MATHEMATICS TEACHING toolkit

ISSUES IN THE TEACHING OF MATHEMATICS

Ability Grouping

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THE BIG PICTURE: 'ABILITY' GROUPING IN MATHEMATICS

THE CONTENTIOUS PRACTICE OF GROUPING STUDENTS BY ABILITY IN MATHEMATICS

Many Australian schools group students according to achievement and correspondingly adjust the curriculum. In primary schools, this practice commonly takes the form of *within* class ability groupings (e.g., 'low', 'middle', and 'high'), while in secondary schools this practice commonly takes the form of *between* class groupings (also known as streaming).

While much has been written about the practice of grouping students according to their achievement over the past 60 years, it remains one of the most contentious issues in mathematics education today. So, what do the research findings on ability grouping show?

This monograph invites school leaders and teachers to consider the issue of ability grouping in school mathematics in terms of the following two questions:

1. What is the problem that 'ability' grouping, in its various forms, seeks to address?
2. How can we organise the teaching and learning of mathematics to support all learners?

KEY TERMS AND DEFINITIONS

Before considering what we can learn from research on ability grouping, it is important to clarify some of the key terms and definitions in this complex field of inquiry. This monograph presents the following definitions to clarify these terms from an Australian perspective.

Ability grouping

A problematic but "generic term to encompass any grouping, whether it is *within* class or *between* classes, flexible or inflexible, that involves students being separated according to perceptions of their ability" (Boaler, 2020, p. 1). While some view 'ability' as a fixed, innate property of the individual, this monograph takes the view that 'ability' refers to what a student is capable of at a particular time based on some measure of achievement.

Within class ability groups

Involves grouping students within a class on the basis of perceived ability or achievement. In Australia, this practice is most commonly seen in primary schools where it is referred to as like ability groups (see below).

Like groups (also referred to as like needs, within class ability or homogeneous groups)

Involves assigning students to groups within a class based on an assessment of their achievement in a particular subject. Most commonly used in relation to reading and mathematics in Australian primary schools where groups tend to remain fairly stable over time. To the extent that the content and/or pedagogy is modified for one or more of the like ability groups, this practice can be viewed as a form of differentiation.

Cross-grade grouping (also referred to as vertical streaming)

Involves ability grouping across year levels.

Streaming (also referred to as *between* class ability grouping)

Involves assigning students to classes based on an assessment of their overall achievement. In secondary schools students can remain in their streamed class for the majority of subjects.

Setting

A form of *between* class ability grouping, whereby students are assigned to classes based on an assessment of their achievement in a particular subject (usually mathematics or English), while they undertake other subjects in mixed-ability classes. Widely used in the UK and the USA, it also occurs in Australian primary schools where two or more classes are held in large, open-planned areas and in secondary schools where mathematics is timetabled at the same time (sometimes referred to as *regrouping*).

Tracking

An organisational practice whereby different classes are offered different content (e.g., algebra or geometry). The track that students choose or are allocated to in the middle years, determines the subjects they can undertake in subsequent years. A form of *between* class ability grouping, this practice used to be common in Australian secondary schools where students were grouped into classes on the basis of their assumed career or post-school options (i.e., academic, general, or vocational) and offered different content.

Mixed ability groups

Refers to the practice of assigning students to classes or groups within classes randomly or on some basis other than ability or achievement (e.g., friendship, interest). Mixed ability groups can also be referred to as *heterogeneous* groups.

Differentiated instruction

"A broad term that refers to a variety of classroom practices that accommodate differences in students' learning styles, interests, prior knowledge, socialisation needs and comfort zones" (Benjamin, 2002, p. 2). Differentiated instruction can be viewed as a form of ability grouping where instructional adjustments are made in relation to perceptions of students' readiness to learn, prior knowledge, or achievement.

Differentiated teaching

"Occurs when a teacher plans a lesson that adjusts either the content being discussed, the process used to learn, or the product expected from students to ensure that learners at different starting points can receive the instruction they need to grow and succeed". (DET, 2019) To the extent that adjustments are made in relation to a students' prior knowledge or achievement, differentiated teaching may be seen as a form of ability grouping.

Note: Many of these terms are used inconsistently or have changed over time. In what follows, terms familiar to Australians such as *streaming* and *like groups* have been included where appropriate. Another important point to note is that terms such as 'low', 'middle/average', and 'high/top' are used here as they are reported in the literature. These should be understood in the same sense as 'ability' above – that is, as indicating something that is not a fixed characteristic of any individual or group, but something that is a relative to a particular context and point in time.

QUESTION 1:

What is the problem that ability grouping seeks to address?

Achievement is the most visible dimension of student difference. According to Masters (2013), "in any given year of school, the most advanced learners … can be at least five or six years ahead of the least advanced students" (p. 3). This difference is even more pronounced **in the middle years of schooling where the range in mathematics achievement in each year level can be as much as seven to eight years** in curriculum terms (Siemon, 2019).

However, students also differ in terms of their physical, social, cognitive, and emotional development (Masters, 2013). Students vary in terms of their readiness to learn, personal interests, and preferred approaches to learning (Tomlinson, 2014), and each of these differences may be influenced by culture, gender, and socio-economic background (Francis et al., 2019).

On the surface, the notion of difference and readiness to learn seems to justify ability grouping on the grounds that teachers will be better able to modify the curriculum and their pedagogy to suit the learning needs of *all* learners. However, while this practice may be well intentioned, it ignores the impacts of ability grouping on students' confidence and predisposition to learn which can seriously impact their participation in schooling and future life (e.g., Anthony et al., 2019; Boaler, 2020; Kutnick et al., 2005; Zevenbergen, 2005). This suggests the evidence needs to be considered in two parts: evidence related to ability grouping and achievement and evidence related to ability grouping and equity.

EVIDENCE BASE

There are essentially two types of ability grouping research, (1) large-scale, quantitative meta-analyses focused on student achievement, and (2) smaller-scale, mixed methods research that tends to focus more on the teachers' and students' experiences of grouping. The evidence will be considered in terms of the two parts referred to above, that is, evidence related to achievement followed by evidence related to equity.

1 ABILITY GROUPING AND ACHIEVEMENT

Unsurprisingly, the most cited argument for the use of ability grouping in school mathematics is that it **increases students' opportunity to learn** as teachers will be better able to address the learning needs of all learners (e.g., Hallinan & Sørenson, 1987; Slavin, 1987; 1990). However, the extent to which this actually happens in ways that are transformative and inclusive is questioned (Anthony et al., 2019; Francis et al., 2019; Hattie, 2009).

Others argue that ability grouping **decreases students' opportunity to learn** as students placed in 'lower' achieving groups are not exposed to the same curriculum as those placed in 'higher' achieving groups, and there is a greater likelihood they will be taught by a teacher with less experience or knowledge of teaching mathematics than those placed in 'higher' achieving groups (e.g., Boaler et al., 2000; Linchevski & Kutscher, 1998; Marks, 2012, 2013; Zevenbergen, 2005).

A) RESEARCH SYNTHESES AND META-ANALYSES

This type of research aims to distil the results of a large number of studies to inform practice (Hattie, 2017). These 'quantitative reviews' can be useful to busy consumers of educational research, but they can overemphasise the effect of some factors and under emphasise or ignore other, potentially critical factors because of the methods and/or assumptions used (Wiliam, 2019). Furthermore, many of the most cited meta-analyses related to ability grouping are quite dated.

