Best Practice in Mixed-Attainment Grouping

SECTION 1: THE EVIDENCE BASE

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Best Practice in Mixed-Attainment Grouping

ACKNOWLEDGEMENTS

Foreword

Welcome to the Best Practice in Grouping Students project. Thank you for your commitment to ensuring that the best pedagogy possible is offered to all our students, and especially those from disadvantaged backgrounds. Thank you also for participating with us in this Education Endowment Foundation-funded research to support this good practice: together we can make a difference, and build the research evidence and good practice needed to improve the educational experiences and outcomes of all students.

Research evidence suggests that students with lower prior attainment (often students from disadvantaged backgrounds) do better if taught in mixed-attainment ('mixed-ability') settings. However, we know less about why this is, or what characterises successful practice in mixed-attainment classes. The Best Practice in Mixed-Attainment intervention seeks to address these questions by applying and testing principles of good practice.

The information in this resource supports pedagogy in the Best Practice in Mixed-Attainment intervention. It explains the intervention rationale and methods, provides information on the elements needed to support high expectations and appropriate pedagogic approaches, and also presents some exemplar English and maths lessons. The exemplar lessons have been provided by our brilliant pilot schools, and are intended as discussion points and exemplars for further development, as well as for potential use. I hope you find the resource useful, and of course we welcome your feedback.

Thanks again for your participation, and I hope that you find the project journey stimulating and rewarding.

Project Director Professor Becky Francis,
Professor of Education and Social Justice,
King's College London

Note to teachers

This resource provides guidance and support for teachers delivering maths and English to mixed-attainment student groups.

The information presented in this resource is intended for guidance only. We are keen to avoid being prescriptive and believe that teaching professionals are best placed to decide how to organise teaching and learning.

The Best Practice in Mixed-Attainment Grouping intervention is looking at the implications of teaching students in mixed-attainment groups, and supporting good practice, in order to assess the impact of these approaches for students' progress and attainment. Although a key area of interest is the impact on disadvantaged young people, the project will track the progress and attainment of all students.

The Best Practice in Mixed-Attainment Grouping intervention was piloted in three schools in 2014–15, and is being rolled out to ten more schools in September 2015.

This resource provides guidance and support for teachers delivering maths and English to mixed-attainment student groups. It draws heavily on expertise and exemplars supplied by the pilot schools.

The research team has developed a set of guidance around:

- Growth mindset and flexible conceptions of intelligence

- High expectations

- Within-class grouping

- Differentiation

Each of these is explained in Section One and is followed in Section Two by a number of exemplar lesson plans which put the guidance into action. These materials will be explored and elaborated further at professional development events led by the team from King's College London. Schools have agreed that teachers will then cascade their learning to colleagues and implement practices in their own settings.

Section 1
The evidence base

Background

Grouping students by 'ability' is a topic of long-standing contention in English education policy, research and practice.

EVIDENCE BASE

While policymakers have frequently advocated 'ability' grouping as reflecting educational 'standards', research has consistently failed to find significant benefits of these practices. Indeed research has identified disadvantages for some (low-attaining) student groups. This section describes the evidence and presents a rationale for mixed-attainment grouping in order to support the achievement and progress of all students (see also Francis et al., 2015, in press).

The term 'ability grouping' confuses current educational attainment with a notion of innate

Reviews of evidence show that ability grouping has no significant benefit for attainment – but it does have a negative impact on the attainment and identities of those in lower sets, who are disproportionately likely to be from lower socio-economic backgrounds.

potential academic 'ability'. Moreover, as Dracup (2014) observes, the term 'ability grouping' can include a very diverse range of discrete practices. Arguably the term is so unhelpful that it should be discarded. We prefer to use 'attainment grouping'.

Attainment grouping practices most frequently include streaming, setting, and within-class grouping by attainment. 'Streaming', referred to in the US as 'tracking', involves separating students according to academic 'ability' across all (or a majority of) subjects, so that students remain in the same group for all or most lessons. Setting is premised on the same notion of academic 'ability', but is more flexible and can involve smaller groups, with students being put into different attainment sets for different subject areas. Within-

class grouping by attainment is very often used in primary schools, where children are seated at 'ability tables' within a class containing a broad range of prior attainment.

The precise extent of setting and streaming in the English system is far from clear. Nevertheless it seems to be the case that these practices have steadily increased and now predominate. Little data is collected, but one source suggests that almost three quarters of secondary students are taught in sets or streams for maths (71%); nearly two-thirds for Science (62%); and over half for English (58%) (Hansard, 2011, cited in Dracup, 2014).

There is an extensive research literature on the impact of 'ability grouping' on student outcomes, as elaborated in the EEF/Sutton Trust Toolkit (EEF, 2015b), and in several other reviews.[1] The evidence suggests that, overall, these practices are not of significant benefit to attainment, with a negative impact for lower sets and streams – those wherein students from lower socio-economic groups are over-represented.[2] As Slavin (1990) observes, advocates of 'ability grouping' maintain it allows teachers to adapt instruction to the needs of a diverse student body, giving them the opportunity to provide more difficult material to high achievers, and more support to low achievers. Yet Slavin's (1990) systematic review of the most significant, methodologically-robust research from the US and elsewhere found that the effects of ability grouping on achievement are not statistically significant (see also Nomi, 2009).

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1 Ireson & Hallam, 2001; Kutnick, Sebba, et al., 2005; Slavin, 1990

2 Cassen & Kingdon, 2007; Dunne et al., 2007; Kutnick, Sebba, et al., 2005

Ireson, Hallam, and Hurley (2005) more recently investigated the effect of setting in English, maths and science at GCSE, and found no significant effects for setting in either subject. These overall findings could be read as suggesting that ability grouping neither helps nor hinders, but there is a negative impact for those in lower sets, in which students from low socio-economic backgrounds are disproportionately represented. As Boaler and Wiliam (2001) summarise:

> '...bringing together the different research studies on ability grouping the general conclusion is that streaming has no academic benefits whatsoever, while setting confers small academic benefits on some high-attaining students, at the expense of large disadvantages for lower attainers.' (p. 179; see also EEF, 2015b).

The 'Best Practice in Grouping Students' project involves two interventions that draw on existing research evidence to implement good practice interventions in two different approaches to student grouping. It seeks to monitor and compare progress and attainment outcomes for low achieving (and other) students following the adoption of different approaches to student grouping. In this way, it is intended to provide evidence concerning the efficacy of different approaches to student grouping on improving the attainment of (disproportionately disadvantaged) low achieving students, and hence for narrowing the socio-economic gap for attainment.

The intervention 'Best Practice in Mixed Attainment' seeks to document and provide materials to support good practice in mixed attainment pedagogy: our review of the literature found that the constitution of good practice in mixed attainment classes is currently an under-researched area. The project team are also running a randomised controlled trial of an intervention 'Best Practice in Setting', which aims to eliminate some of the factors related to setting shown by previous research to be harmful. Impact (or otherwise) of the interventions is then to be compared with the control groups of schools, with the eventual aim of being able to compare effect size across the two interventions to identify which practices are most effective in supporting students with low prior-attainment (along with the impact on other groups of students).

Implementation

Schools participating in 'Best Practice in Mixed-Attainment Grouping' will all be making changes to practice, but the amount of change will vary between schools, depending on their starting point.

EVIDENCE BASE

In this section on implementation, we review research into effective continuing professional development and making changes in professional practice. We draw on the relevant research literature and on the experiences of our pilot schools.

Timperley and colleagues (2007) reviewed 97 research studies that set out to improve teaching and student achievement. Their findings suggest that continuing professional development has greatest impact when it involves an outside expert, and is delivered to all members of the school community. The content should be evidence-based and challenge current practice. Timperley et al. observe that teachers learn like students and so anything that works in the classroom will also be likely to work in professional learning. The school's senior leadership team should provide leadership and monitoring of the implementation and develop a learning culture with their teachers, supporting them to engage in professional dialogue over an extended period of time. Timperley et al. emphasise the importance of a 'Community of Practice' – a group of teachers who talk with each other and who are all teaching the same or similar courses or students. An example might be a maths or English department participating in the 'Best Practice in Mixed Attainment Grouping' intervention. Such a community shares ideas for improvement – both consciously through training or discussion and incidentally through other routes such as peer pressure.

Professional dialogue is a key element of changing practices within a school.[3] Hattie (2012) highlights the necessity of teachers talking to each other about teaching, rather than about curriculum, student issues, assessment, administration etc:

> **'The topic of staffroom conversations needs to move towards a collective understanding of the adults' effect on the children.'** (p.155).

