students learning needs, as "research strongly supports the view that children's arithmetical difficulties are highly susceptible to intervention" (Dowker, 2004, p. 42). Concerning the sort of intervention, she highlights the advantages of tailored interventions to support students needs and mentions they do not need to be lengthy to be effective (Dowker, 2004). This underlines the responsibility of assessment in pinpointing a child's strengths and needs and targeting toward an individual's

difficulty. When targeted effectively, the differentiation instruction may not need to be intense. It is evident from this research that planned differentiated lessons accommodate diverse abilities.

The issues associated with ability grouping. Most primary classrooms consist of mixed abilities in some form. Berry & Williams (1992) stipulate that every class is multileveled. They identify the key difficulty for teachers of mixed-ability classrooms is to effectively assist the various students learning needs and support them in reaching their full potential.

Within mixed-ability classrooms, attainment in mathematics has been delivered in some primary schools by ability grouping (Dooley, 2019). Mc Guillicuddy and Devine (2018) identify 71.5% of teachers in their study conduct ability grouping when teaching mathematics. However, recent literature has identified grouping students because of their abilities can result in unfavourable outcomes as it is believed to support exclusion and impacting student's progression academically as they feel labelled (Smith, 2017). Mc Guillicuddy and Devine (2018) express ability grouping as a pedagogical device that “funnel and filter students into set social spaces based on perceptions and expectations for different learners” (p. 89). Patterns such as “high, mid and low” ability groups is identified among teachers in their study (Mc Guillicuddy & Devine, 2018, p. 90). Smith (2017) stated that it impacts student's self-esteem as they form lowered achievement expectations and identify themselves as ‘slow’ and it signifies students academic abilities, damaging their educational expectations. A student’s progression in a group with students who achieve less well comparatively with their peers present delays in their progression by one to two months per year (Higgins et al. 2015). Often students align their own ability with the ability group they are in, which negatively impacts their ambitions and motivation will decrease accordingly.

So, Seah, & Toh-Heng, (2010) identifies that students working collaboratively, supports, encourages and overcome challenges from one another when educated together of different abilities. This evidently supports Smith (2017) statement on the negative impacts of streaming mention previously. Surprisingly, maths programmes such as Mata sa rang and Ready, Set, Go – Maths calls for differentiated groups so that students can get what they explicitly require to support them in their learning (PDST, n.d.). However, within ability groups differentiation is still required as there may be diverse learners within each ability group (Deunk, Smale-Jacobse, de Boer, Doolaard & Bosker, 2018).

Although Dowker (2004) highlights the significance and benefits of group intervention she refers the key role of the teacher “peer tuition and computerised teaching play a useful role in mathematics interventions but cannot substitute for interaction with a teacher” (Dowker, 2004, p.26). Ginsburg, Jacobs and Lopez (1998) and Westwood (2007) argue the focus on targeted interventions and as to what interventions is most promise of success. The contrast to modern or constructivist methods to teaching and traditional teaching approaches has shown us the disparities among them, the latter's ineffectiveness and benefits of the former in mixed-ability classrooms.

Withdrawal verses in class support. Traditionally, the dominant learning support model has involved SETs removing students or small groups from the classroom to deliver instruction to support learning in maths (Weir, Moran & O'Flaherty, 2014). Schools have significant discretion with how learning support is utilised based on the greatest level of need and the continuum support process (DES, 2017). The withdrawal model of learning support can be conducted in various forms. Co-ordinating mathematics teaching in the school, class or team teaching, and assessment for children who are experiencing difficulty (Weir, Moran & O'Flaherty, 2014).

Travers (2011) conducted research on withdrawal support for mathematics in Irish primary schools. The study revealed 94% of respondents were conducting withdrawal support for maths. Findings from respondents revealed benefits such as, advantages for different learners, positive contrast with mainstream classroom and better use of concrete materials (Travers, 2011). The DES (2011) discredited the over-reliance on withdrawal support. It encouraged support to be conducted within the classroom, as literature has highlighted the benefits that it provides for the student (Griffin & Shevlin, 2007).

The Literacy and Numeracy strategy (DES, 2011) includes an explicit recommendation that in-class assistance for children recognised as having problems in literacy and numeracy offered by an SET in junior infant classes from 2013 onwards (DES, 2011). It is evident from this research that change is difficult and perhaps the practice of withdrawal with students of SEN has been engrained in schools and this practice might be hard to adjust.

In recent years, we have seen a shift towards team teaching through station teaching and lead by an SET (PDST, 2018). Station teaching allows for enhanced instructional intensity and individualisation. It also provides teachers with the capability to assess students and to identify learning achieved. With support teaching, all students are immersed in the same curriculum and integrated interventions (PDST, 2018).

McMahon (2015) and Cull and Travers (2018) explore the effect of station-teaching in mathematics. The literature identifies improvements in student's participation and enjoyment when completing maths lessons. Station teaching is also presented as an easy and effective method to learn mathematical skills (McMahon, 2015). Cull and Travers (2018) examine station teaching in a multi-grade primary class. Results present effective intervention for development of crucial skills in numeracy. However, the NCCA (2018) consultation report highlight that primary schools require guidance on how to establish and implement team-

teaching. This supports the need for teachers to receive adequate training and support with developments in strategies on differentiation.

Vygotsky (1978) notes that children engage and learn when they are within their zone of proximal development (ZPD). As students within classrooms today have various readiness levels for maths, their ZPD, as a result differs (Prasta, Van d Weijer-Bergsmaa, Kroesbergena, & Van Luit, 2015). Tasks designed within achievement for median children's ZPD may be a challenge for some children's and not challenging enough for others as the gap between current understanding, skills and the task is too big (Prasta et al., 2015). This suggests different abilities require unique differentiation instruction, which is often the case when team teaching resulting in ability grouping (Prasta, et al., 2015). To accomplish the correct balance is a challenging skill and can often result in frustration and withdrawal from learning or on the other hand, create a useful and engaging learning environment (Csikszentmihalyi, 1990).

A vision for maths for all promotes an equitable curriculum in the Research Report 17 (RR17) and Research Report 18 (RR18) (Dooley, 2019). This curriculum is preceded by culturally sensitive pedagogy and understanding that individual's comprehension of maths occurs differently (Dooley, 2019). Sleeter (2012) contends that "what makes more sense is for teachers to bring to the classroom an awareness of diverse cultural possibilities that might relate to their students, but then to get to know the students themselves" (p.571). Warren and Miller (2016) numeracy project on schools in Australia's marginalised contexts formed recommendations such as observation and assessment, tailor learning experiences, identifying and utilising students' strengths and weaknesses, (Dooley, 2019).