Of the small number of meta-analyses reporting a positive achievement benefit for ability grouping, either the overall effect sizes are small to very small (e.g., Kulik & Kulik, 1982; Lou et al., 1996), or the achievement benefit is limited to high achievers placed in special programs for 'gifted' students (e.g., Kulik & Kulik, 1982; Steenbergen-Hu et al., 2016).

Although Slavin's (1987) best-evidence synthesis of research on ability grouping *within* and *between* classes in primary schools is quite dated, it is one of the very few meta-analyses that specifically report the effect of ability grouping in mathematics. While Slavin found no effect for *between* class grouping (i.e., streaming), he did find a small positive Effect Size (ES) of 0.34 for ability grouping *within* the same mathematics class at the upper level of primary school. This is below the 0.4 'hinge-point' identified by Hattie as indicative of a worthwhile intervention, but it is positive in a field that is populated by close to 0 effect sizes so it cannot be completely ignored given Slavin's **very important rider**:

> ***for ability grouping to be effective at the primary level, it must create true homogeneity on the specific skill being taught and instruction must be closely tailored to students' levels of performance* (Slavin, 1987, p. 323).**

Importantly, Slavin found **no achievement benefit** for students placed in 'low', 'middle', and 'top' groups *within* classes at the primary school level where only minor adjustments were made to curriculum and/or pedagogy. While not specific to mathematics, Slavin's (1990) follow up synthesis of research on ability grouping *between* classes in secondary schools (i.e., streaming/tracking), found that the effects of ability grouping on student achievement were "essentially zero" (p. 484) and concluded that

> ***study after study, including randomized experiments of a quality rarely seen in educational research, finds no positive effect of ability grouping in any subject or at any grade level, even for the high achievers most widely assumed to benefit from grouping.* (p. 491)**

While Slavin's methods for constructing effect size have been criticised, these results for ability grouping *between* and *within* classes are supported by subsequent research in the field (e.g., Kulik & Kulik, 1992; Hattie, 2009; Steenbergen-Hu et al, 2016). In other words, while there is no evidence from these meta-analyses to suggest *between* class ability grouping is positively associated with mathematics achievement, there is some evidence to suggest that particular forms of *within* class ability groups may be effective.

While subject to some of the same criticisms as Hattie's (2009) synthesis, the UK-based *Education Endowment Foundation's* (EEF) T*eaching and Learning Toolkit*[1] rates the impact of setting or streaming (i.e., *between* class ability grouping) on attainment as having a "very small negative impact for low and mid-range attaining learners, and a very small positive impact for higher attaining students". Concluding that, although there are some exceptions, the "overall effects are small, and it appears that **setting or streaming is not an effective way to raise attainment for most pupils**" (n.p.).

Consistent with other meta-analyses, the EEF Toolkit[2] concludes that there is a small positive effect for *within* class ability grouping. However, the Toolkit acknowledges that lower attaining students do not benefit to the same extent and "grouping pupils on the basis of attainment **may have longer term negative effects on the attitudes and engagement of low attaining pupils**" (n.p.). Note that an Australian version of the EEF toolkit[3] is available.

Take Out

There is no evidence from research syntheses and meta-analyses to suggest that *between* class ability grouping (i.e., streaming/tracking) is associated with improved mathematics achievement. While small positive achievement benefits have been reported for gifted students undertaking specialist programs and for *within* class ability grouping under certain conditions, the research that underpins these two claims tends not to consider the impact of ability grouping on students' self-confidence, efficacy, or long-term social standing.

[1] https://educationendowmentfoundation.org.uk/evidence-summaries/teaching-learning-toolkit/setting-or-streaming
[2] https://educationendowmentfoundation.org.uk/evidence-summaries/teaching-learning-toolkit/within-class-attainment-grouping
[3] https://evidenceforlearning.org.au/the-toolkits/the-teaching-and-learning-toolkit/full-toolkit/

Even though ability grouping *between* and *within* classes is still widely practised in Australia (Forgasz, 2010a; Johnston & Wildy, 2016; Vassallo et al., 2016), most of the research on ability grouping and achievement is from the UK or the US. The few Australian studies that have considered ability grouping tend to focus on the provision of special programs for gifted students (e.g., Plunkett, 2009), teacher attitudes towards ability grouping (e.g., Forgasz, 2010b), and/or the social and affective impact of ability grouping on students (e.g., Macqueen, 2013; Zevenbergen, 2003b, 2005). These impacts are discussed further below, but let's first look at the research on *between* and *within* class ability grouping in relation to achievement.

Between class ability grouping (i.e., streaming) and achievement

An influential study in this space was Boaler's long-term study of two secondary schools in the UK. This study looked at the impact of two different approaches to the teaching and learning of mathematics on student achievement over three school years (Boaler, 1997b; Boaler et al., 2000). The two schools had similar student populations but were organised very differently for mathematics. At Amber Hill, students were organised into ability groups (i.e., sets or streams) and followed a fairly procedural, textbook-based curriculum. At Phoenix Park, students worked in mixed-ability groups and there was a more open-ended approach to the teaching and learning of mathematics. An extensive range of quantitative and qualitative data was collected including classroom observations, interviews, and surveys. After three years, Phoenix Park students outperformed their peers at Amber Hill even though there was no significant difference in their respective levels of mathematics attainment at the outset.

Although not a major focus of the study, it was evident that the grouping practices at the two schools played an important role in this outcome, which led Boaler (2005) to conclude that the mixed-ability teaching at Phoenix Park

> ***led to better results and better life chances than its more traditional counterpart whose ability grouping practices created, in the words of one ex-pupil, 'psychological prisons' that 'break ambition' and 'almost formally label kids as stupid'.* (p. 135)**

In a similar US study some years later, Boaler and Staples (2008) found that where mathematics was taught in mixed-ability classes using a student-centred approach (i.e., rich tasks, collaboration, and a focus on understanding and reasoning), the students not only outperformed their peers at the other two schools that streamed their classes and taught mathematics traditionally, they also "**learned more, enjoyed mathematics more and progressed to higher mathematics levels**" (p. 609).

This conclusion is supported by Krahn and Taylor (2000) who compared the long-term impact of streaming across four Canadian provinces and found that students from provinces that streamed less had more post-secondary options available to them than students exposed to higher levels of streaming in other provinces. It is also supported by a review of research on detracking in the US (Rui, 2009), and two large-scale, longitudinal studies, one involving junior secondary students in the US (Burris et al., 2006) and one involving upper primary students in the UK (Nunes et al., 2009).

In their, '*Tell me with whom you are learning, and I'll tell you much you have learned',* Linchevski and Kutscher (1998) compared mixed-ability to same-ability grouping in Year 9 Israeli mathematics classes. They found that placing students

> ***in mixed ability mathematics classes was not detrimental to their achievements when compared to achievements of students of similar ability levels who had learned in separate, same-ability classes. On the contrary, the average and weaker students' achievements showed significant gains, whereas the loss in achievements of the stronger students was negligible".* (p. 550)**

Take Out

The opportunity to learn mathematics in mixed-ability classes leads to better cognitive and social outcomes than learning mathematics in classes grouped by ability (i.e., streamed or tracked classes).

Macqueen (2012) explored the practice of *regrouping* (i.e., *between* class ability grouping) in upper primary students for literacy and mathematics in Australia. Macqueen used growth data from the NSW Basic Skills Test for Years 3 and 5 to compare the literacy and mathematics achievement of four schools that regrouped students in Years 5 and 6 to four schools that did not regroup. She found that there was **no achievement benefit in regrouping**, although she acknowledged that group allocation methods might have been a mitigating factor.