He recommends that teachers work together to develop and critique their planning, focusing in particular on the challenge provided to students, the progress they are making and the evidence of impact of teaching practices. Hattie cites McNulty and Besser's (2011) idea of a 'data team' (p.62) where teachers work together to:

1 Collect and collate data, and formulate questions about teaching and learning arising from the data.

2 Set carefully prioritised goals, then review and revise these as they are worked towards.

3 Ask questions of the instructional strategies that are being used. Which need to be stopped? Which can be kept? What new strategies are needed?

4 Keep monitoring the impact of teaching strategies on learning.

As well as discussing teaching and learning with colleagues, teachers need to be self-reflective (Timperley et al., 2007) and regularly evaluate the impact of their own practices.

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3 Black & Wiliam, 1998b; Coe, Aloisi, Higgins, & Elliot Major, 2014; Cordingley, 2015; Hattie, 2012; Timperley et al., 2007

Implementation

Wiliam and colleagues[4] recognise the challenges inherent in changing professional practices and suggest that:

'The teachers who are most successful are those who change their practice slowly, by focusing on only two or three aspects at a time. As they become skilled with these new ideas, and incorporate them into their natural practice, they can then turn their attention to new ideas. Teachers who try to change many things about their practice at the same time are unlikely to be successful.' (Marshall & Wiliam, 2006, p.21)

Two professional activities are identified as having particularly powerful impact: regular meetings with colleagues who are trying to effect similar changes, and peer observation with feedback from a trusted colleague, where the agenda is set by the observed teacher. This reinforces the emphasis on professional dialogue.

Extended coaching is also highlighted by Hattie (2012) as a key part of effective continuing professional development. At the core of effective coaching is effective questioning. Timperley et al. (2007) suggest the following questions to use in teacher enquiry and knowledge building:

1 What knowledge and skills do students need to acquire?

2 What knowledge and skills are therefore required by teachers?

3 How can we deepen professional knowledge and refine pedagogical skills?

4 How can we then engage students in new learning experiences?

Hattie (2012), whose best-known maxim is 'know thy impact', points out that the link in the cycle from (4) back to (1) must incorporate an assessment of impact of the practices that have been tried. This cycle could form the basis of a coaching session, using a framework such as that set out by Zeus and Skiffington (2002), but there are many other approaches and resources available, e.g. Lesson Study (Fernandez, 2002), Teacher Learning Communities (NCTE, 2010).

One key challenge for schools is how to make change sustainable. Coe et al. (2014) identify six principles of feedback that they claim will result in sustained improvement. These are:

1 Focusing on improving outcomes for students.

2 Setting 'clear, specific and challenging goals' for the teacher.

3 Feedback is focused on improving personal performance rather than measuring against norms, and focused on learning, not on the person.

4 Continuous, independent learning is encouraged.

5 Feedback is offered by a trusted mentor within a supportive relationship.

6 A culture of 'professional learning and support' is promoted throughout the school by the senior leadership team.

Lastly, impact is rarely instantaneous. Changing ingrained practices through an iterative process of trying something out, reflecting and modifying practice takes time and research typically suggests it can take up to two years to see full impact (Adey et al., 2004; Hattie 2012).

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4 Hodgen & Wiliam, 2006; Marshall & Wiliam, 2006

Learning from our pilot schools

Later in this resource we will see the classroom practices of our pilot schools exemplified in sample lesson plans. Here, we will provide a brief outline of some of the professional learning and development practices that they have found helpful in implementing mixed attainment teaching.

Senior leadership support has been critical in securing resources to support change. In one school, a senior leader focused on empowering a department new to mixed attainment teaching by asking questions to establish needs and then working with key members of the department to change attitudes and practices. Support was sought from colleagues experienced in teaching mixed attainment groups, for example in other departments within the school, and teachers at other local schools and an FE college. Observations were carried out and followed up with coaching: 'what did you see? what do you think we can learn from it?'.

Teachers were supported to identify opportunities and coaching was used to break down assumptions and resistance. In some cases, co-observation of lessons was helpful to provide a shared starting point for the coaching.

Later in the process, a skills audit helped members of the department to identify their strengths and areas for development. The lead practitioner then used this to construct pairings for peer observation where teachers were able to share their complementary skills.

Department meetings have been core to the change process in all schools. Mixed attainment teaching provides the great benefit that all teachers can teach the same content at the same time. This means that department meetings are an excellent opportunity to discuss learning in the current topic/lesson sequence. In one school a weekly meeting was timetabled (department members sacrificed a shared free period) where 'we don't do admin, we just talk about teaching'.

Co-planning is a great boon of mixed attainment teaching: 'we just shared out things that people would look at and they'd come up with some activities'. More than just planning together, teachers could learn from the questions raised by students in colleagues' classes:

'If I've got a lesson I'm doing, you've also done it, so we can share resources, physical resources, but also questions that kids asked about it. […] By discussing stuff and talking about stuff you can know, 'Oh, this will be an interesting thing to pursue, and this stuff might come up and if it does that's worth looking out for'.'

Throughout, a positive, supportive and empowering approach has been essential:

'And it is about maintaining positivity, saying, look, nobody is expecting you to get this perfect. You're not going to get this as perfect as you will have previously because that's what you've been doing all your career. But what we're asking you to do is evaluate, be self-reflective. Don't be afraid to change. Talk about teaching and learning. Work together.'

SUMMARY

A whole school culture of professional learning and support, backed and monitored by senior leadership, provides the optimum context for implementing change.

Professional dialogue is essential – teachers must focus conversations on students' learning.

Coaching and peer observation, within the context of a trusting professional relationship, can be a powerful tool for change. Both of these must be 'safe' to be effective and so the agenda must be set by the teacher being coached or observed.

Teachers must be reflective practitioners and continually evaluate the impact of their practices.

What works for student learning will likely work for adult learning as well.

ACTIVITIES

Activity 1
Where is your school and your department at now in relation to professional learning and mixed attainment teaching?

a What are the strengths?

b What might you need to work on?

Activity 2
On page 13 is an outline of our professional development process. With colleagues from your school, read and discuss the model:

a What do you think will work well at your school without much effort?

b What challenges do you foresee?

Activity 3
It can be helpful for this activity to work with colleagues who are outside your particular situation. Listen to each other's responses to activity 2. Using coaching/questioning try to help each other find solutions to some of the challenges. One approach could be:

a What do you want to achieve? (Goal)

b What is the situation now? (Reality)

c What options are available to you? (Options)

d What will you do now? (Way forward)

Activity 4
How can you develop opportunities for your department to work together? What changes in policies/practices might you need?

Activity 5
How can you encourage a supportive, learning culture at your school? If you already have one, what makes it successful that you could share with colleagues from another school?

Activity 6
Who is your advocate on the senior leadership team? What support do you need from her/him?

BEST PRACTICE IN MIXED–ATTAINMENT PROFESSIONAL DEVELOPMENT PROCESS

Professional development event

- Evidence-based information
- Activities to aid reflection
- Planning time for cascading and implementation
- Follow-up activities to complete at school

Bring examples of successes and problems to next professional development event

Bring completed follow-up activities to next professional development event

Cascading in school

- Evidence-based information
- Activities to aid reflection
- Planning time for implementation in lessons

Application

- Learning applied in planning, teaching, assessment and feedback

Modify practice based on review

Complete follow-up tasks

Review

- Peer observation
- Reflection and self-evaluation
- Learning-focused discussions
- Coaching
- Identify improvements and problems

Growth mindset and flexible conceptions of intelligence

EVIDENCE BASE

According to a recent report on 'Promoting social mobility' for the Association of School and College Leaders (Hill, 2013), a strong culture of high expectations and achievement for all is 'at the centre of any successful strategy for raising attainment, particularly for disadvantaged students'. Furthermore, researchers such as Dweck (2010) and Yeager et al. (2007) have found that teaching students that intelligence can be developed – rather than it being a fixed trait that one inherits at birth – enables more students to reach their true potential.

Dweck (2008) maintains that overplaying the importance of superior intelligence or ability, and the implication that such traits are innate and rigid, leaves people unmotivated to learn. On the other hand, teaching students to have what she describes as a 'growth mindset', which focuses on effort as opposed to intelligence, motivates students to learn. Teachers and parents can help young people to develop this growth mindset by teaching them that intelligence is malleable and can be developed through learning and hard work.

