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Title	Bridging the primary to secondary school mathematics divide: Teachers' perspectives
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Publication date	2019
Original Citation	Prendergast, M., O'Meara, N., O'Hara, C., Harbison, L., and Cantley, I. (2019) 'Bridging the primary to secondary school mathematics divide: Teachers'perspectives', Issues In Educational Research, 29 (1), pp. 243-260.
Type of publication	Article (peer-reviewed)
Link to publisher's version	http://www.iier.org.au/iier29/prendergast.pdf
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Download date	2026-10-13 12:57:52
Item downloaded from	https://hdl.handle.net/10468/10364

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Bridging the primary to secondary school mathematics divide: Teachers' perspectives

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The transition from primary to secondary school is regarded as one of the most difficult crossings in students' educational careers. The move, which typically occurs between the ages of twelve and fourteen, can be particularly pronounced for mathematics. This article describes the results of a questionnaire distributed in the Republic of Ireland in which the views of primary and secondary teachers were ascertained with regard to the transition process. A total of 298 primary and 173 secondary teachers completed the questionnaire. Results showed that teachers at both levels identified similar issues such as a lack of continuity between curricula, a lack of knowledge of each other's curriculum and a lack of communication between both levels. Many of the teachers' suggestions on how the transition process could be improved centred on these issues, as well as highlighting a need to provide joint professional development opportunities for teachers.

Introduction

The transition from primary to secondary school presents a significant challenge with lasting effects on the educational career of the student (West, Sweeting, & Young, 2010). The move, which typically occurs between the ages of twelve and fourteen, is deemed to play a central role in the academic performance and social well-being of the individual (Mackenzie, McMaugh & O'Sullivan, 2012; Zeedyk et al., 2003). Internationally, much research has been carried out to investigate this transition and the issues surrounding it in more detail. In New Zealand, Bicknell, Burgess and Hunter (2009) noted that such issues are complex and involve challenges from a social, academic and systematic perspective. In a study involving South African students, Paul (2014) surmised that the requirements of the transition, such as adjusting to different subject requirements and teacher expectations, coupled with managing multiple deadlines for homework and other work, increased the danger of students developing negative attitudes towards their school, their relationships with teachers, and teaching and learning. Some of the resulting consequences are a decline in students' academic performance and confidence (Attard, 2010; Paul, 2014), as well as stress and heightened levels of anxiety (Mackenzie et al., 2012; Zeedyk et al., 2003).

Although the transition can cause declines in student achievement across a range of subject areas, the literature indicates that mathematics is often one of the main subjects affected (Grootenboer & Marshman, 2016; McGee, Ward, Gibbons & Harlow, 2003). This can result in students' interest and liking for the subject decreasing, leading to disengagement and reduced levels of self-confidence and motivation (Attard, 2010; Paul, 2014) In an Australian study, Hopwood, Hay and Dyment (2016) found that the implications of this for student learning are quite alarming. With this in mind, the research carried out by the authors investigates the issues surrounding the difficult transition in mathematics in more detail, specifically from the viewpoint of teachers. The aim of the study was to identify and compare primary and secondary teachers' perceptions on the barriers to transition and ways in which the transition experience of students could be improved. Such an investigation is important as teachers play an important role in guiding and assisting students through the transition years. However, despite this, minimal research exists around teachers' perspectives of transition from primary to secondary school mathematics.

Setting the scene: The school transition

A school transition is seen as moving from the known of primary school to the unknown of secondary school (Green, 1997). As such, this transition can be termed as an 'institutional discontinuity' (Anderson, Jacobs, Schramm & Splittgerber, 2000; Rice, 1997). Anderson et al. (2000) explained that there are two types of institutional discontinuities, one known as organisational – which includes, changes to school size, heightened student autonomy and more rigorous academic standards – and the other referred to as social – which includes changes in the diversity of the population and sense of belonging. The move from primary to secondary school includes both organisational and social discontinuities. These discontinuities arise as a result of the schooling system being divided into sections that students are moving to and from (Green, 1997). For instance, in Ireland, students' formal education begins in primary school which they typically commence when aged five years old. Following eight years in primary school, students make the transition from 'sixth class' to 'first year' in secondary school.

With specific reference to mathematics, the subject is a core focus of the Irish primary and secondary school curricula. In 1999 there was a major reform of primary school mathematics. The revised curriculum, which is still in use today, focuses on a constructivist approach to learning mathematics in which children play a central role. Its main aim is prepare children to meet the demands of the 21st century and prepare them to think and communicate quantitatively in order to solve problems (NCCA, 1999). However, these changes which occurred at primary were not reflected at secondary level where the syllabus had remained relatively unchanged since the 1960s and where an emphasis was placed on mathematical structures, abstraction and rigour (Lyons, Lynch, Close, Sheerin & Boland, 2003). This resulted in a highly procedural approach to teaching mathematics in secondary schools (NCCA, 2005) and also in a lack of coherence between the teaching and learning of the subject at both levels (Prendergast & Treacy, 2018).