Take Out

Lower and middle-attaining students achieve more in mixed ability classrooms than they do in *between* class ability groups (i.e., streamed classes). Higher attaining students appear to do equally well in either classroom organisation.

Linchevksi and Kutscher (1998) also reported **issues with group placement and achievement**, particularly for students whose achievement was at the borderline between one ability group and the next. Where these students were placed into a lower ability group, they **achieved less than if they had been placed in a higher ability grouping**. This result has been confirmed by later studies (e.g., Boaler & Staples, 2008; Francis et al., 2019; Ireson et al., 2002, 2005) raising equity concerns about group allocation methods (see further discussion below).

In an attempt to mitigate the inequitable practices associated with setting (i.e., streaming), the longitudinal *Best Practice in Grouping Students* study (Francis et al., 2019) used a range of research methods including randomised control trials, to evaluate the impact of a 'best practice' setting intervention on student achievement. The study found that the **setting intervention did not improve attainment outcomes**, which they attributed to "differences in pedagogy and expectations for students in different sets ...[and] the impact of labelling on students' engagement with schooling and their perceptions of themselves as learners" (p. 157).

This conclusion is consistent with Boaler's findings and many previous studies of ability grouping *between* classes (e.g., Ireson et al., 2002, 2005; Linchevksi & Kutscher, 1998; Kutnick et al., 2005; Marks, 2014b; Wiliam & Bartholomew, 2004).

While some research evidence shows that ability grouping benefits very high achieving students (e.g., Plunkett, 2009), this research is highly qualified, and the effects are difficult to distinguish from those due to 'gifted' programs and those due to ability groups for high achievers. In addition, where these effects have been found, they tend to come at the expense of lower attaining students as **the longer students spend in ability grouping, the wider the achievement gap between low and high achievers becomes** (Francis et al., 2019; Krahn & Taylor, 2000; Wiliam & Bartholomew, 2004; Zevenbergen, 2005). This raises the question of equity, which is considered in more detail below as another finding of grouping students by ability is that it **also comes at the expense of high achieving girls** who are disproportionately impacted by what Boaler *(1997a)* referred to as the 'top set effect', that is, a perceived climate of pressure and competition in the highest ability group.

Take Out

There is no evidence from research studies that ability grouping *between* classes (i.e., streaming or regrouping) is associated with improved mathematics learning outcomes for all students. However, there is evidence that the longer students remain in ability groups, the greater the achievement gap between lower and higher-attaining students becomes.

Within class ability grouping and achievement

There are very few recent studies on the achievement benefit (or otherwise) of *within* class ability grouping even though this practice is widely used in Australian primary classrooms (Johnstone & Wildy, 2016; Sullivan, 2011; Vassallo et al., 2016). Most research studies on *within* class ability grouping have tended to focus on the incidence of this practice (e.g., Anthony & Hunter, 2017; Hallam & Parsons, 2013), group allocation methods (e.g., Taylor, 2019), and/or the effects of group placement on student's social and emotional well-being (e.g., Davies et al., 2003; Marks, 2014b; Francis et al., 2019). These issues are discussed further below.

According to Kutnick et al. (2005) comparisons of the achievement effects of ability versus mixed ability grouping *within* classes have found "**little difference in attainment scores**" (p. 15) although they note that the use of class averages may mask larger differences at the extremes of the range. Consistent with the research on *between* class ability grouping, Ireson and Hallam (2001) reported that lower attaining students placed in **low ability groups within classes tended to achieve less and were less motivated** than when they were placed in mixed ability groups within classes. However, they also note that within class groupings "formed to enable teachers to target specific aspects of the curriculum can raise attainment, providing they are implemented appropriately" (p. 23).

More recently, referring to both *within* and *between* class ability grouping, Hattie et al. (2017) argued that these practices should be avoided, particularly if they remain in place for long periods of time as "they assume student learning needs and potential remain constant over time" (p. 227).

Take Out

Fixed *within* class ability grouping (i.e., semi-permanent like ability groups) appears to function in the same way as *between* class ability grouping (i.e., streaming). There is no evidence to suggest that this practice will lead to improved mathematics outcomes for all students, and it can have a detrimental impact on the achievement of lower attaining students.

However, consistent with the evidence from the research syntheses and meta-analyses cited above, Hattie et al. note that there is evidence to suggest that

> ***needs based instruction, with flexible groups, should not be eliminated. Student centred teaching, basing instructional actions on student understanding, and then engaging students in small group learning can be very effective provided the grouping is flexible rather than fixed.* (p. 227)**

The key issues here are that the **learning needs are highly localised and specific, groups are flexible, and the focus of instruction is on developing student understanding**. An example of effective *within* class grouping is provided by Breed's (2011) work with nine at risk Year 6 students from two schools who had been identified in Zone 1 of the *Learning and Assessment Framework for Multiplicative Thinking* (Siemon et al., 2006). That is, they relied on modelling and counting to solve computation problems and had little or no access to mental strategies, place-value, or fractions. Breed worked with the students in small groups in their mathematics classes for up to 40 minutes two to three times a week for two terms.

She did not attend the schools in Term 4, however, the results from the final round of assessment in November showed that eight of the students were now in Zone 5 and one student was at the top of Zone 4. This growth was reflected in their confident contributions to class and success on school-based assessment. While the students worked apart from the class for some of the time, they spent the majority of the mathematics time with their peers. An important component of the intervention was the use of reflective journals and feedback which ensured the teaching remained close to the student's learning needs.

Take Out

Small, flexible groups formed for the purpose of addressing an important, specific, shared learning need can be highly effective in improving student mathematics outcomes particularly where the teaching is informed by reflection and feedback.

2 ABILITY GROUPING AND EQUITY – THE SOCIAL AND EMOTIONAL IMPACT

Mixed methods studies that consider the efficacy as well as the equity impact of ability grouping on students over time are also needed to make informed judgements about this practice, keeping in mind that schooling

> ***should be socially just, so that: students' outcomes from schooling are free from the effects of negative forms of discrimination based on sex, language, culture and ethnicity, religion, or disability; and of differences arising from students' socio-economic background or geographic location.***
> **(Adelaide Declaration on National Goals for Schooling, MCEETYA, 1999, p. 230)**

By far, the most significant and consistent findings on ability grouping relate to the devastating impact it can have on the social and emotional well-being of students, particularly for those from disadvantaged backgrounds but also for girls placed in higher ability groups (e.g., Boaler, 1997b).

As the evidence mostly comes from qualitative studies involving surveys and interviews, a sample of the most relevant studies will be drawn upon to illustrate the points made in the voices of students and teachers. The studies are described briefly in Table 1.

For well over 60 years, research studies have consistently shown that relatively **fixed forms of ability grouping impact students' opportunity to learn in ways that serve to reinforce and perpetuate social disadvantage** (e.g., Boaler & Staples, 2008; Francis et al., 2019; Jackson, 1964; Johnston & Wildy, 2016; Oakes, 1992; Zevenbergen 2003a, 2003b, 2005). According to Hattie (2009) the equity effects of streaming "are more profound and negative" (p. 90) than the achievement effects.

NAPLAN and PISA results show that students from lower socioeconomic and disadvantaged backgrounds are much more likely to score in the lower proficiency bands than their peers from more advantaged backgrounds (Thomson, 2021). A situation that is exacerbated by the fact that students from lower socioeconomic and disadvantaged groups are over-represented in low achieving groups and under-represented in higher achieving groups (Anthony & Hunter, 2017; Connolly et al., 2019; Boaler, 1997a; Macqueen, 2013; Jackson, 1964; Zevenbergen, 2005).