According to Dweck, the reason that some students give up when they come across academic problems, while others persist, is because of their beliefs about the nature of academic ability. If students have a belief that academic ability is innate, when they make mistakes their self-confidence suffers because they feel unable to make changes. Students then avoid challenges, because they feel powerless to avoid the failure that might be the result.

On the other hand, those students who think intelligence is malleable and can be developed through hard work are more motivated to learn. If mistakes are seen as problems to be solved, the student's mindset changes. This leads students see challenges as an opportunity to develop their intellect and realise that mistakes can be remedied by putting in effort. Dweck claims that challenges are energising for students who believe in the concept of malleable intelligence: what she calls a 'growth mindset'. On the other hand, those students who hold a 'fixed mindset' have negative views of effort believing that 'clever' people do not need to work hard. Dweck found that those students with the 'growth mindset' worked harder and were more persistent than those who held the belief in a 'fixed mindset'. Students who had a growth mindset also showed academic gains over students who had a fixed mindset.

One study undertaken in the US by Blackwell, Trzesniewski, and Dweck (2007) measured the mathematics performance of more than 300 Year 7

> Students who think intelligence is malleable and can be developed through hard work are more motivated to learn.

students over two years. There was a significant impact on outcomes, with students who had the growth mindset being a standard deviation above the fixed mindset group.

A second study in the US by Blackwell et al. (2007) involved giving an intervention group of 48 Year 7 students eight 25-minute lessons in which they were taught that the brain was malleable. The control group consisted of another 43 students aged 12–13 years old. The two groups did not differ in prior attainment. However, once again, the subsequent difference in mathematics grades between the groups was significant, with those in the intervention group gaining better outcomes. Recently, Paunesku et al. (2015) delivered an online

growth mindset intervention to 1594 students in US high schools, finding improvements in results for students who had been performing poorly.

One way of transmitting a 'growth mindset' is offering praise to the student. However, it is important not to praise the student's intelligence which tends to promote a fixed mindset. Rather one should provide carefully-worded praise for the specific process a student uses to accomplish something. This encourages and motivates the student by focusing on the actions that lead to success. This in turn gives the student confidence, as well as knowledge of how to progress (Mueller

> When offering praise, teachers' comments should be 'task-oriented'. This means focussing on what a student did in order to produce a piece of work, such as their effort and strategy.

& Dweck, 1998). Another way of encouraging a growth mindset is minimising the use of marks, levels or grades, which can distract students from teachers' immediate comments (Butler, 1987) and encourage an ego-orientation that seeks the appearance of success at the expense of actual learning.

Mueller and Dweck (1998) found that 10 year-olds praised for intelligence performed worse when they had experienced failure. However, children praised for effort actually increased their performance following failure, suggesting that a growth mindset can help children overcome difficulties and challenges.

When offering praise, teachers' comments should therefore be 'task-oriented'. This means focusing on what a student did in order to produce a piece of work, such as their effort and strategy. This contrasts with 'ego-oriented' praise, which focuses on what a piece of work might indicate about a student's attributes, such as their ability. Teachers should also actively encourage their students to use the task-oriented approach to praise when engaging in peer assessment.

Task-oriented praise should also provide students with detailed information about their competencies, as well as effective problem-solving strategies that they can apply to similar situations in the future. Praise must be specific in order to function as effective reinforcement (O'Leary & O'Leary, 1977). The well-known feedback scaffold of 'what went well…' and 'even better if…' is an effective exemplar here. The 'what went well' element (followed by specific, task-oriented explanation of what the student did well in a set task) provides task-oriented encouragement and praise, and the 'even better if' element (followed by specific explanation of how the student could improve next time) provides constructive, developmental support to improve further.

SUMMARY

'Intelligence' is not fixed, but malleable.

A 'growth mindset' can facilitate progress and attainment.

Teachers' high expectations of students and encouragement of their belief in their ability to overcome problems, can improve outcomes.

Encouragement and praise have desirable effects on attitudes and attainment when they are task-oriented, specific, varied and sincere (Askew, 1995; Dweck, 2008; Higgins et al., 2014).

ACTIVITIES

Activity 1

Here are nine examples of praise:

1 You're really good at maths, aren't you?

2 You put a lot of effort into the description – your use of adjectives here is excellent.

3 Yes – clever lad!

4 You found a method that works. Can you think of other methods that might also work?

5 You must be very clever. You have a real talent for this.

6 You have worked hard to get the hang of fractions, and succeeded – well done!

7 Your presentation demonstrated lots of research – well done. For next time, some visual aids would help to make your points even clearer.

8 You're a good girl.

9 You've made an excellent point. Can you provide a quotation to support it?

a Circle the numbers that represent good practice.

b Check the answers given below against your own.

c Can you improve any of the good practice examples to help a student move their learning on even further?

d Extend the discussion with exploration of examples 3 and 8. Teachers frequently give this kind of praise in order to support and affirm their students. However, research suggests that it can reduce the impact of task-oriented praise or feedback (Hattie, 2012). You could discuss the contexts in which a teacher might wish to give this kind of praise and what better practice might be in those contexts. For example, a teacher may wish to comfort a student who has not succeeded at a task and a solution might be to praise effort and offer alternative strategies, or to recognise that the activity is mismatched to the student's prior attainment and re-plan accordingly.

Activity 2

Agree with colleagues in your department to collect some written examples of the praise you have given your students, then:

a In pairs, consider whether each example is task-oriented, specific, varied and sincere.

b As a group, discuss the extent to which your examples are consistent with the evidence-based approach to praise.

c Again, as a group, discuss the challenges and opportunities of pursuing this approach in your department.

Activity 3

Research has suggested that a positive classroom climate is a helpful foundation for students to make progress (Coe et al., 2014; Marshall & Wiliam, 2006). Discuss how you can create this in your classrooms.

Activity 4

With a colleague, plan and teach a lesson aiming to develop a growth mindset in all your students. You might like to observe each other or video your lessons. Reflect on your lessons together, focusing on feedback and growth mindset.

a To what extent did you succeed in developing a growth mindset in your students?

b Reflect on how a growth mindset affected the learning of individuals. Who was helped most? Did anyone resist? Why?

c What will you try next to build on what you have learned from this lesson? What if any new policies and practices will you need?

High expectations

Numerous research studies have provided us with a substantial amount of evidence that teacher expectations can positively or negatively influence student performance and achievement.[5]

EVIDENCE BASE

Teacher expectations may manifest themselves in the learning opportunities provided, the affective climate created and the interactional content and context of the classroom. Teacher expectations can therefore become 'self-fulfilling prophecies'. In other words, initially erroneous beliefs result in their fulfilment (Weinstein, 2002).

Work examining self-fulfilling prophecies has been undertaken by psychologists, sociologists and educationalists. Merton's (1948) seminal work still resonates today. He wrote that:

'The self-fulfilling prophecy is, in the beginning, a false definition of the situation evoking a new behaviour which makes the original false conception come true. This specious validity of the self-fulfilling prophecy perpetuates a reign of error. For the prophet will cite the actual course of events as proof that he was right from the very beginning.' (Merton, 1948)

The definition of self-fulfilling prophecy was refined by Rosenthal and Jacobson (1968) as:

'How one person's expectations for another person's behaviour can quite unwittingly become a more accurate prediction simply for it having been made.'

Writing in the same year, Jackson (1968) described how, on entering kindergarten, a child discovers that not all children receive the same reaction from the teacher. The first formal evaluations begin to shape the child's thoughts of him or herself as an achiever or a non-achiever. Finn (1972) went on to confirm that other factors influencing students' conceptions of themselves as learners include their parents and other students. Several research studies have found that

teachers use information related to a host of individual characteristics in the formation of their expectations of students.[6] A large number of individual student characteristics have been identified as potentially influencing teacher expectations and there has been research into the significance of these for student learning (Baron, Tom, & Cooper, 1985). These include gender, ethnicity, social class, language style, the age of the student, other siblings, and one-parent background.

Teacher expectations, assumptions and actions have been shown to have an impact on students' educational outcomes. Palardy (1969) investigated 22 primary school teachers' expectations of over 200 boys' reading comprehension which, has implications for all teachers. He reported that:

'In terms of self-fulfilling prophecy when teachers in this study reported that they believed that boys are far less successful than girls in learning to read, the boys in their class were far less successful than the girls. Conversely when teachers reported that they believed that boys are as successful as the girls, the boys in their classes were as successful as the girls.' (p.374)

5 Babad, 1993; Brophy, 1982; H. M. Cooper & Good, 1983; Good, 1987

6 Archer & Francis, 2007; Ball, 1981; Campbell, 2015; Francis & Archer, 2005; Jackson & Marsden, 2012/1966

Student social class has been shown to have a particularly strong impact on the expectations of many teachers. In their study with 22 teachers and 327 students across nine state secondary schools in England, Dunne and Gazeley (2008) found that 'teachers' tacit recognition of students' social class positions was a key factor in their constructions of students' underachievement' (p.452). The authors found a tendency for middle-class students to be encouraged to achieve while working-class students' failure was normalised. They also found that teachers used different strategies for dealing with academic underachievement depending on whether students were middle-class or working-class.