Such inconsistency between both curricula continued until a major reform of secondary mathematics education entitled *Project Maths* was rolled out on a phased basis in all schools nationally in 2010. The main aim of Project Maths was to promote an understanding of mathematics so that students can appreciate the relevance of what they are learning, how mathematics can be used to solve problems and how mathematics is applied to everyday life (Prendergast & O'Donoghue, 2014). Its implementation involved changes to what students learn in mathematics, how they learn it and how they are assessed. A key feature of the Project Maths curriculum reform at secondary level was the introduction of a *Common Introductory Course* (CIC) for incoming first years students. In conjunction with the CIC, a *Bridging Framework* was developed to connect the sixth class and first year syllabi and facilitate a smoother transition from primary to secondary mathematics. As demonstrated in Figure 1, the strands of mathematics at primary level can now be linked to those at secondary level in order to ensure better continuity, not just in pedagogical approaches, but also in content.

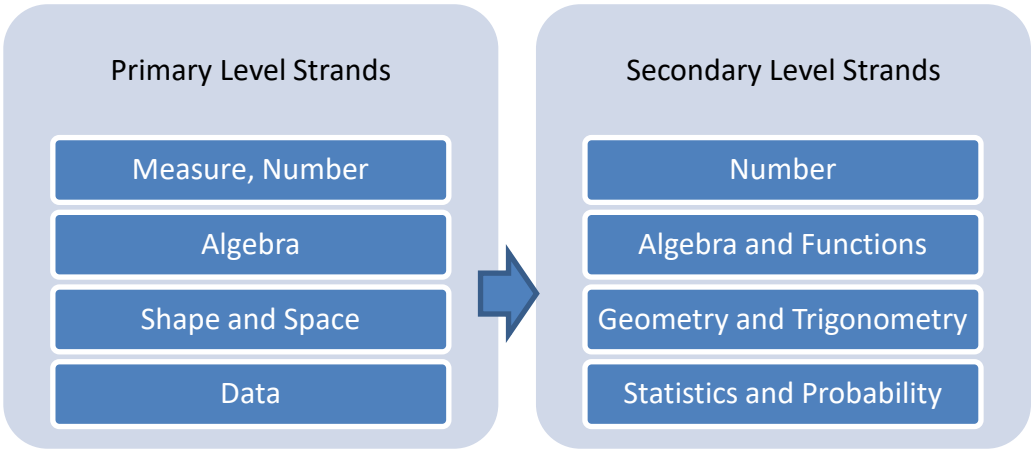

Figure 1: Alignment of primary and secondary mathematics syllabi

Such moves on providing better continuity between curricula are in line with national policy. For example, one of the Irish Government's objectives in the *Action Plan for Education 2017* is to improve the transition of learners at critical stages in the education system (DES, 2017). This is in light of many issues which have been highlighted in international literature, particularly regarding the transition from primary to secondary education.

Issues regarding the transition

The transition from primary to secondary school often involves young people moving from a discrete, self-contained classroom to a large, more heterogeneous school with a heightened expectancy of independent academic performance and reduced levels of teachers' scaffolding (Hanewald, 2013). More explicitly, the change in context involves making new friends while adjusting to a new school environment, school day organisation,

and multiple subject-specialist teachers with different teaching and learning approaches (Bicknell et al., 2009). As a result of these social, academic and systemic challenges, practically all students are affected in some manner (Anderson et al., 2000; Bicknell et al., 2009).

An empirical study by Alspaugh (1998) in the U.S. recorded losses in students' achievement scores in mathematics, reading and science as they moved from primary to secondary school. In New Zealand, Cox and Kennedy (2008) conducted a study on students' performance in mathematics, reading and writing during the transitionary period. The results indicated that there was a decline in achievement in mathematics for the average student, despite these students having a relatively positive attitude towards the subject. The researchers also found that the greatest variability between students' scores was in mathematics and that the gap between high- and low-achieving students was extended following the transition to secondary school. Mizelle and Irvin (2000) in the U.S. found that some students' self-image as a competent learner was challenged by their expectation of more difficult mathematics in secondary school. In addition, as the transition to secondary school drew closer, students' confidence in themselves became fragile, thus affecting their attitudes towards the subject.