Inequity arises when teaching practices result in different treatment for different groups based on stereotypical views related to socioeconomic background, gender, ethnicity, cultural or linguistic background, and perceptions of ability. It is apparent in how students and teachers are assigned to ability groups, teacher expectations and interactions with students from different groups, and decisions about curriculum content and pedagogy. These issues are explored in more detail below.

Table 1. Sample studies used to illustrate the social and emotional effects of ability grouping

Study Author(s)	Location	Study Focus
Boaler et al. (2000)	6 Secondary Schools UK	Lesson observations, survey on attitudes and beliefs about mathematics, and interviews with 72 pairs of students in Years 8 and 9 about their experience in streamed and mixed ability classes
Forgasz (2010a, 2010b)	44 Secondary Schools VIC	Survey of teachers in state, Catholic and independent schools on prevalence of and attitudes towards streaming
Macqueen (2012, 2013)	2 Primary Schools NSW	Draws on larger study that explored student and teacher discourses around ability grouping – observations and interviews, Year 4 and 6
Marks (2013, 2014a, 2014b)	2 Primary Schools UK	Investigation of student and teacher views of within and between class ability grouping
McGillicuddy & Devine (2018, 2020)	A range of Schools, Ireland	Mixed methods including surveys, interviews, focus groups with students and teachers on the impact of and responses to ability grouping
Zevenbergen (2003a, 2003b, 2005)	6 Secondary Schools, QLD	Interviews with 96 Year 9 and 10 students nominated by their teachers to represent range of achievement and motivation on the effects of streaming

Group allocation and opportunity to learn

While there is a tendency to assume that placement into ability groups is made based on one or more measures of prior mathematics achievement, the evidence suggests that this is not the case. It is now widely recognised that placement into ability groups may be influenced by other factors such as unconscious bias on behalf of teachers or school administrators in relation to a student's socio-economic status, gender and/or ethnicity (e.g., Anthony & Hunter, 2017; Connolly et al., 2019; Francis et al., 2019; Hallinan & Sørensen, 1987; Kutnick et al., 2005; Taylor, 2019; Zevenbergen, 2005). There is also evidence to suggest that allocation to ability groups may be based on behaviour and motivation rather than prior achievement (e.g., Davies et al. 2003). Such decisions are inequitable as assignment to a 'low' ability group or stream can have a significant impact on student achievement and subsequent life choices (e.g., Boaler et al. 2000; Wilkinson & Penny, 2014).

There are many reasons for these differential outcomes but a key one is that once in a lower ability group, there are **fewer opportunities to learn**, and it is almost impossible to move to another group. As a result, students are more likely to disengage and give up, so perpetuating the cycle of disadvantage. The following example is from Zevenbergen 2003a (p. 8).

> ***I get so annoyed with maths coz I want to get out of this class. The teacher doesn't really care about us, the boys all muck around and we get no work done. I have worked really hard and even got a home tutor to help me. But we aren't doing the hard stuff, so I don't know the work on the exam. I want to get into a better class, but I just can't.*** *– Rachel, Year 9, low stream*

Having said that, **opportunity to learn can also be an issue for students in higher ability groups** or streams who find the pace of instruction and the pressure to work at a high level difficult (Boaler, 1997b; Marks, 2014b). For instance, Boaler et al. (2000) found that all of the girls in set 1 (highest achieving group) wanted to move down to set 2 or lower and six of the eight boys were equally dissatisfied but did not want to move to a lower set. The major reason cited was that there was no time to understand, although this experience also induced feelings of failure and anxiety. The following example is from Boaler et al. (2000, p. 636).

> ***I used to enjoy maths, but I don't enjoy it anymore because I don't understand it. I don't understand what I'm doing. So, if I was to move down I probably would enjoy it. I think I am working at a pace that is just too fast for me.*** *– Andrea, set 1*

Another source of inequity related to the allocation of students and teachers to ability groups is the issue of **teacher quality**.

Boaler et al. (2000) noted that students in lower sets (i.e., streams) were much more likely to be allocated a non-mathematics teacher, experience frequent teacher changes, and be offered a "continuous diet of low-level work that the students found too easy." (p. 637)

> ***It's just our group who keeps changing teachers ... Cause they don't think they have to bother with us, ... They get say a teacher who knows nothing about maths, and they'll give them [to] us, ... They think they can send anyone down to us. They always do that. They think they can give us anybody.***
> *– Lynne, Year 8 or 9, low stream*

Another two examples illustrate the inequity in teacher allocations. The first one comes from Zevenbergen (2005, p. 615), the second from Zevenbergen (2003a, p. 6).

> ***Like we get the crap teachers. They don't know how to teach maths. You know that they don't like being in our class. They think we are the dummies and treat us like that, they might be clever but they just don't know how to teach, like the one I have now is so boring and he just talks all the time and then says, "Now do it" When you ask for help, he just says "do it and if you can't, leave it" It doesn't help me to understand***
> *– Robert, Year 9, low stream)*

> ***We are lucky in our class—we have the Head of Department, and he is really good. We don't muck around as he is pretty strict, but he is a good teacher. He explains things well and, if we don't understand, he goes through it again.*** *– Stephan, Year 10, high stream*

The issue of teacher quality and its related effect on motivation is important as Olsen (2009) has noted:

> *the consequences of low-level instruction and lack of engagement are extremely significant: If a student has more than 1 year of ineffective instruction, it may take 2 years to catch up, and after 3 years of ineffective instruction a student may never be able to recover.* (p. 117)

Take Out

The tendency to allocate less qualified mathematics teachers to 'low' ability groups can have a debilitating impact on students' opportunity to learn, their motivation and attitudes towards mathematics, and as a result, their future life choices and chances.

Teacher expectations and interactions

Another worrying effect of ability grouping is the impact it has on the well-known, mutually reinforcing relationship between teacher expectations of students and students' expectations of themselves which influences the behaviours of both to create a **self-fulfilling prophecy** sometimes referred to as the **Pygmalion effect** (Rosenthal, 1974). For example, where the teacher's expectations of students are low, students perceive this through the teacher's actions and align their behaviour and expectations of themselves with that of their teachers to create a vicious cycle which makes it appear that the original expectation was well-founded when it was nothing other than a belief based on a label (Francis et al., 2019).

Teacher expectations can be based on perceptions of student ability and/or beliefs about certain socio-economic or cultural groups which are often held tacitly and acted upon unintentionally (Anthony et al., 2019; Marks, 2013). In either case, different expectations of different groups of students can trigger a self-fulfilling prophecy in relation to student's construction and perception of themselves as learners of mathematics.

Fixed ability thinking is evident in the views of the secondary teachers surveyed by Forgasz (2010b), 74% of whom agreed with the policy of ability grouping, with one teacher expressing the belief that

> *[streaming] enables advanced students to move ahead and not become bored with classroom activities. Provides healthy competition between students. Allows sensible discussion of concepts which most students follow and can participate in. Also allows students who have difficulty with mathematical concepts to learn at a pace more suitable to their needs and they improve their confidence in maths.* **(p. 74)**

The implicit labelling of students evident in this statement is a form of 'othering' that can serve to position students. This is starkly evident in McGillicuddy's (2018, p. 93) report of a senior mathematics teacher who expressed the view that

> *you couldn't have the likes of these [mid ability] working with the likes of mine [high ability] because they would be held back and these, you know, they mightn't know what is going on.*

Take Out

Fixed ability thinking and the assumptions it generates powerfully influence teacher expectations of and interactions with students which impacts students' subsequent behaviour and motivation.