The findings suggest that the quality of teaching has significant benefits for access, enrichment and creative mathematics (Dooley, 2019). As stated in RR17, "it is not that distinctive teaching approaches (or indeed distinctive curricula) are required but that

mathematics teaching should address specific needs” (Dooley, 2019, p.124). There is no differentiating formula to follow when differentiating within the classroom. As a result, teachers work daily to adapt teaching methods to find methods that support individual learners. However, it is evident from the literature that the challenges teachers face in accommodating the range of abilities within the classroom cannot be understated.

Challenges for Differentiation in Practice

Heacox (2014) believes that teachers must develop differentiation skills and that over time their ability and confidence will flourish when practicing differentiation. Interestingly in another European Union state, The Dutch Inspectorate of Education, report that half of the classes observed in a study showed teachers not differentiating appropriately (Safar, 2019). A reason stated was the lack of information about differentiation during Initial Teacher Education (ITE), as the focus was predominantly on subject knowledge (Safar, 2019). In contrast to Heacox (2014) statement, Safar stated that “not enough teachers differentiate in their classrooms, even after teaching for several years” (Safar, 2019, p.7). Therefore, gaining knowledge on differentiation is critical during ITE as it provides a basis for teachers to follow and develop.

Hertberg-Davis (2009) argues that misinterpretation of differentiation can lead to a less challenging classroom environment. Therefore, professional development (PD) to support differentiation in mathematics should be provided to teachers (Taylor, 2017). This evidently supports Mc Guillicuddy and Devine (2018) finding as they identify younger less experienced teachers with no additional PD courses working in marginalised communities conducting ability grouping as a means for differentiation and the need for further PD courses to support them. Monitoring teachers and offering opportunities to observe others while providing feedback can help teachers develop skills and strategies on differentiation in maths (Dixon et al., 2014). According to Safar (2019), significant development of differentiation skills comes

from teachers sharing skills they have mastered and supporting others in developing differentiation skills.

Developing differentiation skills varies on numerous factors (Safar, 2019). Teachers must be creative and develop explicit knowledge of differentiation and its significance (Hall, Strangman & Meyer, 2003). They need to believe differentiation will benefit and improve students learning and devote time and determination in differentiation (Nicolae, 2014). Furthermore, teachers must understand all students are different and if support in the learning process is at the students level (Stavrou & Koutselini, 2016; Tomlinson & Imbeau, 2010). Sprott's (2019) findings suggest that formal and informal professional development training provides teachers with support in learning new teaching strategies and evaluating their practice.

Dixon, et. al. (2014) identifies difficulties teachers experience when developing differentiation skills. These challenges can occur from various factors such as timing, cultural diversity, diverse learning styles and a student's emotional and social maturity (Tomlinson, 2002; Eacute & Esteve (2010). These aspects can substantially affect how a student may propose to learn and their learning capacity. These different attributes establish obstacle for teachers to formulate and customise their teaching methods to various students. However, differentiated instruction is the standard practice for teachers to adapt their teaching methods and mindset concerning students learning (Hall et al., 2003; DES, 2017). Eacute & Esteve (2010) note the value students receive when the correct differentiated method is implemented.

Another concern is student-teacher ratio in Irish primary schools, which is apparent in government policy and discussion for years (Weir, Archer, & McAvinue, 2010). Comparatively, Ireland has problematic issues of larger student-teacher ratios in comparison to other European Union and Organisation for Economic Co-operation and Development (OECD) average countries resulting in negative analysis on its performance (Kelleher and

Weir, 2016). The large student-teacher ratios can pose challenges for the class teacher in relation to time to facilitate all learners educational and diverse needs due to the volume of students. Peter (1992) contends that teachers need extra time to design and implement differentiated instructions of tasks and assessments as it is complex and significant process.

Therefore, the complexity of “current realities of school such as large student-teacher ratios sizes, limited resource materials, lack of planning time, lack of structures in place to allow collaboration with colleagues and ever-increasing numbers of teacher responsibilities” (Brighton et al., 2005, p.13) are significant challenges for teachers to provide effective differentiation in mathematics.

Conclusion

To conclude, the review of literature outlines common issues and concepts associated with the significance of effective differentiation within mixed-ability classes to support mathematics teaching and learning. It has informed the foundations upon which this research study is founded. Differentiation is significant in education to support children's learning, engagement and overall development. Although it can present many challenges to teachers, the outcomes show exceptional positive results of learning and rewarding for both the teacher and student. The research of literature has provided invaluable information on methods to explore differentiation instruction. The literature has displayed that differentiation adequately challenges and supports all students in mixed-ability classrooms. It is pivotal to our success and effectiveness as teachers in providing for diversity in education.

Chapter 3: Research Methodology

Introduction

This research investigates “Irish Primary School Teachers Perceptions and Approaches to differentiation in Mathematics”. This chapter will include the research project's design, outlining the different research methods and how it will be conducted. The data collection method will be outlined and discussed, as will the framework for data analysis. Ethical issues, limitations, reliability and validity associated with this study will be explored and the sample selected is specified and explained.

Qualitative Research

This study employs a qualitative research methodology to understand how teachers utilise differentiation in maths. This process involved forming questions and procedures, collecting data from participants, data analysis and finally, interpretation of data gathered (Creswell, 2009). In education, an interpretative study is commonly used as a method of qualitative research (Merriam, 2009). Qualitative research methods support obtaining an insight into the individuals in co- interpretations of meaning, their lived experiences, cultural traditions and oppressive practices (Atkinson, 2017). The qualitative method of this study consists of interviews with an encouraging possibility to play vital roles for all academic accomplishments “in terms of the formulation of questions, building operational definitions and designing research instruments” (Atkinson, 2017, p.66).

An interpretive principle was implemented in this study. Interpretivism permits individuals to build subjective meanings of their experiences. This allowed the researcher to look for the complexity of opinions instead of narrowing intentions into specific objective data (O'Donoghue, 2007). Therefore, qualitative research was considered appropriate for this study.

Research Design

For this research study, data was collected in the form of interviews. According to DeMarrais (2004) interviews are a primary method of data collection in qualitative research. Jones (1985) explains that interviews provide a valuable form of understanding individual's views and opinions. DeMarrais (2004) identifies interviews as “a process in which a researcher and participants engage in a conversation focused to questions related to a research study” (DeMarrais, 2004, p. 87). This statement best explains the process in which the interviews of this study were conducted.