In mathematics, in particular, students' attitudes have been found to become more negative after they transition from primary to secondary school (Galton, Hargreaves & Pell, 2003). In the U.S., as far back as 1984, Eccles et al. found that after the transition there was a sharp increase in students' pessimism towards their ability and potential in mathematics along with more negative views on the value of the subject. More recently, this deterioration in students' outlook towards mathematics was mirrored in findings reported by the TIMSS (Trends in International Mathematics and Science Study) large-scale international comparative study conducted in 2015. On average, across the countries that participated in the TIMSS fourth grade study, 81% of 9-10 year old students (upper primary school students) reported that they very much liked or liked learning mathematics, while 21% indicated that they did not. However, for the countries participating in the eighth grade study, on average 61% of 13-14 year old students (lower secondary level students) reported that they very much liked or liked learning mathematics, and 38% did not (Mullis, Martin, Foy & Hooper, 2016). This is noteworthy given that many studies have shown a correlation between students' attitudes towards mathematics and their achievement in the subject (Ma & Kishor, 1997; Papanastasiou, 2000).

Thus there is ample evidence outlining a variety of issues which arise during the primary-secondary transfer. However, much of this evidence is based on the experiences of students making the transition. The other main stakeholders involved in the process are teachers, at both primary and secondary levels. Teachers play a pivotal role in a students' education and in their transition experience (Midgley et al., 2000), and they are in a central position for providing the social and academic support students need in order to transition successfully (Hopwood et al., 2016). Despite this, little is known about the perceptions of teachers at both sides of the divide and the issues they identity as problematic in supporting students from one year to the next. The most relevant piece of

research in this area to date, is an Australian based qualitative study carried out by Hopwood et al. (2016) in which twelve teachers from both primary and secondary schools were interviewed. Findings from the research identified three key methods which primary and secondary school teachers believed were essential for facilitating successful transition experiences for students: curriculum continuity and awareness, communication between primary and secondary schools, and adequate teacher support (Hopwood et al., 2016). The authors' study expands on these findings in an Irish context, through a quantitative approach which involved a much larger sample size of teachers. The aim of the study is to address the following research questions:

1. What are the main barriers to successful transition from primary to secondary mathematics education in Ireland?
2. How can the transition from primary to secondary school mathematics education be improved?

Method

This study involved the distribution of a questionnaire to a representative sample of sixth class teachers in primary schools and first year mathematics teachers in secondary schools. The questionnaire was designed specifically for this study and it was developed by the authors with the assistance of two advisory groups, one with three primary teachers and one with four secondary mathematics teachers. Their role was to help with the development and piloting of the questionnaires and to help the authors in relation to sampling issues. These seven teachers were experienced in their positions and were recruited using a purposive sampling method (each teacher was known in a professional capacity by at least one of the researchers). They were invited to participate on the basis of the expertise they could bring to the research and the contemporary experiences they have in similar peer groups to the research participants.

When developing the questionnaires, both advisory groups were asked to consider how data addressing the research questions could best be gathered through the use of a questionnaire. It was decided that each research question should be directly included in the questionnaire accompanied by a series of related Likert scale items, dichotomous, multiple choice, and further open ended questions. The final draft consisted of four distinct sections and a total of twenty three questions. These questions, which included the two research questions, sought basic demographic information and also looked to gather information on a range of matters in relation to teachers' views and awareness regarding the transition. For example, teachers of both levels were asked about recent Irish Government transition initiatives such as the *Bridging Framework* and the *Education Passport*. The designs of the questionnaire for both sets of teachers were matching to allow for comparison of responses. The only changes were those which were forced due to variations in terminology between the two systems (for example the *Shape and Space* strand in primary school is referred to as *Geometry and Trigonometry* in secondary school). Prior to distribution, the questionnaire was piloted with the seven members of the advisory groups who offered advice regarding its layout and structure and the wording of some questions.

The sampling frame for the study was a list of all 3,300 primary schools and 723 secondary schools in Ireland. Based on the population size it was determined that, to allow for a 5% margin of error for a proportion, the study would require 263 responses from sixth class teachers and 133 responses from first year mathematics teachers. With this in mind, the targeted sample size was 700 sixth class teachers and 400 first year mathematics teachers. By consulting the primary teachers' advisory groups, the authors established that on average, there is one sixth class teacher in each primary school in Ireland. As a result, a simple random sample of 700 primary schools was selected. Overall, the sample included 21.2% of all primary schools. Having consulted with the secondary teachers' advisory group, it was established that on average, there are two mathematics teachers teaching first year mathematics in each school in Ireland. Hence using this estimate, a stratified random sample of 200 secondary schools around Ireland was selected. This sampling technique ensured that an accurate representation of each type of school (secondary, vocational, community and comprehensive) in Ireland was included in the sample. Overall the sample included 27.7% of all secondary schools in Ireland.