Curriculum content and pedagogy

Students cannot learn what they have not been taught. This is a major source of inequity as there is a significant body of research to suggest that different ability groups are offered very different opportunities to learn in terms of content and pedagogy (e.g., Boaler et al., 2000; Boaler & Staples, 2008; Francis et al., 2019; Hallam & Ireson, 2005).

In MacQueen's (2013) analysis of regrouping in NSW primary classrooms concluded that "regrouping was no more equitable than streaming" (2013, p. 295) and that the

> *students most affected by such inequities are those achieving at the lowest levels. Students placed in low-achieving classes are taught in smaller groups, limiting social interactions and role models, and are provided the most limited curriculum, presented through inferior pedagogies.* **(p. 307)**

Take Out

Ability grouping *between* classes (i.e., streaming/regrouping) produces inequities in students' opportunity to learn. Higher achieving students have greater access to the curriculum and richer opportunities to learn while lower achieving students have limited access to the curriculum, peer support, and role models, further limiting their chances to succeed.

Ability Grouping and Student Self-esteem – The emotional impact

As indicated above, one of the strongest arguments against ability grouping is the effects it can have on student's social and emotional well-being (e.g., Boaler, 1997b, 2005; Francis et al., 2019). These effects can be seen in students' self-esteem and confidence in a particular area, and in their emotional response to school, which in turn effects their motivation and willingness to engage and persist with tasks. A student's perception of themselves can also be impacted by other factors such as social disadvantage, developmental changes, and gender differences.

Feelings induced by ability grouping – Francis et al. (2019) provide compelling evidence of the negative impact of ability grouping on the self-confidence of students in lower attaining groups and the positive impact on self-confidence for those in higher attaining groups. They also describe the impact of labelling on students' confidence which can affect their feelings about school, as the following example from a middle school student illustrates:

> *Because it can really lower your self-esteem. If you think you're a lot better than you are and then you're put in the bottom group for some- thing and you'd be like... it might upset you, it might make you feel angry, and it would definitely affect the way you thought of school.* **(p. 61)**

Francis et al (2017) include other examples where students speak of the "pain and shame of their ascribed set group". They argue that these findings "need to be taken seriously: both for the deleterious effects on individual psyches and the consequences for student outcomes and wellbeing therein, but also with regard to the detrimental impact on social mixing and harmony within school contexts" p. 24). This finding is supported by McGillicuddy and Devine (2020) who explored upper primary children's 'psychosocial' response to ability grouping. They found that ability grouping evoked strong emotional responses "characterised by feelings of 'shame', 'upset' and 'inferiority' for those in the low-ability groups. In contrast, children placed in higher- ability groups felt a sense of 'pride', 'happiness' and 'confidence'". (p. 553).

The pace at which students are expected to work can be a source of anxiety for students, particularly for girls, and not just for those in 'top sets' as the following example from Boaler et al. (2000, p. 643) shows.

> ***M: I get really depressed about it, and I don't want to ask, but then again like it really depressed me, the fact that everyone in the class is like really far ahead and I just don't understand.***
>
> ***L: Yeah 'cause like especially when everyone else understands it and you think 'Oh my God I'm the only one in the class that doesn't understand it'.*** *– Maggie & Linda, middle set*

The construction of learner identities – Issues of **agency** and **identity** are often ignored in programs designed to improve school mathematics outcomes or attempts to understand why some students are indifferent or resistant to mathematics (Zevenbergen, 2005). According to Zevenbergen (2003a) "inserting students into particular ability groups creates learning environments that influence how students come to see themselves as learners of mathematics, that is, the construction of a mathematics identity, which can have implications for future learning" (p. 5). This is evident in the language students use to describe themselves and their peers. The first example is from Zevenbergen (2003b, p. 6), the second is from Zevenbergen, (2003a, p. 9).

> ***I don't like being in this class [because] it is the only one I feel dumb in. I mean in English or workshop, I am doing OK, but in maths, I feel like a 'retard'. The teacher treats us as if we know nothing.*** *– Tyler, Year 9, low stream*

> ***I am so glad to be in this class rather than with the dumb kids. They don't know anything and just muck around all the time Here our teachers know that they can teach us important things and we will learn because we are smart, I feel sorry for the teachers in the other classes, as the kids are so bad.*** *– Mel, year 9, high stream*

Drawing on student survey data, the *Best Practice in Grouping Students* study (Francis et al., 2019) found that ability grouping had a particularly debilitating impact on the self-confidence of low attaining students, but it also shaped students' learner identities, the long-term effects of which were evident in their subsequent placement into mixed attainment settings.

> *We identified a strong preference for mixed attainment among pupils with low prior attainment. ... Nevertheless, a small number of low-attaining students felt anxious about their potential to succeed in a mixed attainment class due to their prior experiences with 'ability' grouping that shaped their learner identities, and conversely, some of the high prior attainers felt entitled to preferential treatment. Discourses of 'natural' talent, 'ability', and meritocracy remain prevalent.* **(p. 158)**

Take Out

The experience of ability grouping together with fixed personal and societal views of ability can affect student's self-esteem and confidence and have a long-lasting, negative impact on learner identity and agency.

Academic self-concept – Known as the **big-fish-little-pond-effect (BFLPE)**, this notion is based on perceptions of one's own ability in relation to the perceived ability levels other students in the immediate context. Examining this effect in eight select entry Australian schools, Marsh (2004) found that the placement of "gifted students in academically selective settings resulted in lower academic self-concept not higher academic self-concept" (p. 22) as generally assumed. This is consistent with an earlier, large-scale Israeli study (cited in Marsh, 2004) which found that the gifted students in mixed ability classes "evidenced markedly higher academic self-concepts, lower anxiety, and higher school grades" (p. 10), than their peers in the gifted classes.

For academically disadvantaged students placed in special education classes, the BFLPE is the opposite, that is, the students had significantly higher academic self-concepts than their peers placed in regular classrooms. This has led some to argue for ability grouping on the grounds that it can increase the motivation of low attaining students by removing competition or intimidation from working alongside higher attainers (e.g., Dunne et al., 2011). However, Marsh (2004) cautions against generalising these effects as **academic self-concept is not necessarily related to self-esteem or confidence which are known to have a much greater impact on achievement and learner identity** (Ireson & Hallam, 2009). The BFLPE is not a sufficient reason to group students by ability given the overwhelming evidence that this practice disproportionately effects the social and emotional well-being of all students.

Take Out

Fixed ability thinking and the Fixed forms of ability grouping impact student identity and agency regardless of prior attainment. For lower achieving students, this results in disengagement and feelings of shame and failure. For the highest achieving students, it can result in anxiety induced by the pace of instruction, competitive learning environments, and fear of failure.

To summarise, there is no evidence to support ability grouping *between* classes on the grounds of achievement. While there is some evidence to suggest particular forms of *within* class ability grouping may be effective in improving student outcomes, the conditions under which these groups are formed and operate is highly qualified. But by far the most salient argument against any form of fixed ability grouping is its potentially destructive impact on equity and students' social and emotional well-being.

QUESTION 2:

How can we organise the teaching and learning of mathematics to support *all* learners?

With the vast majority of the evidence on the efficacy of 'ability' grouping showing that it does not work, we now consider how teachers can organise the teaching and learning of mathematics to promote access, build confidence, and improve learning outcomes for all students. The two approaches discussed below both advocate some form of differentiation in mixed ability classrooms. Lastly, in thinking about what is needed to address difference, this section concludes by addressing some of the myths surrounding ability grouping in order to challenge deeply held convictions about its efficacy.