Research of the different forms of interviews were conducted. These findings suggested that conducting structured interviews restricted the researcher from gaining access to the participant's perspectives and understanding of the world, resulting in preconceived ideas of the world being recorded (Cohen, Manion & Morrison, 2011).

Unstructured and open interviews were examined and identified as the lowest level of pertinent data collected compared to semi-structured interviews for the research question. However, understanding and teachers perspectives can be achieved in this method (Merriam, 2009).

From this research, semi-structured interviews were employed as the method of data collection. In qualitative research, interviews that consist of open-ended questioning ensure participants perspectives and responses to their world view in a distinctive form. For this research, open-ended questions were valuable as the responses collected were more likely “to reflect the full richness and complexity of the views held by the respondent” (Denscombe, 2010, p.165). This is important to this study as differentiation is a complex process with various practices in different settings. The interview questions formed are significant and still maintained salient data (Merriam, 2009). The time allocation of thirty minutes was given for

each interview, allowing for data to be collected. Conducting interviews in this format permit the researcher to investigate the participant's insight and interpretation of the research topic without imposing any preceding categorisations that could restrict the inquiry field (Punch & Oancea, 2014).

Pilot Study

In qualitative research studies, pilot studies are utilised to test the research tool's efficacy being implemented in the study (Malmqvist, Hellberg, Mollas, Rose, Shevlin, 2019). Pilot studies are best described as “a small-scale replica and rehearsal of the main study” (Sarantakos, 2013, p.275.) which was applied in this study.

Leedy and Ormrod (2012) believe that a pilot study examines the practicality and feasibility of the research tool allowing for potential alterations to be employed. It provides the researcher with the opportunity to examine the process, clarify instructions and eliminate uncertainties in the layout of questions, wording and feedback (Cohen, Morrison, & Manion, 2007). The pilot study undertaken for this research was successful. It identified elements in the wording, questioning and structure that were improved and established a firmer structure of questioning.

Ethical Considerations

This research adheres to the ethical standards required by Marino Institute of Education when pursuing a research study. Before commencing this research study, ethical clearance from ‘Marino Ethics in Research Committee’ (MERC) was approved. British Educational Research Association (BERA) established guidelines for educational research. This research followed the BERA ethics for educational research to meet the highest ethical standards taking responsibilities and promoting respect for participants of the study (BERA, 2018).

BERA (2018) express the significance of voluntary informed consent. This research followed by contacting participants with a letter via email outlining the purpose of the study, data collection and the method of interviews. All participants in this study received informed consent forms stating the studies voluntary nature, which followed by them committing to the education research through the letter and consent form they received (BERA, 2018). In addition to signing the consent form, the researcher also spoke with participants prior to the interview and reminded participants that they could withdraw their consent at any moment prior to two weeks before publication of the study (Cohen, Morrison, & Manion, 2007). Assuring confidentiality to all participants, the following codes were used: Participant A, B, C, D, E, F, G, H and I.

Once data was collected, it was stored on a password-protected computer followed the Data Protection Act of 2018. Each participant was made aware of how their data was being used and stored. Once the research is completed, all data gathered will be deleted to comply with GDPR regulations.

Sampling Selection

Due to the small-scale study in nature, this qualitative study conducted purposeful sampling. This form of sampling was performed in a “deliberate way, with some purpose or focus in mind” (Punch & Oancea, 2014, p.210). A range of participants with various years of experiences were selected to provide a broader understanding of the topic in question. This strategy permitted participants to be selected that provided valuable knowledge on the topic being studied and most likely to be a feature of their work (Denzin & Lincoln, 2018).

Consideration in the selection process ensured a variety among participants, years of teaching experience, the class taught in the schools, gender and socio-economic background. Due to the limitations of this study, nine participants were selected for the interviews. Participants

received a letter that was signed before any interview. A sample of this letter can be seen in Appendix A. The participants were then contacted with consent forms to partake in the interview for data collection. A sample of the consent form can be seen in Appendix B.

Participant Profile

Table 1: *Participant Profile*

Participant Profile				
Participant	Gender	Teaching Experience	Class	Urban/Rural
A	Female	3	5 th	Urban
B	Female	4	6 th	Urban
C	Female	21	2 nd	Rural
D	Female	20	3 rd	Urban
E	Female	7	6 th	Urban
F	Male	10	Junior & Senior Infants	Rural
G	Female	2	1 st	Urban
H	Female	5	3 rd	Rural
I	Male	12	4 th	Rural

Data Collection

In terms of this study, the data collection was gathered through nine semi-structured interviews to gain insight, in depth and reflection regarding the research question (Patton, 2002). The opportunity to question and probe nine participant interviewees on their lived experiences and attitudes toward this subject area was vital for this research study.

The interview questions (See appendix C) were created with the influence of relevant literature and the research study's overall aim. To aid the researcher in addressing the research questions, an interview schedule was developed. This created a focus for the questions and allowed the participants to respond with their unique perspectives and reflections based on their personal experiences. Open-ended questions allowed the participants to convey their views and not being directed by the interview questions. Prompt questions were also designed as a strategy to redirect participants should they go off course or “occasional side-tracks” in conversation (Leedy & Ormrod, 2012, p.145).

Only one interview was conducted in a face-to-face setting due to the COVID-19 pandemic and school closures. The remaining interviews were conducted via zoom. This alternative method was selected as research has highlighted the sustainability of Zoom as a tool for the collection of qualitative data. This is due to data management features, security options and easy use (Archibald, Ambagtsheer, Casey, & Lawless, 2019). All interviews were recorded on an iOS app, voice memo on a laptop, which was then transcribed and allowed for data analysis and discussion of findings to be completed. Ethical consideration was employed at all times and the data collected was anonymous.

Data Analysis

Monette, Sullivan, & DeJong (2010) argue that data accumulated is ‘raw’ and needs to be attributed meaning. Therefore, the interviews were recorded and transcription was then conducted for data analysis to form the meaning of the content recorded. A thematic analysis of the interviews and data collected was conducted (Braun & Clarke, 2006). This permitted the researcher to examine the data gathered and conduct “a rigorous and relevant thematic analysis” (Nowell, Norris, White & Moules, 2017, p.1.). This analysis method is identified as the foundational method for data analysing in qualitative research and the themes utilised capture significant data collected. “Thematic analysis is a method for identifying, analysing

and reporting patterns within the data” (Braun & Clarke, 2006, p.4). The researcher believed this method supports the examination of each piece of the data.