The questionnaires were distributed (one to the 700 primary schools and two to the 200 secondary schools) in early April 2016. The primary school questionnaires were sent to the principal of each school and they were asked to distribute it to a sixth class teacher. The secondary level questionnaires were sent to the head of mathematics in each of the 200 schools and they were asked to distribute them to first year mathematics teachers. The packs to both sets of schools included information sheets for all involved, the questionnaires, and stamped addressed envelopes for them to be returned. The information sheets issued to the primary school principals and secondary school department heads invited the recipients to make copies of the questionnaires for additional teachers in their schools if necessary. Each stamped addressed envelope included was also given a number corresponding to the school selected so the researchers could identify the schools that had not returned the completed questionnaires. Two weeks after sending the questionnaires, follow-up telephone calls to each of these schools were undertaken so as to increase the response rate.

The response rate was 298 primary school teachers (about 42.5%) and 173 second level teachers (about 43.25%). Upon receipt of the completed questionnaires the quantitative data was entered and saved into the computer program *SPSS* (Version 22.0) which was used to calculate descriptive statistics as well as to perform independent sample t-tests. The data from the open ended questions was transcribed into a Microsoft *Word* document and a thematic content analysis was performed pertaining to the two research questions. The primary and secondary teachers' responses were coded independently by two of the authors, highlighting common themes in relation to each research question until the coding was complete. The different sets of themes were then compared by the authors and any discrepancies were discussed in order to provide sound and consistent interpretation of the data. The emergent themes were summarised using a frequency/percentage analysis, supplemented by direct quotations from participants' responses where relevant.

The primary teachers who responded were distributed across 271 schools (38.7% of schools surveyed) while the secondary teachers who responded were distributed across 101 schools (50.5% of schools surveyed). Overall, there was a near even split (45% : 55%) between responding schools which were located in an urban or rural area, although there were more rural primary schools (63%) and more urban secondary schools (58%). The school size ranged from approximately 10 to 900 students for primary schools, with a modal number of 50 students per school (18%). For secondary schools, the size ranged from approximately 50 to 1400 students, with modal numbers of approximately 300 and 500 students per school (8%).

In terms of the demographics of the 471 responding teachers, the majority (67%) were female and this gender divide was matched in both the primary and secondary school responses. As evidenced in Figure 2, the modal number of years that teachers were qualified was between six to ten years (25% of primary and 22% of secondary).

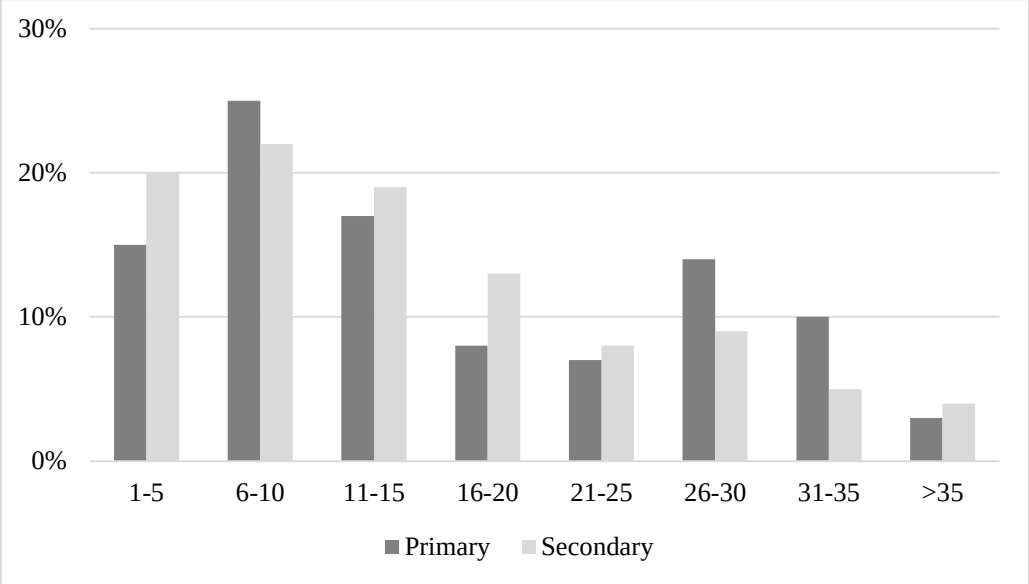

Figure 2: Number of years qualified

Findings

The data from the questionnaires are presented with reference to the two research questions.

RQ 1: What are the main barriers to successful transition from primary to secondary mathematics education in Ireland?

Teachers at both levels were questioned on their views regarding the transition and were asked to outline their opinions on the main barriers to a successful transition. The analysis

of this open ended question identified a number of common themes, the most prevalent of which are outlined in Table 1.