One of the principal ways in which teachers' expectations affect student achievement is through opportunities to learn. Of particular concern is the way that those of lower socio-economic status tend to be placed in low ability groups.[7] Jackson and Marsden (2012/1966) found that students with similar IQs tended to be placed in higher streams if their fathers had professional jobs and tended to be placed in lower streams if their fathers had unskilled jobs. More recently, Dunne et al. (2007) found that working-class students, including students from some minority ethnic groups – tended to be disproportionately concentrated in low streams and sets and that, given their prior attainment, many students appeared to be in the wrong sets.

Studies by Hallam and Ireson (2003, 2005) found that ability grouping such as setting and streaming impacted the expectations held by teachers for their students, which in turn affects the curriculum content and the teaching methods adopted. Gamoran (1986) and Hallam, Ireson, and Davies (2004) found that this in turn affected students' expectations. Hallam and Parsons (2013a) then found that parents' expectations were also affected, with those whose children were in the lower attainment groups less likely to expect their children to continue into post-compulsory schooling.

Hallam and Ireson (2005), in their survey of 1500 teachers, found that there were considerable differences in the teaching of low- and high-ability groups, even when the same teacher taught both groups. The students in the lower groups were taught a different curriculum in a different manner with less discussion, less homework, less feedback, more practical work and more repetition. It is sobering to note Hallam and Parsons (2013b)'s

finding that more than half the students in the bottom groups were classed as having lived in poverty.

It is also important that students have high expectations of their own attainment, and we know that students in lower sets can have lower

Raising students' expectations and confidence in their own potential can raise attainment.

expectations of themselves. Hattie (2012) found that students' expectations were powerful predictors of their future achievement. Raising students' expectations and confidence in their own potential can raise attainment. This might include asking students to predict which learning objectives they will have successfully have met by the end of a lesson, or forecasting their own results for summative assessments. Students need to believe their own predictions for this to be effective.

'Teachers need to provide opportunities for students to be involved in predicting their performance; clearly, making the learning intentions and success criteria transparent, having high, but appropriate, expectations, and providing feedback at the appropriate levels is critical to building confidence in successfully taking on challenging tasks. Educating students to have high, challenging, appropriate expectations is among the most powerful influence in enhancing student achievement.'
(Hattie, 2012, p.60)

Hattie (2012) reports that certain groups of students have a tendency to set their sights too low, particularly students from some ethnic minority groups and those with lower attainment. Teachers may be able to help by consistently communicating their own high expectations to students, by assisting students to recognise their achievements accurately and by sharing with students the idea of a growth mindset. However, Hattie warns that it is very difficult to change students' perceptions of their potential once they are at secondary school as their negative beliefs and low confidence may have been reinforced over many years.

Schools use a range of approaches to target-setting to establish and communicate their expectations of students. It is considered good practice for secondary schools to set cohort targets for achievement at the end of Key Stage 4. Many schools also set individual annual targets for students: these can be generated from prior

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7   Barker Lunn, 1970; Dunne et al., 2007; Hallam & Parsons, 2013a, 2013b; Troyna & Siraj-Blatchford, 1993

attainment data such as Key Stage 2 results or from tests of 'learning potential' such as CATs or MidYIS tests. These targets may be either minimum or aspirational targets. In some cases, teachers may be able to adjust targets using their professional judgement.

Individualised target-setting is one way that schools can communicate high expectations to students, but there is a risk that low-attaining students might find their targets demoralising (because they are 'low' in absolute terms). Where contextual information about the school or the student is taken into account then it is also possible

High expectations have a profound impact on student achievement.

that targets may be lower for certain students, e.g. those who live in disadvantaged postcode areas. Another issue is that while ensuring that students make 'expected progress' is important, this does not necessarily reflect the aspirational approach needed to narrow gaps.

A further level at which targets can be set is

within a lesson or sequence of lessons. Teachers communicate learning intentions and expected outcomes clearly at the beginning of a lesson and students either aim or are required to achieve these. Learning intentions and activities must be pitched at the right level for each student to learn new knowledge or skills – this is explored further in the materials on differentiation. Some schools reinforce high expectations by using a 'mastery' approach (Gurskey, 2009) where all students are required to achieve a minimum standard before they can move on to the next area of learning.

To summarise, high expectations have a profound impact on student achievement. The resultant learning experience is rich, engaging and challenging; students have greater autonomy and there are more opportunities for collaboration with peers. Students also receive the message that their teachers believe in them and want to encourage them to do well; facilitating a growth mindset.

It is important to remember that this is in our hands. As Jeremy Hodgen writes:

'Teachers and schools can make a difference – by believing, and acting as if, all students have the potential to succeed.' (Hodgen, 2011, p.219)

SUMMARY

Teacher expectations can positively or negatively influence student performance and achievement.

Teacher expectations can lead to self-fulfilling prophecies.

Students from lower socio-economic backgrounds are particularly vulnerable as research shows that teachers tend to have lower expectations of them.

When students believe in their own potential for success, this increases their chances of achieving.

Target-setting needs to be used carefully to avoid demoralising lower attaining students or putting a ceiling on what students (and their teachers) believe they can achieve.

High expectations in the classroom, communicated clearly through challenging and appropriate learning objectives, are a powerful vehicle to raising achievement for students at all levels of prior attainment.

ACTIVITIES

Activity 1

Read the two case study vignettes below[8] and consider the following questions with your colleagues:

a Do the vignettes describe patterns that could plausibly occur at your school?

b How might teachers at your school intervene to disrupt these patterns?

Vignette 1: Implications of a lack of financial and social capital

Josh lives in a council flat with his parents and three siblings. His parents have low-paid jobs, and struggle to make ends meet. Facilities are cramped and there is no money to spare for books and resources. Josh's primary school was not high quality, and he received relatively little focused support in preparation for his SATS, either from home or school. He didn't take much notice of his results, but they were below the expected national standard.

Secondary school feels culturally alien for Josh, and it's hard for him to adjust. He is placed in a different set from his friends for maths and English. Like his friends, Josh quickly understands that this has separated the 'clever kids' from the 'slow ones' and that he in 'low ability' sets. He begins to see himself as 'not much good' at schoolwork and 'not clever'. His parents, keen to protect Josh from painful feelings they remember from their own school days, try to alleviate his distress by pointing out they didn't do well at education either, and not to worry. Josh lowers his expectations of his own educational outcomes accordingly, and gradually starts to invest instead in behaviours that give him value via credibility with his peers, rather than teachers – disruptive classroom behaviours, and his skill at football.

Vignette 2: Implications of the possession of financial and social capital

James lives in an owner-occupied, detached four-bedroom house with his parents and sister. His mother is a well-paid professional, and his artist father works from home. James' parents invest substantial time and money researching and securing the best books, educational tools and trips. James does not attend the closest school as his parents' research showed that this had been graded 'good' – he attends an 'outstanding' school a little further away (luckily his father's flexible working arrangements enable him to drive James to school and collect him too). He was well prepared for his SATS, including practising at home with test papers purchased by his parents. However, while he received a top grade for literacy, his maths result only reflected the nationally expected grade.

When James arrives in Year 7 he has a highly developed vocabulary, which gives him the confidence to contribute in class. He and his peers are placed in different sets for maths and English. Like his friends, James quickly understands that this has separated the 'clever kids' from the 'slow ones'. While in the top set for English, he is in the 'low ability' set for maths. However, when his parents discover this from their questioning of the class teacher at parents evening, they immediately secure a home tutor, and James' mum spends 20 minutes every evening working with James on his numeracy. His parents discuss dyscalculia as well as potential misallocation by the school, but these discussions swiftly become irrelevant as James' rapid improvement, monitored by his parents in close discussion with his class teacher, mean that he is soon allocated to a 'higher-ability' set. None of this impacts James' expectations of doing well educationally and following in his mother's footsteps.