First, the researcher evaluated the data creating transcripts and created themes using coding. Transcription were utilised as this study was not a matter of “writing down what someone or some people said or did”: it includes making analytic judgments about what to represent and how to represent it” (Gibson & Brown, 2011, p. 2). The transcripts re-presented that data which were then streamed into themes through the method of coding.

The research was then analysed through thematic coding, creating categories and subcategories. The coding process included color-coding line by line, which permits categories of themes to be obtained.

Table 2: *Categories of Themes*

Theme One	Theme Two	Theme Three
Teachers understanding and awareness of differentiation in maths and their role as educators.	Strategies utilised for differentiation in maths	Challenges associated with differentiation in maths education.
Sub Themes		
Significance and recognition of differentiation in maths.	Withdrawal vs in-class support.	Lack of training.
Early intervention	Ability vs mixed ability grouping.	Large student – teacher ratio.

As seen from the table above, themes arose from the categories that permitted the researcher to analysis data. Both producers involve high reflexivity levels to efficiently analyse the data collected (Gibson & Brown, 2011).

Issues of Reliability

Reliability signifies the consistency of a measure (Heale & Twycross, 2015). If this study was replicated, any alteration in findings would be due to the outcome's change and not due to sampling bias (Denscombe, 2010). Conducting the pilot study allowed analysis of the interview process and questioning where the researcher enhanced the interview questions. The content of the letters informed the participants while identifying anonymous data and that all answers to be truthful to the topic in question (Cohen et al., 2011). Additionally, the reliability of interviews in a research study can be improved by coding responses (Cohen et al, 2007) as was carried out in this study.

Validity in Qualitative Research

“Validity is an essential criterion for evaluating the quality and acceptability of research” (Burns, 1999, p.160). Validity within a research study analyses the research, its countability and the data's accuracy (Zohrabi, 2013). According to Maxwell (2012), bias can be a risk to validity. This may occur in the form of data selection that reflects the researcher's existing preconceptions on the research question and perhaps information gathered that “stands out” to the researcher (Miles & Huberman, 1994). When constructing the interview questions, I ensured they were both relevant and appropriate to the study. The pilot study allowed for the question to be critiqued future. Therefore, any findings would accurately describe the perspectives of the teachers. To ensure the study's validity and reliability, Maxwell's (2005) strategies were applied to counteract bias. After collecting data, transcriptions of scripts were from the interviews and not solely what felt significant to gain richer data (Maxwell, 2005).

Reflexivity

Reflexivity relates to the “analytic attention to the researcher's role in qualitative research” (Palaganas et al., 2017, p.427). The interviewer and the interview situation may significantly influence the research and what the interviewee says (Maxwell, 2012). However, some factors can be employed to prevent such influence, like avoiding leading questions. As previously discussed regarding bias, the researcher understood the significance to comprehend how one can influence what the interviewee says and how it can alter the validity of the inferences drawn from the interview (Maxwell, 2012),

Limitations

A limitation encountered in this study was the time constraints of the research. Due to this limitation, a small sample size of nine participants were interviewed. Therefore, these research findings were limited to the participants perspectives and knowledge and may not represent all teachers as they are not generalisable. However, the results provide an understanding of the experiences of the professionals operating in the field. As the research was restricted to interviews via zoom under the current pandemic, it could be argued that observations and student's perspectives may have enhanced the study.

Conclusion

This chapter has examined the qualitative approach of this study and the form of data collection. The rationale for the chosen methodology has been discussed and the research conducted on other methods explored. Furthermore, this chapter has described the ethical approval, sample selection selected and practice elements such as data collection, piloting, data analysis, reliability and validity and finally, limitations. The next chapter will discuss the themes that emerged from the analysis of data collected.

Chapter 4: Analysis and Discussion of Results

This chapter presents and discusses the findings that emerged from this study. The researcher took a thematic approach during the analysis of data, utilising the essential measures as set out by Braun and Clarke (2006). From the data analysis of the nine semi-structured interviews, the three primary themes emerging from the data will be discussed in this chapter. The first theme explores teachers understanding and awareness of differentiation in maths education and their role as educators. The second theme considers strategies utilised for differentiation in maths. Lastly, the third theme that surfaced will identify challenges associated with differentiation in maths education. Additionally, within each theme, there are further sub-themes. The findings that emerged will be linked to the literature discussed in chapter two.

Teachers Understanding and Awareness of Differentiation in Maths Education and their Role as Educators.

Question one of the interviews asked for the participants perception of the term differentiation in maths education. According to VanTassel-Baska (2012), differentiation essentially involves customising teaching to attend to a specific student's learning needs and their learning method. All participants were in agreement with the literature when commenting about their perception of what the term differentiation in maths education meant. The majority (6 of 9) of participants acknowledged in the definition of differentiation that it involves catering for the needs of the children to support them in accessing the curriculum. Three others mention that it involves changing the pace and providing different resources to support the needs of the children.

Participant A explained:

Differentiation in maths education allows for educators to provide the best education possible for each child as an individual learner. It allows for children to learn at the

best of their ability, accessing the curriculum and it means that teachers can cater for the different levels of learning within their specific classroom.

It is evident from participant A that their perception of differentiation in maths is in line with relevant literature. Participant A highlighted supporting students to access the curriculum to learn. The DES (2017) stipulates that educators have the responsibility to support and respond professionally by accommodating children's needs to access the curriculum.

Participant B and C was also of the impression that not all children learn in the same way or at the same pace and therefore it is their responsibility as teachers to critique their teaching to cater for all learners. Participant D agreed and further went onto say that “to make sure all children are learning, we may need to change certain things, e.g., pace, work given, resources. The differentiation is that change you make to meet the needs of the children”. The Education Act of 1998 supports inclusive differentiation practices as it states the classroom teacher to be responsible for education and personal development of all their students.

Tomlinson (2002) states that one-sized clothing does not fit all which participants of this study highlighted and support in their teaching. This is corresponding in relation to student learning. When differentiation is implemented in the classroom, the majority of participants (7 of 9) emphasised working collaboratively with the SET to find a differentiation method that works best for that student to progress in their learning which, often involves a trial-and-error process. However, the teachers role is to create a stimulating and supportive classroom environment where all students feel equal, valued and supported in their learning (DES, 2017). Differentiation in maths education supports this outcome.

In line with Continuum of Support Guidelines, teachers have the role of identifying and reacting to their students with additional needs including differentiating the curriculum as appropriate (DES, 2017). From the data collected, it is clear that all nine participant primary

teachers value differentiation in relation to maths. The findings reflect on the inclusivity of the modern classrooms and the use of differentiation in maths to cater for student diversity (Gaitas & Martins, 2017).