Table 1: Common barriers to successful transition

Barrier	Primary teachers (n = 229)		Secondary teachers (n = 131)	
	Freq.	Sample responses	Freq.	Sample responses
Incoming students lack of basic knowledge	0 (0%)	N/A	30 (23%)	S10: The basics of numbers, tables, fractions, decimals, etc. are not to a good enough standard. S92: Students coming through from primary unable to do what would be considered the basics - multiplication, division, etc.
Lack of continuity between curricula	88 (38%)	P27: Maths curriculum changed at Junior Cycle level in the recent past while we still work fromthe 1999 curriculum. Hard to believe that these are aligned with each other.	28 (21%)	S77: Methods adopted in primary school differ greatly to secondary school. S105: The gap between what they do in primary to first year is too wide.
Teachers lack of knowledge of each other's curriculum	70 (31%)	P34: Lack of knowledge of secondary curriculum by primary teachers and vice versa. P269: I teach primary curriculum and am unaware of curriculum of secondary school	14 (11%)	S47: Not enough awareness of curriculum between primary and secondary. S150: Lack of genuine information as to material actually covered in 5th and 6th classes and methodologies used.
Lack of communication between both levels	58 (25%)	P15: Not enough communication between primary and secondary teachers. P171: There is no interaction between 6th class teachers and 1st year teachers to promote understanding and a smoother transition.	22 (17%)	S48: Lack of communication between primary and secondary teachers.
Variety of standards and levels from the different feeder schools	0 (0%)	N/A	18 (14%)	S13: Students from different schools seem to have different levels in maths. S59: Different feeder schools doing different amounts of their course.

As evidenced in Table 1, there were a number of common themes mentioned by both primary and secondary teachers. For example a "lack of continuity between curricula" was cited by 38% of primary teachers and 21% of secondary teachers. In the literature review there was mention of the *Bridging Framework* which was introduced by the Irish Government in 2012 to ensure improved continuity between the primary and secondary mathematics curricula. In the questionnaires, teachers of both levels were asked a dichotomous (Yes; No) question about whether they were aware of this Framework. Ninety per cent (90%) of primary and 72% of secondary teachers stated that they were not aware. Furthermore, teachers of both levels were asked to indicate their level of agreement with the following statement using a five point Likert scale (see Figure 3): "There is a fluid transition between primary and secondary mathematics curricula". The findings showed that while a large number of teachers indicated that they were unsure, by neither agreeing nor disagreeing with the statement, 45% of respondents at both levels disagreed that there was a fluid transition.

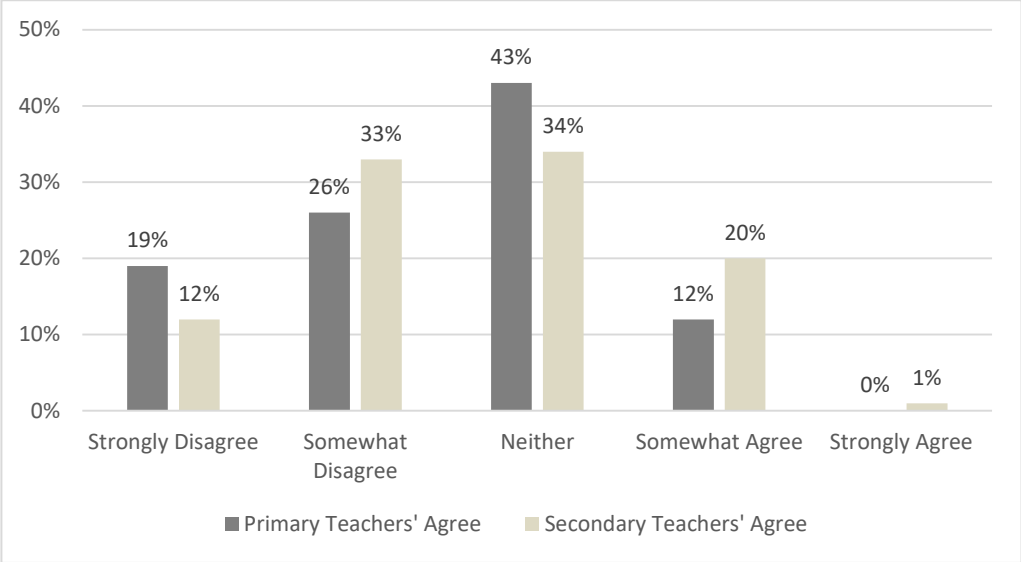

Figure 3: Teachers' responses as to whether there is a fluid transition between curricula

Another common theme which emerged from both sets of responses (25% of primary and 17% of secondary) was a "lack of communication between both levels". This was also examined further through a closed question where secondary teachers were again asked to rate their level of agreement with the following statement: "There is a good relationship between mathematics teachers in my secondary school and sixth class primary school teachers in our feeder schools". This statement was reversed for primary teachers. The findings disclosed that only 8% of primary teachers and 5% of secondary teachers either 'strongly' or 'somewhat' agreed that such a good relationship existed.