DIFFERENTIATED INSTRUCTION OR DIFFERENTIATED TEACHING[4]

Differentiation to better meet the needs of all learners is not new. Teachers in very small schools have always had to adjust the curriculum and their pedagogy to respond to the learning needs of students whose ages might range from five to fifteen. However, differentiation that **attempts to respond to all the dimensions of difference** (i.e., learning styles, interests, readiness, etc) is unlikely to be achievable let alone sustainable if it involves what Tomlinson et al., (2003) suggests below.

> *[Differentiation is] an approach to teaching in which teachers proactively modify curricula, teaching methods, resources, learning activities and products to address the diverse needs of individual students and small groups of students to maximize the learning opportunity of each student in a classroom.* **(p. 121)**

Although there are accounts of how changes to content, processes, products, and the learning environment might be made to suit the needs of different learners (e.g., Tomlinson, 2014), it appears that there is **little empirical research to support differentiation that takes all the dimensions of difference into account** (Smale-Jacobse et al., 2019; Taylor et al., 2015). Also, to the extent that this sort of differentiation modifies the curriculum and adapts instruction for particular groups of students for extended periods of time, it can be "a source of inequality rather than the solution to it" (Taylor et al., 2015, p. 26) as it can **restrict students' opportunity to learn and create de facto ability groups**.

By contrast, Taylor et al (2017) suggest that

> *differentiation is better achieved through carefully designed, stimulating tasks that all students are able to make a start on. This type of task enables the teacher to offer rich feedback to students and allows students at all levels of prior attainment to progress* **(p. 338)**

That is, in their view and the view of many others (e.g., Boaler & Staples, 2008; Francis et al., 2019; Sullivan et al., 2006), **differentiation is best achieved in well-taught mixed ability classes where "the whole class works on a problem or an investigation that can be tackled in different ways**" (Boaler et al., 2000, p. 645). This brings us to a consideration of 'best practice' mixed ability teaching.

4 https://www.education.vic.gov.au/school/teachers/classrooms/Pages/approachesppn16differentiationtt.aspx

MIXED ABILITY TEACHING

Decades of research evidence show that when students are taught in mixed ability classes supported by "good teaching practice" they achieve at higher levels and have better social and emotional outcomes than students taught in classes grouped by ability (Boaler & Foster, 2021). However, the reference to best practice is important as mixed ability teaching has been criticised for 'teaching to the middle' which can result in work that is too easy for some and too difficult for others (e.g., Francis et al., 2019; Wilkinson & Penny, 2014).

While the characteristics of effective mixed ability teaching essentially mirror those for effective mathematics teaching, the following list has been distilled from a range of sources that have considered mixed ability teaching specifically (i.e., Boaler, 2006; Boaler & Foster, 2021; Boaler & Staples, 2008; Francis et al.,2019; Sullivan, 2011; Sullivan et al., 2004).

- Teachers have high expectations of all students and avoid fixed views of ability.
- Students are engaged in rich, 'high-level', 'groupworthy' tasks that are accessible to all.
- All students work on the same task, either as a whole class or in small, flexible groups.
- Closely related tasks might be offered to provide choice or provoke connections/generalisations.
- Differentiation is achieved through questioning, prompts, and constructive feedback related to the shared task(s) rather than by offering different tasks to different students which risks labelling and curriculum inequities.
- High value is placed on exploring multiple solution strategies, discussion, understanding, reasoning, and problem solving.
- There is a conscious focus on mastery rather than performance and on effort rather than ability.
- Students accept responsibility for each other's learning.
- There are multiple ways to demonstrate success.
- Formative assessment is used to understand student's thinking and reasoning.

There are several important caveats to be considered in adopting a mixed ability approach. The first is that effective mixed ability teaching requires knowledgeable confident teachers. This requires significant investment in professional learning and a commitment to collaborative school-based planning (Boaler & Foster, 2021; Taylor et al., 2015; Timperley et al., 2007).

The second is that there is a risk in adopting a task-centred approach that students may become dependent on the teacher to provide access to the curriculum. This is a small risk that can be overcome through the provision of consolidating or extended activities which students can choose to do independently or with peers. The third is that for tasks to be accessible but challenging, teachers need to know where learners are in relation to key underpinning mathematical ideas and strategies (Boaler & Foster, 2021; Siemon et al., 2019). This does not mean pre-testing every topic in the curriculum, it means teachers knowing and attending to students' thinking in relation to a small number of big ideas (Siemon et al., 2006, 2019). This practice, known as targeted teaching (*see* The STEM Agenda, DET 2021), involves small, flexible within class groupings which can be implemented in the context of effective mixed ability teaching.

Take Out

Effective mixed ability teaching involves high expectations for all, an unrelenting focus on understanding and reasoning, accessible but challenging tasks supported by differentiated teacher responses, and attending to the affective as well as cognitive needs of all learners.

Useful resources to support effective mixed ability teaching include:

- ***AAMT's Top Drawer Resources:*** https://topdrawer.aamt.edu.au
- ***Boaler on inquiry-based learning:*** https://www.youtube.com/watch?v=len-86bXCrI
- ***Challenging mathematical tasks*** *(Sullivan et al., 2013)*
- ***Good questions: Great ways to differentiate mathematics*** *(Small, 2017)*
- ***maths300*** - Rich tasks with lesson plans, computer-based simulations: https://www.maths300.com
- ***nrich*** - Low threshold high ceiling tasks: https://nrich.maths.org/8769.
- ***Open-ended maths activities*** *(Sullivan & Lilburn, 2004)*
- ***ReSolve*** - Inquiry based tasks: https://resolve.edu.au

DISPELLING THE MYTHS OF ABILITY GROUPING

Despite the evidence, ability grouping remains 'alive and well' in Australian schools. Given that the convictions held about the efficacy of ability grouping are often deeply held, it is important at this point to challenge and dispel the following myths.

- **The myth of 'like-ability' or the 'no difference' myth** – Grouping students by their performance on comprehensive assessments such as NAPLAN can lead to the mistaken view that all students in the group are equally capable of learning the same thing at the same rate (i.e., that they are of 'like ability'). This is untenable given that there is:
    - a 28% chance that students either choose a correct multiple choice for the wrong reason or an incorrect option for a good reason (Ellerton & Clements, 1997);
    - a 10% error rate in allocating students to scales such as in NAPLAN (Wu, 2010); and
    - students can be in the same band for completely different reasons (e.g., strengths in one strand but not in the other two).
- **Ability grouping increases students' opportunity to learn** – The evidence overwhelming supports the opposite. Students in low achieving groups have restricted access the curriculum whereas students in higher achieving groups can be required to work at a pace that, for many, is not compatible with learning with understanding. Marks (2012) captures this situation powerfully in her description of two Year 6 students, Samuel (lowest set) and Megan (top set). For Megan, and for many others in the top set, particularly girls, her lack of opportunity to learn arose from

  the competitive, self-absorbed culture of the top set where making mistakes is not allowed. This led to Megan experiencing high levels of anxiety and being too fearful of peer reactions to regularly join in with classroom discussion. **(p. 8)**