Significance and the recognition of differentiation in maths education. The findings correspond with the relevant literature regarding the enhanced recognition of differentiation in maths education in modern society. When asked if differentiation was more commonplace within the classroom today compared to when first began teaching, all participants express the significance of differentiation in maths education. Out of the nine interviews, seven participants state the significant development of differentiation in maths.

Participant C states, “Absolutely. When I started, there was little to no differentiation, only what was provided by Learning support and that was not for minor learning difficulties”. Participant D agreed and further developing saying, “Yes, definitely. I feel like differentiation was a more optional element of teaching and learning when I began teaching. Children who struggled were referred to as being unable to ‘keep up’ with the rest of the class.”

This echoes the literature that indicates the development from a didactic model of traditional teaching. This approach did not accommodate diversity, differentiation or flexibility in practice to cater for individual students uniqueness or needs (Kalantzis, 2005). The move away from the didactic model of traditional teaching and the increased recognition supports diversification and has adjusted to a constructivist approach.

The remaining two participants highlight the importance of differentiation in maths but note that they have experienced little change since the beginning of their teaching career as they have only been teaching for two and three years. However, both participants express how differentiation is expected, essential and delivered in every mainstream classroom. With

participant G adding “especially for maths as it is often a subject where various abilities are evident”.

Modern society has evolved in terms of supporting diversity in maths education and these elements are now required in practice to facilitate all learners. In addition to this, The Continuum of support process designed by the DES (2007) provides a foundation and continuous support process of three specific based strategies, which include classroom support, school support and school plus support.

Participant H supports this statement explaining, “I have only been teaching for the last five years and I have seen differentiation being increasingly implemented, adapted and changed regularly in maths”. This shows how prevalent differentiation is becoming and how teachers need to be abreast of relevant differentiation and teaching strategies in maths.

Early intervention. As recommended by the DES (2007), a stage process of implementation and identification was suggested for children with SEN. However, according to Mc Carthy (2011), reinforcement of this policy in the early years would support the identification of children's learning difficulties as soon as the second term of Junior infants. In addition to this, there is also conjecture among participants to the adequate stage to introduce differentiation.

Participant H explains that “differentiation should be implemented as early as possible. If a child is supported early on, it may reduce or eliminate their need for withdrawal in later years”. Participant I is of the same concern explaining, “the sooner it can be implemented, the better. Students will believe that they are “not good” at maths”. Also, participant E suggests, “it should be implemented at an early age to encourage a child to challenge themselves and it also reassures them that no matter what their ability there are resources for everyone ”.The

Continuum of support and guidelines designed by the DES support teachers call for early intervention strategies, confirmed by some participants.

However, participant C contradicted this and stated, “no, I think it is more beneficial to wait until signs are more evident. Pupils are individuals and some just need a little more time adjusting to school life/ learning etc.” Similarly, to this, participant D believes “it depends on the child, but I would lean more towards waiting until signs are more evident as you don’t want to label a child as being weak from an early age.” Interestingly, not all teachers agree with the guidelines. Both sides to early intervention have good reasoning in their opinions. However, this raises questions around the implementation of policy into practice.

Differentiation Strategies implemented by teachers in maths education.

Withdrawal verses in class support. Another theme evident from the analysis of data was teachers views on in-class versus withdrawal support in maths education.

Figure 2: *Models of support: In-class vs. Withdrawal Support, Teacher Preferences*

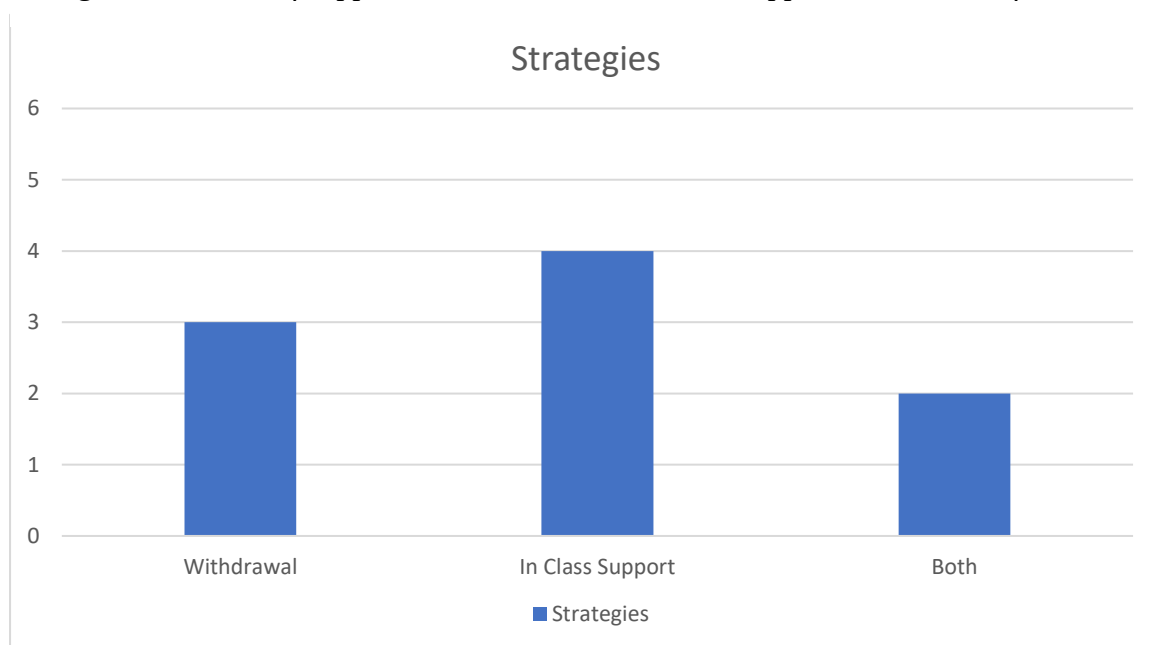


Figure 2 above reveals participants responses to withdrawal or in-class support as being more effective for the students learning in maths education. The findings revealed mixed opinions with in-class support marginally dominating withdrawal support. This is again

conflated with current policy, which strongly recommends an in-class support model for most children despite those who require very specialised instruction, perhaps students with dyscalculia.