The main barrier to successful transition mentioned by secondary school teachers in the data was "incoming students' lack of basic knowledge". This issue of student under-preparedness was further investigated in the questionnaire. Using the same five point

Likert scale, teachers of both levels were asked to indicate their level of agreement with the following statement: 'Sixth class students are well prepared in [each of the five primary mathematics strands] when they leave primary school / start secondary school'. The percentages of primary and secondary teachers' who either 'strongly' or 'somewhat' agreed are outlined in Figure 4.

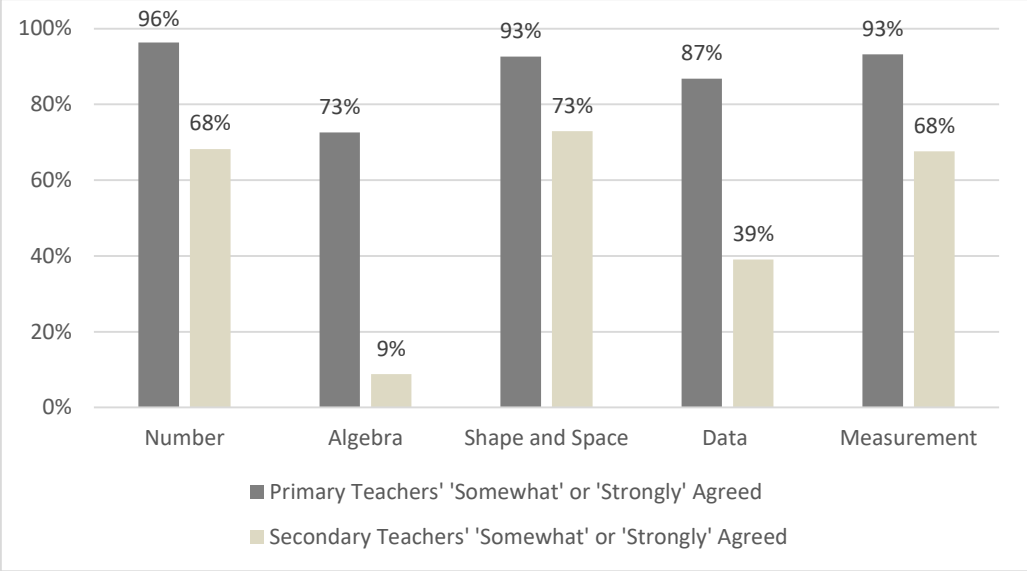

Figure 4: Teachers level of agreement with the preparedness of students

As shown in Figure 4, primary teachers were more likely to be in agreement regarding student preparation levels, when compared to secondary teachers' responses. Over 85% of primary teachers agreed that students were well prepared in four of the five strands. Independent samples t-tests found that the differences in the mean agreement levels between both groups were statistically significant for each of the five strands ($p = 0.000$). However, the main difference of opinion regarding students' preparedness was in relation to the algebra strand. 73% of primary teachers, compared to only 9% of secondary teachers agreed that students were well prepared in this domain when leaving primary/ starting secondary school.

RQ 2: How can the transition from primary to secondary school mathematics education be improved?

The second research question focused on how to improve the transition from primary to secondary mathematics education. Teachers at both levels were asked for their suggestions in an open ended question. Once again, the data analysis conducted by two of the authors identified a number of emerging themes, outlined in Table 2.

Table 2: Suggestions for improving the transition

Suggestion for improvement	Primary teachers (n = 248)		Secondary teachers (n = 125)	
	Freq.	Sample responses	Freq.	Sample responses
More communication between teachers of both levels	66 (26%)	P78: More communication and team work opportunities between 6th class teachers and 1st year teachers.	36 (29%)	S65: I think first year maths teachers should meet with primary school teachers to discuss how and what they are teaching and maybe come up with common approaches.
Provide professional development for teachers	59 (24%)	P36: Educating (CPD) teachers in sixth class and first year (secondary) on each other's curriculums and how to integrate elements for a smoother transition.	29 (23%)	S44: In-service for secondary teachers to understand methodologies used in primary schools and to have knowledge of the syllabus used in primary schools.
Better continuity between curricula	56 (23%)	P148: A syllabus and curriculum at 6th class and 1st year level that works in tandem and moves effortlessly between the end of primary and the beginning of secondary.	26 (21%)	S92: A CIC syllabus for sixth class which ties into the CIC for first year so all students are coming in with the same material covered.
Teachers should have greater knowledge of each other's curricula	39 (16%)	P124: Primary teachers need to be familiar with the secondary school curriculum and vice versa.	10 (8%)	S95: Greater awareness on the part of secondary/ primary teachers of the others methods/ curricula.
Introduce a transition program for students	28 (11%)	P106: Students in 6th class, as part of transfer programme could have sample maths lessons in their local secondary school.	0 (0%)	N/A
Improve incoming students' lack of basic knowledge	0 (0%)	N/A	15 (12%)	S135: Special emphasis on fractions, decimals, and percentages in primary school - it appears students lack the basics when they enter secondary school.
Primary schools should follow and complete the same syllabus	0 (0%)	N/A	9 (7%)	S135: Ensure that all students cover the same topics in primary school.