8 Based on Francis (2013), amended for this project

Activity 2

Discuss the following questions with your colleagues:

a What methods of target setting for individual students does your school use? What form do these targets take? How are they communicated to students? What are they used for?

b What are the potential consequences of a student receiving:

    i the highest possible target

    ii a very low target

    iii a mastery target

    iv a target they can achieve easily

    v no target

c How can you ensure that the targets you set communicate high expectations to all students?

Activity 3

With your colleagues, consider the following statement: 'Establishing and maintaining high expectations for all students is an important role for all teachers. This involves teachers setting ambitious targets for each student and convincing students that they can achieve these targets. Teachers must work hard to combat the negative influence of messages about low expectations that affect their students' vision of academic achievement.' (Adapted from Teaching as Leadership, 2011)

a Is the above statement achievable?

b What can you do to ensure that high expectations are applied equally to all students?

c What would this look like in practice?

d Agree on at least three strategies that can be applied by all teachers in your department.

Activity 4

With a colleague, plan and teach a lesson aiming to communicate high expectations to all your students. You might like to observe each other or video your lessons. Reflect on your lessons together, focusing on high expectations.

a To what extent did you succeed in communicating high expectations? How do you know that you set high expectations for all students?

b Reflect on how your expectations affected the learning of individuals. Who was helped most? Did anyone struggle? Why?

c What will you try next to build on what you have learned from this lesson? What if any new policies and practices will you need?

Within-class grouping

The Sutton Trust-Education Endowment Foundation toolkit (Higgins et al., 2014) states that flexible within-class grouping can be beneficial where grouping is designed for specific tasks.

EVIDENCE BASE

Where grouping is inflexible, such as in sets and streams, or where students always work together in the same attainment-based within-class group, it is likely to 'undermine low attainers' confidence and the belief that effort is more important than ability' (p.6).

Research shows that teachers often group students for behaviour and classroom management rather than learning purposes (Kutnick, Blatchford, Clark, MacIntyre, & Baines, 2005). However, there is research that can help teachers structure groups to support both learning and behaviour.

A number of research reviews provide evidence that dividing students into groups within a class, rather than always teaching the whole class at the same time from the front, can support learning. This can include pair work, as well as larger groupings.

Early reviews of research found that small group teaching had a positive effect when compared with whole-class teaching. Slavin (1987) conducted a best-evidence synthesis of seven studies from primary schools and found average effect sizes of +0.45 for reading and +0.34 for maths, indicating that within-class grouping raised attainment by the equivalent of four to six months additional progress (Higgins, 2012). Kulik and Kulik (1987) reviewed 19 studies at both primary and secondary level and found a much smaller average effect size of +0.17 (approximately two months progress), with the greatest impact on students identified as 'gifted and talented'.

Lou et al. (1996) conducted a meta-analysis of 145 studies of within-class grouping in primary, secondary and post-secondary settings, intending to improve on the earlier reviews. They explored whether small group teaching facilitated student learning, attitudes and self-concept. Further, they investigated what made grouping most effective,

comparing different types of grouping and different conditions. Lou and colleagues found that when students learned in groups they 'achieved more, held more positive attitudes, and reported higher general self-concept' than students who were not grouped (Lou et al., 1996, p. 446). Lou and colleagues found that the positive effect of grouping is particularly strong for larger classes and is stronger for maths than for English. They found that the optimum size for small groups is 3–4 and that if groups are any larger then students are less likely to contribute equally to activities (Lou et al., 1996).

Lou et al. found that within-class grouping was more successful when it took group cohesion into account and that this enhanced group commitment to a task. Teachers need to take into account motivational factors in addition to prior attainment when organising students into groups. They also made the very practical observation that within-

> **Teachers should make their grouping decisions strategically to support learning.**

class grouping works best when the classroom furniture is arranged appropriately.

A further finding from Lou and colleagues' meta-analysis was that students learn equally well in flexible and stable groups. Taking this finding together with evidence that fixed conceptions of ability hinder student progress this provides an argument for a flexible approach to within-class grouping, where students work in different groups for different tasks. Finally, the meta-analysis suggests that groupings might be most effective when teachers combine information about students' specific learning needs for a task with

their professional knowledge about which students are likely to work well together, while ensuring that lower-attaining students are not all grouped together.

Lou et al. found some evidence that lower-attaining students benefit from being in heterogeneous (mixed) prior attainment groups. This is thought to be because one of the advantages of group work is that students learn from their peers' explanations. Where lower-attaining students are grouped together, there may not be anyone in the group able to provide explanations. Furthermore teachers' expectations of the group might be disproportionately low. Middle-attaining students in heterogeneous groups can also miss out on the opportunity to give and to receive

Teaching students in flexible, balanced, carefully structured small groups can raise attainment, improve attitudes and lead to higher self-concept.

explanations, as higher attainers might dominate. If the teacher insists that all students, including middle-attainers, get the opportunity to give and receive explanations this effect should disappear.

There is some evidence that in co-educational schools, it is better for small groups to be balanced for gender than to be unbalanced, to prevent the minority gender being dominated by the majority (Gillies & Haynes, 2011).

Gillies and Haynes also note that teachers need explicitly to teach students how to communicate in groups in order to make the most of these learning experiences. They suggest that students learn both from the communicative behaviour modelled by teachers and through their teachers identifying specific types of thinking that they want students to develop. They conclude that it is not enough just to provide opportunities for cooperative learning, but that teachers also need to use strategies designed to improve higher-level thinking and learning. Kutnick et al. (2006) found that teachers expected students to pick up group work skills by trial and error and that little formal training was either available or considered worthwhile.

Kutnick et al. (2006) observed grouping practices in 24 primary and secondary schools and interviewed teachers and students. They found that at Key Stage 3 within-class grouping strategies varied according to students' prior attainment level and the overall attainment range in the classroom. In particular they found that students who had been identified as low ability had fewer opportunities to work in groups with their peers and were more likely to work one-to-one with an adult, limiting opportunities for social development. Within-class grouping decisions were often constrained by the size and layout of classrooms, rather than by pedagogy. Kutnick and colleagues found that teachers tended to make their grouping decisions based on habit or necessity, rather than strategically to support the learning that would take place in the lesson. Blatchford, Kutnick, Baines, and Galton (2003) suggest that students and teachers reflect on practices:

'All lessons that involve group-work should include briefing and debriefing to enhance reflection and help develop skills. The aim is to help students, as much as teachers, become meta-cognitively wise about group working.' (p.168).

Much of the research into within-class grouping has focused on collaborative or cooperative learning. Galton, Steward, Hargreaves, Page, and Pell (2009) points out that one of the key aims of group work in the classroom is to increase the level of talk between students. While it goes beyond the scope of the intervention to explore strategies for group learning in detail, there follows a summary of some of the things that make collaboration or cooperation more successful.

Galton et al. (2009) distinguish between collaborative groups where students are socially interdependent and work together on a shared task, cooperative groups where students make independent contributions within their groups towards a shared goal and seated groups where students work independently but help each other through checking and comparing their work.

In the meta-analysis already cited above, Lou et al. (1996) found that small groups learn best together when they learn cooperatively and share responsibility for outcomes, i.e. are assessed together for their learning. They point out that teachers need to adapt their lessons for group work and for individuals' needs and that teaching of small groups improves with training and experience. They suggest that tasks need to be designed so that students have positive interdependence and individual accountability.

Positive interdependence means that all the students in the group rely on each other for achieving their individual goals, each have a personal responsibility to the task and all need to interact with each other in order to achieve the desired outcome. Individual accountability means that when students work together, they will be held accountable both for their own outcomes and for the outcomes of the others in their group. Some activities that might enhance group work include class- and team-building activities, training in interpersonal and cognitive skills, opportunities to evaluate and reflect on work and drawing on specific methods for group work, such as carousels.

Slavin (1996) reviewed a range of perspectives on cooperative learning. Group work outcomes can be enhanced by offering students group rewards for high individual achievement for all group members. The key here is to ensure that each student within the group must make a personal contribution, e.g. the measure of success might be the average of group members' individual scores on a test. In situations where there is just one product, e.g. a single poster or worksheet, then only one or two students need contribute and the rest can free-load. Slavin found a effect size of +0.32 (equivalent to an additional four months progress, Higgins, 2012) for studies where groups were rewarded for a goal to which all members contributed, compared with +0.07 (approximately one month's additional progress) for studies where there was a reward for a single group product or no reward.