Participant H explained that “in-class support provides opportunities for more collaborative learning and peer learning in maths, which is hugely beneficial for all children.” Participant E supports this statement further stating, “I feel like in-class support is more effective for Maths as it allows the students to join in more with the group activities and discovery of new topics.” This supports the idea that students who might need explicit teaching might get it through in-class support, peers and discovery learning as above. With differentiated instruction implemented when designing mathematical education and interventions in place by the teacher, in-class support results in many benefits for students learning in mathematics (Bender, 2009; Dowker 2004).

Participant C is of the opposite opinion expressing that, “withdrawal is more effective for those pupils below the percentile score. Out in SET their work is very specific and focused on their needs/ ability in maths”. Participant D supports this statement as they explain, “children who have spent a few months in a withdrawal setting working on core maths concepts have returned to the class and are more than capable to keep up with the content in the class”. The removal of students or small groups to deliver instructional support learning in subjects such as maths endorses the traditional dominant learning model of support (Weir, Moran & O’Flaherty, 2014; Travers, 2011)

However, the DES (2000) highlight the over-reliance on withdrawal support. It emphasised support to be conducted within the classroom setting. This has been supported in recent literature and policies such as the Literacy and Numeracy strategy as it highlights many benefits for the student (Griffin & Shevlin, 2007; DES, 2011). In relation to maths, surprisingly,

both participants C and D have been teaching for over 20 years. Despite being employed as primary school teachers when the DES alluded to the withdrawal support, not much has changed from the perspective of these two teachers interviewed.

A mixture of both in-class and withdrawal was also evident to be beneficial among participants. Participant G explains, having worked in mainstream and in SET, that “there are advantages to both. Personally, I think it depends on the class, class level, child being supported and the area of support”. Similar to participant G, participant F explains, “ideally, if possible, I think a mixture of both is what is most effective for a child’s learning in maths. It allows for in-class support and development as well as intensive, more direct teaching without the distractions that are a part of the mainstream classroom.”

It is evident from the findings that support in class or withdrawal has significant benefits to students progression and development in maths. As a result of the findings, it is interesting to see the increased use of in-class support and teacher’s perspectives of both practices. However, it suggests that withdrawal support is still active in practice today. In addition to this, the DES stated in (2017) that schools have discretion with regards to the implementation of support based on the greatest level of need, which means that pupils with specific disabilities in maths, such as dyscalculia, can receive targeted specific one-to-one support, if deemed necessary by the school.

Ability grouping verses mixed ability grouping. All participants were asked to discuss strategies implemented for differentiation to support the learning and development of children in maths. As seen in figure 3 below, the more common response was the application of ability grouping in the classroom.

Figure 3: *Ability Grouping vs. Mixed Ability Grouping*

Participant H expresses the significance of ability groups explaining that “grouping the children based on ability is also very helpful as it enables the teacher to provide additional instruction to certain groups easily.” Participant C also expresses the benefits of ability grouping, further explaining that resources are distributed to the students when grouped according to the ability to support them in their learning. For example, she explained that for lower ability individuals concrete materials are essential and also the amount of work that is marked for completion must be achievable for the students. And for higher achievers, participant C suggests “after completion of a certain amount of extra worksheets they earn points towards a homework pass.” It appears that often children are grouped by ability for ease of accessing similar resources to support learning. However, meaningful peer learning or modelling will be diminished by ability grouping. Categorising children based on their ability can also result in children classifying or defining themselves based on the group they are allocated (Mc Guillicuddy & Devine, 2018). Regarding higher achievers, only one participant

commented on high achieving students. However, their differentiation strategy was not in coherence to Westwood (2001) and Tomlinson (2005), as they highlight this issue of mistakenly implementing differentiation instruction in the form of extra work. While reasoning may be palpable, it is often ineffective for teaching and learning (Westwood, 2001).

In addition to this participant C includes the significance of station teaching. Although station teaching can be conducted using mixed ability groups, the participant comment on the benefits of station teaching utilised in the form of ability grouping. “It’s fantastic when station teaching based on ability can be facilitated by the help of SET.” Participant I agreed and elaborated further, saying that due to the larger student teacher ratio and range of ability in the classroom, station teaching through the means of ability grouping and support of the SET assists the participant in conferencing with the children in their groups and supporting them in their learning. Participant F also supported ability grouping explaining the use of it through station teaching as it provides an “opportunity to work with children at their ability in a smaller ratio, gives each child a better chance to flourish and it definitely gives the teacher a chance to gain a deeper understanding of each child’s individual needs.” Even within ability groups, children may be at different levels, especially if they are within the two outlier groups. Therefore, differentiation is still required (Deunk et al., 2018).

In recent years, station teaching has evolved lead by an SET (PDST, 2018). It provides for all children to be immersed in the same curriculum through integrated inventions and has proven to show effective outcomes for learning skills in mathematics (Cull & Travers, 2018; PDST, 2018). However, the NCCA (2018) consultation report acknowledge that primary schools require assistance and advice on establishing and implementing team-teaching. This could give rise to the inconsistencies in the application of policy in terms of ability grouping and in-class support. Sufficient training, CPD and support needs to be provided to teachers to successfully implement policy.

Participant A was of the opposite opinion explaining, “I believe that mixed ability groups can have many benefits for differentiation, for example, the “stronger” children could further support those who are deemed to be “weaker” in maths”. Participant D also expresses the benefits of mixed ability groups stating, “children learn from and help each other every day. If grouped, I think weaker classes would fall behind and the learning gap between peers would widen”. This supports So, Seah, & Toh-Heng (2010) statement regarding the benefits for students when educated together with various abilities.

In line with Vygotsky’s ZPD, children within the classroom today have different readiness levels in math, resulting in their ZPD differing (Prasta, et al., 2015). Tasks designed for the median children’s ZPD may become challenging for some and not challenging for others for maths. Therefore, various strategies for differentiation need to be implemented. To achieve effective method for differentiation can be challenging (Csikszentmihalyi, 1990). However, the quality of teaching significantly affects access to the curriculum, enrichment of experience and creative mathematics (Dooley, 2019).

The findings suggest mixed views on the value of mixed and ability grouping. Literature supports mixed ability grouping and suggests that mathematics has been delivered in some primary schools by ability group (Dooley, 2019; Mc Guillicuddy & Devine, 2018). However, the negative impacts have been highlighted due to ability grouping resulting in contributing to exclusion and poor self-esteem, subsequent in identifying themselves (Mc Guillicuddy & Devine, 2018). Smith (2017) explains that ability grouping can affect children’s academic mindset, their educational expectations and delays in progression (Higgins et al., 2015). However, maths programs such as Ready, Set, Go – Maths encourage students to be grouped and taught in ability groups (PDST, n.d). Perhaps this early intervention strategy has a spill-over effect for later years.