As evidenced from Table 2, a number of common themes were mentioned by both primary and secondary teachers. For example, the top two suggestions for improvement from both sets of teachers were matching. The first suggestion (mentioned by 26% of primary and 29% of secondary teachers) called for more communication between teachers

of both levels. In 2014 the Irish Government launched its *Education Passport* initiative to improve communication between 6th class and 1st year teachers. The overall purpose of the initiative is to help children experience continuity as they moved from primary to secondary education. Primary schools are required to pass documentation onto secondary schools which detail each child's progress and achievement, as well as signalling what support they may need. In the questionnaires, teachers of both levels were asked a multiple choice question (Yes; No; Don't know) about whether their school used the *Education Passport*. The data revealed that while 74% of primary teachers used the *Passport* to share student information with secondary schools, 64% of secondary teachers didn't know if their school used the initiative.

The second suggestion from both sets teachers (24% of primary and 23% of secondary) referred directly to the need for professional development in relation to the transition. This theme was also further investigated in the questionnaire. Both groups were asked to indicate their level of agreement using a five point Likert scale with the following statement: 'I am satisfied with the professional development I currently receive in relation to teaching mathematics'. The majority of each group (52% of primary and 70% of secondary teachers) either 'somewhat' or 'strongly' agreed that they were satisfied. However, an independent samples t-test found that the difference in mean agreement scores regarding satisfaction levels was statistically significant between the two groups ($t(464) = -3.913$, $p = .000$, two-tailed).

Data from a further two dichotomous (Yes; No) questions noted that 90% of primary teachers and 97% of secondary teachers had never received professional development in relation to mathematics teaching at the other level. However, 95% of primary and secondary teachers felt that they should receive professional development in relation to the transition from primary to secondary level mathematics.

Discussion

The two main research questions which guided this study will now be discussed in more detail.

1. *What are the main barriers to successful transition from primary to secondary mathematics education in Ireland?*

The primary and secondary teachers who participated in this study identified a number of common barriers in making a successful transfer from primary to secondary education. For example a "lack of continuity between curricula" was cited by many teachers at both levels. Such a lack of continuity is noted in much research conducted into problematic transitions. For example Green (1997) and Tilleczek (2008) both found that the attainment and motivational losses that students often experience when moving from primary to secondary school can, in no small way, be attributed to a lack of continuity in curriculum approaches. In this study, some teachers felt that the lack of continuity is a consequence of a dated primary mathematics curriculum which needs to be revised to

come more in line with Project Maths. This is noteworthy as there are currently consultations underway to restructure and redevelop the primary curriculum (NCCA, 2016).

The main barrier identified by secondary teachers was incoming students' lack of basic knowledge. The strand in which both sets of teachers felt students were least prepared for was algebra. Despite its importance, algebra has long been identified as an area of difficulty in the teaching and learning of mathematics, particularly at secondary level (Prendergast & Treacy, 2018). The findings of this study indicate that secondary mathematics teachers feel that the root of this problem may lie at primary level. Only 9% of responding secondary teachers agreed that incoming students were well prepared in algebra when leaving primary school. This is despite algebra being a core strand of the primary school curriculum all the way through. Further research would be useful to investigate this finding further and explore primary and secondary teachers understanding of algebra and how students' algebraic skills can be developed progressively throughout the formal years of schooling.

2. *How can the transition from primary to secondary school mathematics education be improved?*

Rice (2001) suggested that a smooth transition from primary to secondary mathematics education can be achieved if research plays a more useful role in guiding the efforts of all involved. This research conducted by the authors' has identified many possible ways of facilitating this transition through various suggestions by teachers of both levels.