A related perspective is that students working in groups will be motivated by their group cohesiveness:

> **'Students will help one another learn because they care about one another and want one another to succeed.'** (Slavin, 1996, p.46)

Evidence for this perspective is inconsistent, with an approach called 'Group Investigation' the best-supported. In this approach, the class is divided into groups, which each take on one topic. Within each group the topics are divided into tasks. Students thus investigate the topic, helping each other within their groups and then report their learning back to the whole class (Sharan & Sharan, 1989). The Group Investigation approach combines social cohesion with group rewards, which could (suggests Slavin) be the reason for its success. Other approaches that depend on team building and group work alone do not show any benefit.

In contrast to these social approaches, Slavin reviews other theorists who have suggested that the advantage of group work lies in the cognitive processes involved in working with others. One such approach is that of *cognitive elaboration*. A significant body of laboratory research supports elaboration and explanation of material as key mechanisms in learning and remembering (Wittrock, 1986, cited in Slavin, 1996). Slavin cites a range of evidence from peer tutoring (Devin-Sheehan et al., 1976), pair work (e.g. Dansereau, 1988) and other cooperative activities (Webb, 1989, 1992), indicating that students benefit from receiving elaborated explanations from peers, but that benefits are even greater for those who offer the explanations.

SUMMARY

Flexible within-class grouping is preferred to rigid ability-based grouping strategies as it is not detrimental to lower-attaining or disadvantaged students.
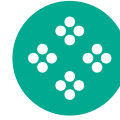
There is some evidence that teaching students in small groups can raise attainment, improve attitudes and lead to higher self-concept.

Groups should be no larger than four students and (in co-educational contexts) should be balanced for gender. Precise size and composition should depend on the learning task. Pair work is often a convenient and effective approach.

Social relationships as well as prior attainment need to be taken into consideration when forming groups.

Students need training in group work skills in order to make the most of the learning opportunities. Meta-cognition (reflection on learning) can help with improving group work skills.

Groups and group work tasks should be planned carefully to meet learning needs.

Group achievements are greatest when students are interdependent and accountable to one another.

Elaboration and explanation aids learning. All students should have the opportunity to be explainers as well as to receive explanations.

ACTIVITIES

Activity 1
What approaches to grouping do you use in your classroom? Do you ever use flexible grouping? What changes would you need to make in order to start using flexible grouping?

Activity 2
You are setting up a task where students will work in groups to gather background information about a new topic. Discuss the advantages and disadvantages of each of the following approaches to allocating students to groups:

a similar prior attainment

b mixed prior attainment

c carefully chosen groups where you believe students will get on with each other and work well together

d randomly chosen groups

Activity 3
Making use of the review of evidence above, each plan and teach a lesson involving group work. You could observe each other or video your lessons.
Reflect on your lessons together, focusing on the group-based learning.

a To what extent did the students meet their learning objectives?

b Reflect on how group work affected the learning of individuals. Who was helped most by group work? Who struggled? Why?

c How will you support group work in future to build on what you have learned from this lesson? What if any new policies and practices will you need?

Differentiation

'Differentiation is a philosophy of education which recognises that pupils learn differently, that is, at different speeds but also qualitatively differently.' (Coffey, 2011, p.197)

EVIDENCE BASE

Differentiation is often seen as an essential component of good teaching practice and yet there is no single clear definition of differentiation nor a universally shared understanding of what it looks like in practice (Hart, 1996).

In the 1970s, classes were typically mixed ability but teaching was usually directed at the whole class and pitched at or below the class average. This led HMI to make observations such as the following, cited in Hart (1996, p.11):

'It was surprising to find that in a large number of cases mixed ability classes were taught as though they were homogeneous groups. The work was usually pitched at a level though appropriate for the majority of the class, and inevitably this was unsuitable for pupils at each end of the spectrum. Sometimes, the level aimed at was below what the average pupil could attain, and the result was a slow pace, undemanding work and general underachievement.' (DES, 1978, p.49)

Observations such as this led to the journey towards what today is called differentiation. Hart (1992) expressed reservations about some traditional approaches, which have treated children as the problem and sought to differentiate between children, rather than finding ways to make the common curriculum accessible to all. Following this through, Hart (1996) describes how differentiation has often been a source of inequality rather than the solution to it. Getting differentiation right is pivotal to a fair system where all children are able to succeed.

While differentiation is a particular challenge for classes with a broad mix of attainment, there is an oft-repeated saying that 'every class is a mixed-ability class' and even within supposedly homogeneous 'ability' sets there will be a range of prior attainment.

In this section, we will review some of the research that has been conducted into differentiation and related practices and consider how the available evidence connects with some of

Getting differentiation right is pivotal to a fair system where all children are able to succeed.

the other principles of the Best Practice in Mixed-Attainment Grouping intervention.

Carol Tomlinson has written extensively about a model of differentiation she calls Differentiated Instruction (DI). Tomlinson (1995) proposes that DI is achieved through varying:

- Content: the information that students need to learn or the way that they will access it.

- Processes: the classroom activities that students engage in during learning.

- Products: the outputs that demonstrate learning.

She recommends that these are varied according to:

- Readiness: by offering tasks at different levels of difficulty.

- Interests: connecting learning with areas of interest to students.

- Learning profile: this includes students' individual profiles of strengths and weakness, including learning preferences.

Versions of this approach proliferate in books and on the internet. However, a review of the evidence by Subban (2006) found that the theory lacked empirical support. Although many papers have been published, there have been no systematic investigations of the effectiveness of DI as an approach. Subban could not find any rigorous published, peer-reviewed evidence supporting DI. Also Tomlinson's approach depends heavily on concepts such as learning styles and multiple intelligences, which have been largely discredited.[9]

An alternative approach is individualised instruction, where each learner pursues his or her own learning tasks relatively independently in the classroom. Teachers are required to manage a diverse range of tasks simultaneously. This highly individualised approach has not been shown to be beneficial, perhaps because teachers end up focused on managing the classroom rather than providing students with meaningful formative feedback (EEF, 2015a). Coffey (2011) points out that individualised instruction also undermines students' classroom social relationships, which are seen as a benefit of mixed attainment grouping.

There are many resources written by and for practitioners that discuss differentiation of curriculum, resources, task, classroom organisation, support, response and outcome.[10] Such resources should be treated cautiously as they vary in the solidity of their foundations in research evidence. However some tentative conclusions can be reached by evaluating resources using evidence from the wider research into grouping and mixed-attainment teaching.

We know from research into setting by ability that where students are separated by prior attainment, those in lower sets have often ended up following an impoverished curriculum[11] or with low expectations made of them.[12] Research into within-class grouping reveals that inflexible grouping can reinforce notions of fixed ability and limited potential (Higgins et al., 2014). Teachers must be careful to maintain high expectations for all and equality of access to the curriculum when differentiating for students with a range of prior attainment. There is evidence that where the curriculum is limited for lower-attaining learners, this restricts future attainment because they may have missed out on key topics that prevent them from re-joining students working at higher levels (Dunne et al., 2007).

Differentiation by resource and by task can lead to a similar effect. When resources and tasks are differentiated for lower-attaining learners it can be the case that the nature and meaning of the task changes dramatically (McNamara &

Moreton, 1997). However, it is important that learning activities are pitched at the right level for each student (Coffey, 2011). This should be slightly above the level at which they are working at the start of the lesson and requires teachers to have a solid understanding of where their students are starting from (see Hattie (2012) and material on assessment for learning below). Teachers might devise core and optional activities, with the expectation that all students will complete the core learning and higher attainers the more stretching extension tasks (Coffey, 2011). With reference to lower attainers in particular, McNamara and Moreton (1997) warn that differentiation by task can create dependency of students on the teacher as they are unable to access the curriculum independently.

Extension tasks can seek to stretch the highest attainers through increasing breadth, depth or pace (National Strategies, 2010). Increasing breadth can provide students with the opportunity to make cross-curricular links, or even connections with subject topics beyond the core curriculum. Increasing depth enables students to explore their current area of study in more detail. Pace in relation to extension activities usually relates to acceleration of learning – moving students further ahead in the programme of study. However, this can lead to a situation where there is effectively a differentiated curriculum, which is undesirable for the reasons outlined above.

Differentiation by classroom organisation has some empirical support from the literature on within-class grouping. Small-group learning has been shown to have some impact in raising attainment (Lou et al., 1996; Slavin, 1996). Where groupings are flexible and based on diagnostic assessment for a specific task this can be particularly helpful (Higgins et al., 2014, and see the section on within-class grouping, plus material on Assessment for Learning below). Students of all levels of prior attainment benefit from explaining their learning to others within small groups or pairs (Slavin, 1996).