  For Samuel, he was provided with low-level work that he could already complete on the mistaken belief that this would improve his self-esteem and engagement. He was denied opportunities to work collaboratively with his more knowledgeable peers and experience the rewards of completing a challenging task.
- **Mathematics is not like any other subject** – This argument is based on the nature of the discipline itself, which is "perceived as 'graded', 'linear', 'structured', 'serial', and 'cumulative' – making it difficult to work with groups of students with different levels of knowledge and ability" (Linchevski & Kutscher, 1998, p. 533). Ability grouping is believed to make the teacher's job easier by reducing the range of attainment enabling the teacher to adjust the content, methods, and pace to suit the students involved and thereby maximise students' opportunity to learn. However, the extent to which ability grouping makes the teacher's job 'easier' or that it serves to meet the needs of all students is not supported by the evidence.
- **High achieving students need to be challenged** – One of the pervasive arguments in favour of ability groups is that students who are "really good at maths" are held back in heterogeneous classes. While there is some evidence that very high achievers benefit from being in homogeneous groups, there is also evidence that **high achieving students do equally well in well taught mixed ability classrooms**. Having said that, there is also evidence to suggest that at least some teachers in each school need to be aware of the special learning needs of very high achieving students (e.g., Plunkett, 2009). Further information can be found in the Department of Education and Training High Ability Toolkit here.
- **Mixed ability teaching is too hard** – All teaching is hard and given the evidence that well taught mixed ability classes lead to better academic and social outcomes for students, this argument needs to be rejected in favour of considering what 'well taught' mixed ability classes might look like in practice (see above). It is also worth keeping in mind that it is easier to source and differentiate a well-chosen task than it is to plan and effectively implement three lessons in every lesson.
- **Computer based programs for individualised learning** – One response to the range in mathematics achievement is the evolution of computer-based mathematics programs. These are promoted on the basis they enable all students to build on what they know and progress at their own rate in terms of the curriculum. While this appears to be consistent with a social constructivist view of learning, recent research in this area suggests that it could be masking an underlying behaviourist orientation to teaching and learning (e.g., Knox et al., 2020). Also, it appears that there is very little independent research on their long-term effectiveness, and while there is some suggestion that this approach may suit some students for some of the time, it does not replace the need to learn to work collaboratively with others to solve problems and communicate effectively with a diverse range of students. Askew (2015) makes this point strongly:

  rather than taking the individual as the starting point for planning learning experiences I argue that practices starting from the position of building learning communities are more inclusive while still ultimately addressing the needs of the individuals within that community. **(p. 130)**

Ability Grouping

SUPPLEMENTARY MATERIALS

Activities and reference material

SECTION 2: ENGAGEMENT ACTIVITIES

Consider the following prompts within a professional learning community to unpack the significance of each topic. Ensure you have downloaded and refer to the accompanying 'Ability Grouping Provocation' PowerPoint (AGPP).

FIRST STEPS TO ADDRESSING DIFFERENCE EQUITABLY

What teachers and school leaders believe matters

There is significant research that points to the role teacher's personal beliefs about ability play in their construction of ability groups and their expectations of students (e.g., Anthony & Hunter, 2017; Boaler, 2013; Francis et al., 2019; Marks, 2013). It is difficult to critically examine 'taken-for-granted' beliefs and values about teaching and learning, but the evidence suggests that many teachers have a fixed view of ability as something innate.

The Mathematical Mindset Tool (see Appendix A) is an observation tool that can be used as a discussion guide for coaching sessions and/or as a formative assessment tool by coaches in the classroom. The tool collects information on five mathematical mindset teaching practices:

1. Teacher Fosters Culture where all Students can Learn to High Levels.
2. Teacher Provides and Facilitates Open Mathematics.
3. Teacher Maintains High Challenge and Cognitive Demand.
4. Mistakes are seen as Valuable, Risk Taking is Encouraged.
5. Teacher Maximizes Student–Student Interactions.

Consider using the Mathematical Mindset Tool to explore and discuss teacher beliefs in a systematic way. The tool is useful for mathematics leaders and coaches as they work with staff to improve practice, but it can also be used by individual teachers or teaching teams to reflect on their practice.

What students believe matters

What students believe about themselves as mathematics learners and about mathematics matters (e.g., Zevenbergen, 2005). Beliefs can impact student confidence and persistence to profoundly impact achievement and the extent to which they participate in mathematics classes. Sullivan et al (2004) explored student perceptions of factors contributing to successful participation in mathematics.

Here is a useful summary of Dweck's views in particular the importance of recognising intelligence as something that is establishing a mastery orientation to mathematics.

Next, view and discuss Jo Boaler's video on how beliefs and fixed mind views impact students' perception of themselves as learners of mathematics. This video also includes some interesting observations from brain science research.

Review current practice

One immediate action schools can take in light of the evidence above is to review current grouping practices from the perspectives of teachers and students.

A survey of staff can be used to determine if and to what extent ability grouping is being used at each year level and why. Suggested questions could include:

- What is your vision for mathematics? Do the tasks and teaching approach used match that vision?
- If ability grouping is used, what form does this take, for example, *within* class ability grouping (e.g., low, middle, high ability groups), *between* class ability grouping (e.g., streaming) or other (specify)? How often is it used?
- Is the decision to use ability grouping a school-wide practice or policy, individual teacher, or teaching team decision?
- What evidence is used to determine ability groups (achievement data, teacher judgement, other?
- What is the rationale for grouping students by ability?
- Is group composition flexible (i.e., students are moved between groups on a regular basis) or relatively consistent (i.e., students are in these groups for most of the time)?
- To what extent and in what ways are the different groups offered different content or different types of tasks/learning activities? Are students in different groups expected to work at different rates?
- Is there a difference in the expectations teachers have of students in different groups?
- Is there a difference in the nature or frequency of teacher interactions with students in different groups?
- To what extent are student subject choices afforded or constrained by their experience of ability grouping?
- If ability grouping is not used, how is difference addressed? What other forms of grouping are used? What strategies are used to promote student engagement? What options are there for very high achieving/gifted students?

Conduct an anonymous electronic student survey, based on but not limited to the interview questions used by Zevenbergen (2005) with Year 9 and 10 students:

- What are the good things about being in your current mathematics class?
- What are the bad things about being in your current mathematics class?
- What are your favourite subjects?
- What are your least-favourite subjects?
- Do you plan to continue with the study of mathematics beyond Year 10?

Alternatively, access AGPP - Slide 1 and 2. Ask students to draw picture that shows when they are learning mathematics well and use the *Pupil Perceptions of Effective Learning Environments in Mathematics* (PPELEM) instrument (McDonough, 2002) or use David Clarke's (1988) IMPACT Procedure to collect written feedback from students about their drawing.

Collate and discuss results in planning teams and with school leadership. Develop an action plan to address the issues identified and involve the school community and students where appropriate in implementing, reviewing, and revising the plan.

Better target the teaching effort

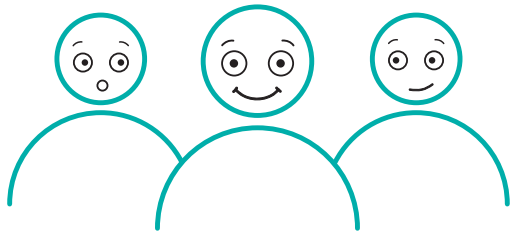
Identifying where students are in relation to important mathematics and focusing on what is known to make a difference through targeted teaching and creative mixed ability teaching is what is needed (e.g., Breed, 2011; Goss et al., 2015; Siemon et al., 2019; Sullivan, 2011). But to do this, schools need to understand the extent of the difference and explore what is possible in relation to targeted teaching in mixed ability contexts. Open a conversation with colleagues to discuss:

a. *Understanding where students are* – Identifying starting points for teaching – Given that access to multiplicative thinking largely explains the seven to eight-year range in student mathematics achievement in the middle years and beyond *(e.g., Siemon et al., 2006)*; consider using either the *Scaffolding Numeracy in the Middle Years* (Years 4-10)[5] or the *Assessment for Common Misunderstanding* (Years F to 10) resources to identify where students are in relation to the development of multiplicative thinking across the school.

b. *Building professional capacity* – Access the teaching advice associated with the resources above and the mixed ability resources referred to earlier to consider what a targeted teaching approach in a mixed ability context might look like.