The main suggestion by both primary and secondary teachers was for more communication between each level. This finding is in line with existing research in the area in which communication between teachers of both levels is identified as vital (Hopwood et al., 2016; Topping, 2011; West et al., 2010). There were some suggestions in the data about how such communication could be improved. The majority centred around ensuring direct contact between primary and secondary school teachers and also opportunities for teachers to work across primary and secondary schools. However, previous research has noted that few schools have such linking and networking arrangements (Jindal-Snape & Foggie, 2008). The Irish Government has made attempts in recent years to address the lack of direct contact across the divide through the introduction of the *Education Passport*. Despite all primary schools being required to use the *Passport* materials since 2014, the findings of this study show that the vast majority of first year mathematics teachers do not even know if their schools are using the initiative.

The second suggestion by both sets of teachers for improving the transition was to provide more professional development opportunities. The continuing professional development (CPD) of teachers has long been an issue of concern in the Irish education system, as well as internationally. A study carried out by Finucane (2004) determined that the average amount of time spent on CPD by Irish teachers was 2.5 days a year. The introduction of Project Maths in 2010 did result in a renewed emphasis being placed on CPD at secondary level. Secondary mathematics teachers received ten national day-long

workshops to inform them and develop their knowledge of the curricular changes. However, there was no professional development provided to primary teachers regarding the major changes which were taking place at the adjoining level. This may offer insight into why primary teachers were significantly less satisfied, than their secondary counterparts with the CPD that they currently receive. While many secondary teachers were satisfied, 95% of teachers from both levels felt that they should receive professional development in relation to the transition. This was supported in the data from the open ended questions, where again teachers from both levels highlighted the need for joint CPD opportunities. A U.S. study carried out by Hawk and Hill (2001) noted that the more teachers know about each other's programs, the easier it is to target the individual needs of students and support them through the transition. This recommendation is undoubtedly still relevant today.

Whilst the study has given some insights into the barriers to successful transition and some suggestions on how it may be improved, it is important to highlight its limitations. Teachers' opinions were gathered using a mixture of Likert scale ratings, dichotomous, multiple choice, and open ended questions. While these methods gathered much data, they did not allow the opportunity for the researcher to probe participants on certain responses and further investigate specific themes as they emerged from the data. Perhaps the next phase of the study should involve some follow up interviews with a sample of the respondents to allow for further exploration. It is also acknowledged that in this study we have solely relied on teachers' perspectives and have not attempted to garner the views of other stakeholders, such as students and parents/guardians.

Conclusion

This research has focused on school transitions, primarily between the ages of twelve and fourteen, whereby students move from primary to secondary education. Many studies have previously acknowledged the negative impacts associated with this transition and this research has demonstrated that many issues still remain. While the research was undertaken in an Irish context, the findings are of significance internationally as such transition concerns are common in many countries around the world (Hopwood et al., 2016; Paul, 2014; Topping, 2011).

However, while previous research surrounding transition has focused predominantly on students' perspectives (De Wit, Karioja & Rye, 2010), this research gives an outlook from teachers who are on the front line of the divide. Despite its limitations, the findings have offered valuable insights into what teachers perceive to be the main barriers to transition and how they feel the move from primary to secondary school can be enhanced. It is noteworthy that there was an overlap in many of the responses from both sets of teachers. Now that such research has been conducted, it is important to ensure that the findings are acted upon and that steps are taken by all stakeholders to ensure a smoother transition between primary and secondary mathematics education.

Ensuring greater continuity between both curricula must be to the forefront in the proposed redevelopment of both the primary school mathematics curriculum and Junior Cycle mathematics. Such continuity is critical in order to allow for an educationally smooth or fluid transition from primary to second level mathematics education (Evangelou et al., 2008). Teachers of both levels also need to be much more aware of and familiar with each other's curricula. Primary school teachers need to be more familiar with the mathematics that students will learn at secondary level in order to ensure greater continuity and progression in their learning. Secondary teachers need to build on the skills, knowledge and attributes which the learner has developed in the preceding phase. This can be achieved through greater communication and collaboration between teachers. Relationships must be encouraged between local secondary schools and their feeder primary schools. Initiatives such as the *Education Passport* must be endorsed and encouraged. Opportunities for joint professional development, both formal and informal, must be provided. Such professional development may undertake many different forms, for example school classroom-based action research projects where small research groups may be formed with participants from both primary and secondary sectors (Hine & Lavery, 2014; Morales et al., 2016).

Although the overall aim may be to improve the transfer of students from one level of schooling to the next, this will not be possible until the barriers identified by teachers have been addressed and the transition is made smooth from their perspective. Only then can the hurdle of discontinuity be overcome and the effectiveness of school transition be improved.

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Please cite as: Prendergast, M., O'Meara, N., O'Hara, C., Harbison, L. & Cantley, I. (2019). Bridging the primary to secondary school mathematics divide: Teachers' perspectives. *Issues in Educational Research*, 29(1), 243-260. http://www.iier.org.au/iier29/prendergast.pdf