9   Coe et al., 2014; Pashler, McDaniel, Rohrer, & Bjork, 2008

10   Cooper (2011); Dickinson and Wright (1993); McNamara and Moreton (1997)

11   Dunne et al., 2007; Ireson et al., 2005; Sukhnandan & Lee, 1999

12   Boaler, Wiliam, & Brown, 2000; Hallam & Ireson, 2005; Ireson et al., 2005

Small-group learning allows students to help one another – one form of differentiation by support. Teachers are also able to provide differentiated support to small groups of students (Lou et al., 1996). Where there are additional adults in the classroom the teacher can plan for deployment of all adults (including the class teacher) to provide appropriate support to students. However, investigations of the deployment of teaching assistants have indicated that lower-attaining students risk having little contact with highly trained and skilled teachers, instead spending time working one-to-one with less-qualified teaching assistants, who are less likely to be subject experts (Webster et al., 2010). Recent guidance on the role of teaching assistants recommends that they should not be used solely to support lower-attaining students; that they should supplement rather than replace high-quality classroom teaching from the qualified teacher; they should assist students in developing independence and self-regulation; and they should be trained and prepared appropriately for their day-to-day classroom role (Sharples, Webster, & Blatchford, 2015).

Differentiation by outcome is achieved when students across the prior attainment range are given the same open-ended and flexible task to complete, but will achieve different levels of outcome (Coffey, 2011). Some teachers choose to prescribe learning outcomes at different levels of attainment, by presenting them in the format:

- All students must…

- Most students should…

- Some students could…

However, there are risks inherent in this approach if teachers or students have a fixed conception of ability. For example, teachers might instruct the class that the 'some students could' objective is always and only for those students labelled as 'gifted and talented' or 'high ability' or who have achieved a certain level of prior attainment, such as a level 5 at Key Stage 2. This approach can result in a self-fulfilling prophecy (Merton, 1948) and potentially disadvantages lower-attaining students in particular. McNamara and Moreton (1997) express concern that differentiation by outcome can result in low achievement, because students might minimise effort. However some teachers prefer to model high quality work with students across the attainment range so that all students develop an understanding of the characteristics of the best work and see it as something to strive towards. Within this context, students have no limit to their potential attainment.

Differentiation by response (or feedback) is closely linked with Assessment for Learning (AfL) (Black & Wiliam, 1998a). AfL has at its centre high quality interactions between teachers and students and the development of a learning culture in the classroom. There are four key components of formative assessment for raising student achievement:

- Increasing the quantity and quality of classroom talk

- Offering meaningful feedback

- Sharing learning intentions and success criteria

- Peer- and self-assessment

These elements support differentiation through the tailoring of feedback to students' individual learning needs. Within the AfL context the teacher starts planning for learning with a sound understanding of what students already know, understand and can do (Hattie, 2012). This can be achieved through diagnostic assessments or through class discussion and is likely to reveal a range of prior attainment in the classroom. The teacher then plans learning tasks that are carefully chosen to enable students to think and develop their ideas. Learning tasks should promote classroom talk and provide opportunities to gain

> Formative assessment focuses on high quality interactions between teachers and students and the development of a learning culture in the classroom.

insights into student learning and what the next steps in learning will be (Hodgen & Wiliam, 2006). The richest tasks will provide opportunities for quality feedback to be given (Marshall & Wiliam, 2006). Differentiation by support (including through within-class grouping) and outcome will be included in planning. This will involve using strategies to involve all students in class discussions (see note below). A key element is that students must understand the learning intentions and success criteria, so that they can assess their own and their peers' work and identify the next steps needed in learning. Marshall and Wiliam (2006) stresses the need for students to engage with exemplar work in order to understand what work of a particular standard looks like. They compare this with the understanding and judgement that teachers develop through participating in standardisation meetings.

In a talk-rich classroom the bulk of feedback will be oral. Hodgen and Wiliam (2006) suggests that teachers should intervene judiciously, ensuring that their feedback is less frequent, but more thoughtful and more challenging. They also emphasise the importance of interpretive listening (Davis, 1997, cited in Hodgen & Wiliam, 2006) – listening to develop thinking rather than determine whether a response is right or wrong – in developing a culture of dialogue. However feedback is delivered students must have the opportunity to respond to it, for example through providing an opportunity at the start of the next lesson to respond to written feedback.[13] Hattie (2012) cites Kohn (2006): 'never mark students while they are still learning' (p.135) – summative marks should be avoided until a piece of work is complete. Marshall and Wiliam (2006) emphasise the importance of the drafting stage as vital for feedback.

Lastly, some strategies to support all learners to engage in dialogue in a mixed-attainment classroom (adapted from Hodgen & Wiliam, 2006):

- Allowing waiting time to elicit longer answers, responses from more students, dialogue between students and a greater range of responses.

- Providing students with opportunities to prepare oral responses by writing them down, discussing with a partner or rehearsing with the teacher.

- Presenting students' work to the class using a visualiser or camera and projector.

- Using 'no hands up' questioning.

- Allowing space for mistakes and partially developed ideas – students say what they don't understand, or suggest what they think (but don't know) might be the case; giving students the opportunity to discuss/disagree with correct answers.

- Interspersing whole class and small group discussion.

- Encouraging students to reflect on comments, identify their own errors and discuss their work with peers.

- Self- and peer-assessment strategies.

_____

13 Black, Harrison, Lee, Marshall, & Wiliam, 2003; Hattie & Timperley, 2007
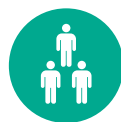
SUMMARY

Every group is a mixed-attainment group – the key is to know students well, avoid labelling them and diagnose their prior attainment accurately in order to apply differentiation flexibly.
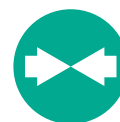
Feedback in the context of assessment for learning is a powerful vehicle for differentiation.

Students can support one another in the classroom through peer assessment and feedback and small group and pair learning.

Differentiation by outcome can be highly effective when high-level work is modelled, and when rich tasks and quality feedback are offered.

Lower-attaining learners are disadvantaged when they experience a reduced curriculum, low expectations, over-simplified tasks or when they have less access to a qualified teacher or to their peers.

Differentiation

ACTIVITIES

Activity 1

How can you use questioning to differentiate?

Activity 2

Make a list of all the different strategies for differentiation that you can think of. Which have you used successfully in the past? Which might you try in the future?

Activity 3

With a colleague, plan and teach a lesson using a differentiation strategy you haven't tried before (or have used only rarely). You might like to observe each other or video your lessons. Reflect on your lessons together, focusing on the differentiation.

a To what extent did the students meet their learning objectives?

b Reflect on how differentiation affected the learning of individuals. Who was helped most? Who struggled? Why?

c How will you use differentiation in future to build on what you have learned from this lesson? What if any new policies and practices will you need?

Section 2
Exemplar lessons

Explanatory note

These exemplar lessons are intended to illustrate ways in which teachers can implement the principles of mixed-attainment teaching in English and mathematics.

The exemplar lessons have been developed by a group of teachers working with the Best Practice in Grouping Students team.

The lessons are designed to enable students to collaborate and challenge each other, to provide opportunities for all students to engage deeply with the task and to enable differentiation by outcome.

The lessons have a common structure, but reflect some differences between the two subjects:

- It is likely that many English departments will need to adapt the lessons to fit the texts in their scheme of work.

- The mathematics lessons include a progression chart to show ways in which a common starting point can provide high expectations for all students.

The lessons are designed to provide appropriate challenges for both Year 7 and Year 8 classes. They are intended to prompt you to think about mixed-attainment teaching and not as 'perfect' lessons. Please adapt and improve them.

The resources referred to, as well as examples of student work and further lesson exemplars and materials, are available on the project website: **kcl.ac.uk/groupingstudents**

ACTIVITIES

Activity 1
Ask all your department colleagues to teach a lesson to a mixed-attainment class, then meet as a group to reflect on the teaching and learning.

a What went well?

b What challenges did you encounter?

Activity 2
In pairs, colleagues could observe each other's lessons with a particular focus on one of the key principles: growth mindset, high expectations, within-class grouping or differentiation.

Activity 3
Having taught a lesson, consider ways in which the lesson could be improved or adapted.

a In what ways can you group the students to encourage discussion between all students?

b What different questions would you ask to challenge students?

Activity 4
You could devote several staff meetings to developing additional lessons for mixed-attainment classes.

Activity 5
It can be helpful for English and mathematics teachers to meet to discuss the similarities and differences in mixed-attainment teaching in the two subjects.