Challenges of differentiation in maths education.

The findings of this investigation reveal that attitudes towards differentiation in maths education are predominantly positive. However, after analysing the data, it emerged that some aspects of implementing differentiation were ‘difficult’ and ‘challenging’. Difficulties arise from a lack of support, large teacher-student ratio or lack of training.

Lack of training. Participant E explains, “I never really learned a lot about differentiation in college, it was mention, but we were never explicitly taught how to apply it to practice.” Participant I also mentions, “I have developed differentiation skills from my own personal experience as an educator and from talking to more experienced colleagues”.

Similar to that of participant E and I, participant C confirms that, “I never received any training on how to differentiate. I learned from hands-on experience and witnessing the benefits of ability grouping made possible by the in-class support of our SET team”. The findings reveal the lack of training received for teachers to feel confident in conducting differentiation in the classroom. According to Heacox (2014), teachers are expected to develop differentiation skills over time, which increases their ability and confidence of differentiation in practice. This correlates with the data collected, as it highlights teachers seeking differentiation advice from experienced others and developing skills through practice. However, the literature expresses the effects of misinterpretation of differentiation such as a less challenging classroom environment for some learners (Hertberg-Davis, 2009). To prevent such outcomes, CPD on differentiation would support teachers in their role and be knowledgeable to provide the best practice for their students (Taylor, 2017). Dixon et al., (2014) suggests observation and monitoring differentiation while offering feedback collaboratively can effectively support teachers to develop skills and accommodate children's needs.

Large student teacher ratio. Another challenge evident from the analysis of the data is large student-teacher ratios and the challenges for the class teacher regarding time to accommodate all learners due to the volume of students. Participant B confirms this, explaining, “it can be challenging sometimes in terms of the class size and time. You are only one person and sometimes that’s the biggest struggle”. Participant F also expressed concern explaining, “I think the biggest challenge during Maths is the class size, time and pace. Children can work at such varied paces”. However, to overcome these challenges, participants mention the use of collaboration methods, for example, station teaching. Participant H explains, “as it is such as big class group, station teaching provides more support for the teaching and the children to try and accomplish all needs in the class”.

Peter (1992) highlights the challenges and conveys the need for extra time for differentiation instructions. The complexity of the reality of the large student-teacher ratio, lack of planning time, lack of training and possible support, presents challenges for teachers for efficient differentiation and the ever-increasing duties of teachers (Brighton et al., 2005). However, it has begun to evolve with the introduction of SETs, station teaching and collaboration.

Conclusion

To conclude, the findings of this research have been highlighted, presented and discussed in the three primary themes, teachers understanding and awareness of differentiation in maths education and their role as educators, strategies utilised for differentiation in maths and challenges associated with differentiation in maths education. Chapter five will conclude the research study and present recommendations based on the findings.

Chapter 5: Summary of the Conclusions and Recommendations

Introduction

The overall aim of the research study was to explore Irish primary school teacher's perceptions and approaches to differentiation in mathematics. This chapter will summarise the study's key findings and present the recommendations, limitations and directions for future research based on the findings.

In correlation with relevant literature, this study found that teachers are aware of their role and understand the significance of differentiation in maths. The continuous developments of inclusion in primary education have resulted in teachers being responsible in catering for all learning abilities effectively. The implementation of differentiation in maths supports teachers to accommodate the diverse classroom environment. However, there were inconsistencies between participants responses and approaches recommend by literature. Participants expressed that all children are unique, and it is difficult to facilitate differentiation effectively, which often results in a trial and error process. Dowker's (2009) study also supports this, stating 'No two children with arithmetical difficulties are the same' (p.3). Therefore, teachers are responsible for investigating the student's strengths and weaknesses and target strategies to suit the individuals difficulties.

The findings highlighted the use of withdrawal and in-class support from an SET as forms of differentiation used by Irish primary teachers in maths. Both forms of support have justification. However, in-class support has been regarded as more favourable in terms of inclusivity and educational benefits. However, it is noted that withdrawal support could benefit students who require intensive instruction to support learning in maths.

The debate between ability groups and mixed ability groups is also highlighted as a form of differentiation in maths. Based on the findings among participants, ability grouping

was more prevalent than mixed ability grouping. Over half of the participants spoke positively about ability grouping as it permitted them to provide differentiation instruction to the correct ability level. However, the literature generally calls for mixed ability grouping as it negates the negative impact ability grouping can have on the children's self-esteem and self-efficacy in maths. The remaining participants express the benefits of mixed ability grouping such as peer learning, inclusivity and closing the learning gap between students.

Although participants attitudes and understanding towards the significance of differentiation and various forms of differentiation in maths were positive, some challenges also emerged. These primarily include a large student-teacher ratio and the lack of training. In reality, challenges develop when meeting all of the needs of thirty-plus students in the same classroom. It is difficult for teachers to have adequate time to provide explicit differentiation instruction. This results in many participants employing station teaching to accommodate and access all learning needs. However, the NCCA (2018) consultation report states the need for training and guidance to effectively establish and execute such a strategy.

A key finding that emerged was a lack of ITE on differentiation to support teachers in employing differentiation methods in maths. This results in teachers conducting their own research and learning from their practice or asking an experienced other.

Recommendations

This research found that there are levels of uncertainty associated with differentiation in maths education and there is a gap in implementation of policy into practice. Therefore, this research makes the following recommendations based on practice, policy and future research.

Practice and policy. It emerged that there is a need for greater emphasis on the differentiation of mathematics at ITE. This could come about as a result of a review of pre-service programmes nationally. The data analysis established that teachers left college unaware

of various strategies to implement differentiation in maths education. Teachers mentioned having to adapt their own learning and practice when teaching in terms of differentiation and not having adequate skills when initially commencing teaching. It is essential for teachers to have the skills and strategies to facilitate all learning needs that may enter their classroom to improve practice.

To keep up with the continuing developments in education and upskilling, teachers should be allocated specific hours to access SEN training and more specifically in differentiation in maths. This could be allocated hours through Croke Park hours in the form of continuous professional development (CPD). Therefore, more CPD opportunities need to be offered to support teachers in an area such as differentiation in maths, a practice utilised daily by primary teachers. An example of this could be utilised to educate teachers on station teaching, providing the training and guidance they require to apply it in practice correctly. This would ensure that teachers are able to meet the needs of all individual children and improve practice on the ground.