5 http://www.mathseducation.org.au/online-resources/growing-mathematically/

TEAM-BASED ENGAGEMENT ACTIVITIES FOR ABILITY GROUPING



Activity 1

Having read and reflected on the evidence presented in this Monograph, discuss in terms of the following questions:

a. What are the implications for teaching and learning mathematics at our school?

b. What will it take for us to teach effectively in mixed-ability groups? What professional learning, resourcing, and structural support would be needed? who needs to be involved? Where might we start? What achievable targets can we set?

Activity 2

Watch Jo Boaler's (2014) video on ability grouping. After watching discuss the following with your colleagues.

a. Reframe and discuss the question she raises at the end of the video, for an Australian context: Why do you think streaming and ability grouping results in lower overall achievement?

b. Boaler also raises the issue of labelling groups by name or set number, but negative messages can also be conveyed to students through gesture, tone, facial expression, or physical movement. Discuss the questions raised on AGPP – slide 3, 'What else might you be teaching?'

Activity 3

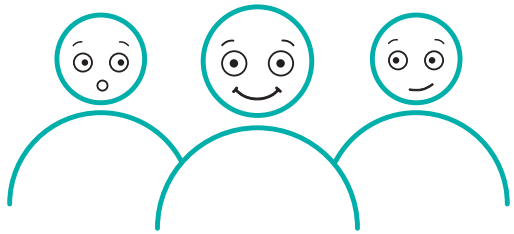
Watch Mike Askew's *(2018)* video on mathematics anxiety and discuss how you might go about creating a classroom culture where to be confused is "great".

Activity 4

Reach out to parents

Many parents experienced ability grouping as children and remember the stigma of being placed in the 'lower' group, but they also want the best for their children and believe that there are benefits of being in the 'top' group or they believe that their 'gifted' child will be held back in a mixed ability class. Consider hosting a parent Q&A on the issue of ability grouping where the impacts of debilitating comments such as "Don't worry, I was never any good at maths" can be discussed. Clarke and Clarke's (2008) 'Is time up for ability grouping?' is a short, accessible article that makes many of the same points made here. This could be distributed on or before the evening to prompt discussion.

TEAM-BASED ENGAGEMENT ACTIVITIES FOR ABILITY GROUPING



Activity 5: For Middle Years Teachers (Years 5-8)

Sagor and Cox (2004) identify five essential feelings they believe are crucial to a young person's well-being and success at school: "the need to feel competent, the need to feel they belong, the need to feel useful, the need to feel potent, and the need to feel optimistic *(CBUPO)*" (p.4). They explain why working on the behaviours and attitudes of discouraged learners alone is insufficient and suggest the inclusion of an additional dimension, that of role. Strategies such as cross-age tutoring is one method they suggest for managing the dissonance phenomenon at this level.

a. *Access the AGPP* slides on Adolescent learners (Slides 4-6) and Five Essential Feelings CBUPO (Slides 7-19).

b. *Discuss:* What are the implications for the teaching and learning of mathematics in the middle years? How do we plan to ensure feelings of competence, belonging, usefulness, potency and optimism? AGPP Slides 20-28 will assist with these discussions.

Activity 6: Primary School Teachers

Read this article by Rachel Marks (2013)

> *Miss Mason makes us go and sit in our maths groups, there's the green table, the purple table, the blue table, the yellow table and the red table. The green table are the best at doing maths; I'm on the red table.... (p.3)*

a. Access AGPP – Slide 29 'At the Red Table' and reflect on the following prompts:

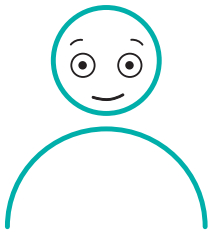
- If you had any personal experiences of ability grouping in maths or any other subject area, how did it make you feel?
- Do you or any of your colleagues – perhaps unintentionally -have a fixed mind set in relation to particular children? Have you described a child as 'low', 'average', or 'really smart' to a parent or a colleague? If so, what did you mean by this?

b. Why do you think Mrs Ellery acted in the way she did to the two students on the blue table and then to the students at the green table who were asked to share their solution? How do you think the two groups of students would feel?

c. Who are the strugglers in your class and why do you think they struggle? How do you support students who experience difficulty in mathematics?

d. Think of an episode in your classroom where you might have inadvertently labelled someone. What, if anything, did you do about it?

INDEPENDENT ACTIVITIES



Teacher knowledge and confidence are identified as important factors impacting the quality of mathematics teaching (e.g., Ball et al., 2005; Sullivan, 2011). Many of the individual activities in the STEM Agenda monograph that pertain to teacher knowledge are equally relevant here – particularly the use of the formative assessment tools and the exploration of a broader range of pedagogical strategies.

However, teachers also have a responsibility to create safe places that maximise opportunities to learn for all students. This is particularly relevant in considering the implications of ability grouping on student's self-efficacy, resilience, motivation, and engagement.

The following activities are aimed at supporting relevant aspects of the professional standards, while they can be done individually, it is best if the experience is shared with a colleague or in a teaching team.

Activity 1

***Creating and maintaining supportive and safe learning environments* – for some students, school is one of the few places where they feel genuinely safe. Use the following suggestions to consider the extent to which the mathematics learning environments you create are safe for your students?**

a. What messages do we send when we keep some students 'on the mat' for mathematics in primary school or assign them to an 'Opportunity Class' for mathematics in secondary schools? Consider this question in light of Jo Boaler's (2005) paper *The 'psychological prisons' from which they never escaped: The role of ability grouping in reproducing social class inequalities.*

b. Teachers of mathematics need to be fully aware of the impact their verbal and non-verbal actions can have on students. *In Wounded by School, Olsen* (2009) includes a letter to Mr. Jones from a past student, which details the long-term pain caused by a mathematics teacher who made them feel inadequate and stupid.

Access the 'Dear Mr. Jones' excerpt on AGPP – Slide 30. Think about a teacher who really motivated you to learn mathematics and make a list of what it was he/she did to made you feel comfortable and willing to have a go.

Activity 2

Teachers need to plan for and implement effective teaching and learning

a. Consider Mathew's story on AGPP - Slide 31. Do you have a Mathew in your class? What is needed to ensure the Mathew's in our classes have the opportunity to share their knowledge and experience?

b. Effective teaching depends on how well we know our students. Read the following paper on strength-based grouping (Leach, 2019), then use the Smart-Tool as suggested (p. 432) to identify "the individual strengths of all of the students in your class. Select four students, who, based on their individual strengths, you would group together to solve a mathematics problem". This is not easy as noted by Josie.

> ***This brought to my attention to how often I think of what my students cannot do in maths as opposed to what they can do. Using the template based on students' strengths, forced me to think about each student in my class and to think about their different strengths and status to think about who could work well together as opposed to thinking about who was going to be able to do the maths and help others to do it.* (p. 432)**

Reflect on how Josie framed a mathematics problem in terms of art to engage a student who never engaged in group discussion and consider how you might try something similar in your own class.

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