Interestingly, when discussing differentiation each participants natural instinct was to mention students with difficulties and student's who were not achieving very highly. All teachers apart from one neglected to mention students who were very well able and the one teacher that did address this alluded to extra work which is deemed in the literature as not appropriate. This highlights further references that teachers need more training on different strategies to accommodating the needs of all children.

Therefore, skilled teaching is required (Chinn & Ashcroft, 2007; National Council for Curriculum and Assessment, 2007). While the information base in mathematics difficulties is not as up to date as that of literacy, there is a foundation of evidence based practices to guide and assist teachers to deliver quality instruction to students with learning difficulties in

mathematics in need of differentiated instruction (Gersten & Newman-Gonchar, 2011). With the implementation of a revised curriculum for mathematics, there brings opportunity for up-to-date quality of instruction, CPD and whole-school and staff training on differentiation in mathematics. Perhaps the NCCA or NCSE could issue guidelines and revised approaches to teaching students with mild and general learning disabilities in mathematics in conjunction with the new revised curriculum. This would potentially support teachers in identifying how to facilitate the needs of all children, of high ability and students that need support through the means of differentiation strategies in maths in mainstream classes.

Future research. This research study is not without limitations. Due to the limited timeframe and relatively small sample of participants, the findings are limited and are not generalisable. However, it offers insight to professionals working in the field exploring differentiation in maths. Future work on a larger scale sample would build on the findings that emerged and allow for greater generalisable data in this area. Including the child's voice and experience would significantly add to this volume of data. Including a cohort of children in further research would allow for children's perspectives on differentiation support, mixed ability groups and withdrawal verses in-class support to be expressed and shared which would significantly enrich findings and recommendations.

Conclusion

This chapter explores the findings, recommendations and limitations of this study. The findings highlight the significance of differentiation, but more importantly, the need for change to occur within ITE and support for teachers to create the best experiences for all learners through differentiation in maths. By recognising the challenges faced by teachers in modern day Irish primary school classrooms, changes can be made to ensure that the needs of children that require differentiation in maths education are being met in an educational context. Until

then, it is apparent that more work and time needs to be devoted to the area of the various forms of differentiation in maths.

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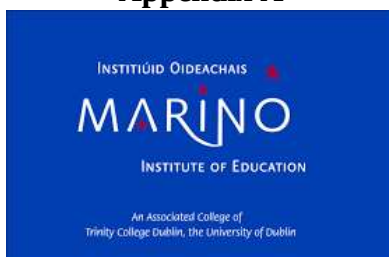
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Appendix A



Address

Date

Dear _____

My name is Kathy Conaty. I am a second year PME student at Marino Institute of Education. As part of my final year dissertation, I am conducting a research project to investigate Irish primary school teachers perceptions and approaches to differentiation in mathematics. This study seeks to explore teachers perspectives, strategies, and challenges faced by primary school teachers employing differentiation in maths in their classroom.

I am writing to ask you to participate in this research project which would involve a short interview. The purpose of the interviews is to explore differentiation in maths learning, how you as an educator employ it in the classroom and the challenges that come with differentiating. The interview will take approximately thirty minutes.

I wish to make it clear that you are free to withdraw from the research and at any stage up to submission without having to offer a reason. Confidentiality is central to my research and to protect participants data. Data pertaining to participants in the research will be anonymised and data will be carefully stored on my personal computer through the means of an encrypted file which is password protected. The data will only be used to write up my dissertation and for matters arising from the completion of thesis.

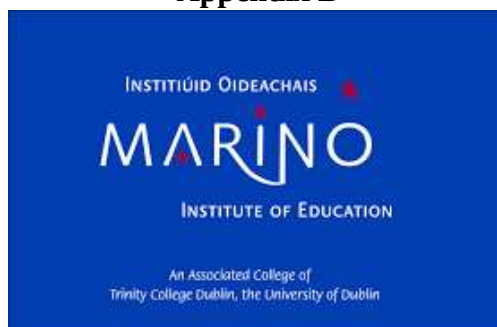
I would be very grateful if you could consent to participate in my research study. If you require any further information, please do not hesitate to contact me at **08xxxxxxx** or by email at xxxxx@mie.ie.

I look forward to hearing from you.

Kind Regards

Kathy Conaty

Appendix B



Consent Form

- Ivoluntary agree to participate in this research study. ☐
- I understand that I have the option to withdraw from the research study withdraw at any time, without giving any reason, and without consequences. ☐
- I understand that information will be entirely confidential or anonymous. ☐
- I understand that merely the researcher, supervisor, and examiners will have access to the data collected. ☐
- I have had the intention and nature of the research described to me and I have had the chance to ask questions about the research study. ☐
- I understand the semi- structured interview will take approximately 30- 40 minute at a time and location that suits me. ☐
- I agree to my interview being audio-recorded. ☐

Contact information:

Researcher: Kathy Conaty

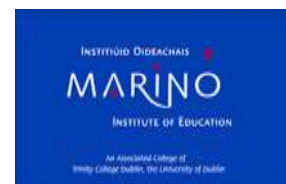
Email: kconatypme19@momail.mie.ie

Phone: 086xxxxxxx

Signature of participant: _____ Date:_____

Signature of researcher: Kathy Conaty

I believe the participant is giving informed consent to participate in this study.



Appendix C

Interview Questions:

What is differentiation in mathematics, in your opinion?

How do you differentiate for maths within your classroom?

Are there any benefits to differentiation in maths? Do you think it is important?

How did you develop the skills and knowledge to incorporate differentiation in maths?

What resources/ strategies do you incorporate into your classroom to support differentiation in maths?

What resources/ strategies do you find work best?

Do you incorporate station teaching as a method of differentiation in maths?

Do you find it challenging to incorporate differentiation into maths? If so, how?

Do you think withdrawal or in-class support is more effective for the students learning in maths? Explain?

Have you noticed any changes in student's experiences/learning in relation to the move towards in-class support rather than withdrawal support?

In your professional experience, would you find differentiation more commonplace/expected within the classroom today compared to when you first began teaching?

In your opinion, would you find seating arrangements as a significant element within the class in terms of differentiation in maths?

Are children grouped for maths instruction? How are they grouped?

Do you think streamed classes should be created in large, scaled schools with two or more classes per class group? Why?

In your opinion, do you think differentiation in maths should be implemented at an early age/ when there are minimal signs of a child struggling? Or wait until signs are more evident for the need for differentiation?

If you could receive additional continuous professional development in relation to differentiation in maths, what would you advocate for?