English exemplar 1

Developing reading skills

Example to demonstrate how mixed-attainment teaching principles can be used to support successful development of students' key reading skills.

Aims

- Show understanding of what has been read.

- Select appropriate evidence to support ideas about the text.

- Evaluate and explore the writer's intentions.

Activity description

In most English lessons, key skills are developed over a sequence of lessons rather than in a single isolated lesson. This activity aims to develop students' reading skills over the course of three lessons each lasting one hour, focusing on the following common generic KS3 and KS4 reading assessment areas:

- Showing an understanding of what has been read

- Selecting appropriate evidence to support ideas about the text

- Evaluating and exploring the writer's intentions.

Many teachers already frequently use the guide frame of P.E.E.L. (Point/Evidence/Explanation/Link to writer's intentions) – or something similar – to support students in developing these key reading skills. This exemplar will aim to show how core tools for good practice in mixed-attainment teaching can offer further support to ensure that students at all levels make the best progress.

Mixed-attainment principles

The lesson sequence includes the following mixed-attainment practices: placing students in randomly-selected groups; using collaborative group work; making learning aims and success criteria clear and explicit from the outset; breaking the task down into clear, colour-coded component parts; modelling to provide support through clear exemplification; independently repeating a task done collaboratively; self-assessment; feeding back of teacher to students through individualised written targets; giving appropriately-pitched targets for improvement (around clearly understood success criteria); allowing time to address targets during the lesson; providing additional individual oral feedback from the class teacher; giving assessment in skill terms (no grades/levels).
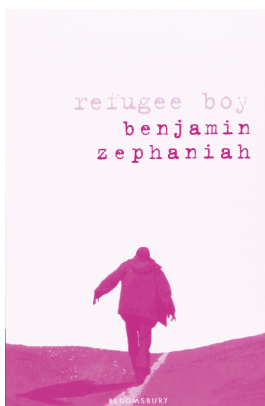
Time

Sequence of several lessons.

Resources

The following can be downloaded from the project website: **kcl.ac.uk/groupingstudents**

- Paragraph frame

- Teacher assessment tool

refugee boy
benjamin zephaniah

BLOOMSBURY

TEACHER GUIDANCE

The aim of this activity is for students to demonstrate understanding of what has been read by selecting and presenting appropriate evidence from the text.

Support

After reading the first 12 chapters of the novel, the teacher separates students into randomly-generated groups of four and asks groups to discuss how they felt about the main character of the novel at this point. Each group shares their ideas with the whole class.

Random selection of groups makes it clear to students that there are no limiting teacher pre-conceptions about their possible attainment (methods for doing this may include grouping students in height order or allocating scrabble letters). Regular and overt random grouping helps to accentuate the key message that all have the potential to succeed and cultivates a 'can-do' attitude in learners.

Generating initial ideas by getting students to engage on a personal level; 'How do you feel?' allows students at all attainment levels to access the task.

Small group discussion of the learning question at the first phase of the task means that all students can develop a confident viewpoint before open questioning begins.

A colour-coded paragraph frame (see resources) is given to all students to support writing. Working together from the confident position of having identified how they feel, students move to the second phase which asks them to locate the evidence from the text that has made them feel like this and express this in writing, using the colour-coded paragraph frame (**Reflection/Analysis**).

Having done this, they move on to the question asking them to explain why it made them feel like this (**Synthesising/Making Inferences**).

Then to the final phase where they work together to explore ideas about what the writer's message was in making the reader feel like this (**Reflection/Evaluation**).

Using the colour-coded frame to guide all students through the separate stages of this process allows all students to visualise and access these increasingly sophisticated skills in a logical, step-by-step way.

Working in a collaborative group allows less confident students the support they need to complete this model paragraph. The more confident students gain a fuller understanding of the process by supporting their peers through the task.

Next, working independently, students select another 'feeling' from the initial discussion to form their POINT for a second paragraph and use their group's model to guide them through the writing process. If they wish they can colour-code their work in the same colours used in the frame.

The move from group to independent work means that students who may need it have a model to refer to when working on their own.

Use of colours allows students to see the separate phases of the task and to link back to the correct area of the model for clear guidance. Some students choose to use these colours themselves when doing this task.

Feedback/next steps

Having looked at the individually written paragraphs, the teacher uses a simple assessment tool which identifies areas each student should target.

Samples of student work are selected for whole group assessment against the success criteria. These need to reflect a range of attainment levels and can be scanned or copied to allow for anonymity. These are displayed to students who, guided by the teacher, decide what each does well and what could improve each.

Students then look over their work and reflect upon their own success, writing comments using the well-known acronyms What Went Well (WWW) and Even Better If (EBI).

Encouragement to aim higher can come from the teacher creating an aspirational paragraph demonstrating top level skills. This can be given to students, who may wish to annotate it as the teacher talks through the exemplified skills.

Feedback for progression

Examples of student work, illustrating the formative assessment process, can be found on the project website.

Developing reading skills

English exemplar 2

Developing character knowledge

This lesson represents a generic approach to beginning any text where there are multiple characters.

Ultimately, the assessment aims might be focused on language analysis or an evaluative look at characterisation and writer's intentions.

Aims
To acquire initial impressions about different characters that will enable students to access the more complex demands of a reading text, over the course of a unit.

Activity description
In completely randomised groups of four, students work collaboratively to:

- Gather information and make inferences about the characters in 'Romeo and Juliet'.
- Access knowledge through reading character summary cards.
- Apply knowledge by completing blank character sheet.
- Listen and process group feedback and reflect on own work.
- Analyse own work and make additions and amendments where necessary.

Collaboratively students read and process a range of character quotes. They:

- Synthesise all learning about the characters.
- Use this to infer which character is most likely to say each quote.

Potentially in a further lesson, the activity could proceed with whole group feedback, where individual students justify inferences made. They reflect on their own inferences and evaluate the processes used to make inferences.

Mixed-attainment principles
The lesson is designed with all attainment in mind – no pre-determining of how students may/ may not access the task. All stages of learning are developed during the lesson, from understanding and comprehension, to synthesis and evaluation. Effective use of modelling to support all students to access the learning is essential. Consistent use of collaborative work, in all stages of the lesson, also supports student learning.

Time
1 hour, with potential to develop into an additional lesson (see Extension).

Resources
The following can be downloaded from the project website: **kcl.ac.uk/groupingstudents**

- Character summary cards
- Blank character information gathering sheet
- Character quotation sheet

Materials adapted from **collaborativelearning.org**

New Penguin Shakespeare

Romeo and Juliet

TEACHER GUIDANCE

To acquire initial impressions about different characters that will enable students to access the more complex demands of a reading text, over the course of a unit.

Support

Organise students into random groups of four (e.g. height order, birthdays, favourite colours, scrabble letters, raffle tickets).

Distribute character names – two characters per student (they are then responsible for gathering information on those characters).

When a character name is called e.g. Tybalt, students with this character card run up to the teacher's desk and read information sheet (timed – 1 minute).

Students return to their group and add notes about character to sheet, from memory. Repeat this until all characters have been covered. **[Teacher prompt: 'Talk through what you remember and let your group help you shape your notes and ideas.']**

In turn, the teacher elicits feedback on each character (whole class discussion – one example for each character). There is an element of competition, in that bonus points are available for students who can identify and share additional information, not covered by initial speaker. **[Teacher prompt: 'What new information are you hearing?']**

Students reflect on their group's notes, in light of whole class feedback, and add any missing/ additional information to their sheets. **[Teacher prompt whilst circulating: 'I have seen that group X have added three new points, can you think of anything you may have missed?']**

Groups are then given a sheet of unattributed quotations from the play, from the characters already explored. They are to read the quotes, explore the language and then discuss and decide upon which character they feel says each quote. The teacher models by selecting one quote from the sheet, prior to starting the task, and uses a range of strategies to identify the character e.g. identifying the pronouns, verbs or themes in the quote (love, conflict).

Possible extension

Use this activity as the starting point for exploring how Shakespeare uses to language to develop character and provide clues about character and their ideas and intentions. (See additional resource sheet 'Getting to know characters' which requires students to analyse and explore the language used by and about characters.)

Feedback/next steps

Feedback on the quotations and group inferences – this is when students will justify and reflect upon their reasoning in the above task. The teacher will follow with deep questioning to provide appropriate challenge to student response.

During the activity

The teacher ensures that any member of a group can be chosen to report back, so that all need to participate. Plenty of time is provided for discussion in this activity in order that students can develop their ideas. The teacher welcomes all opinions, but helps students explore whether some show better understanding than others. Questions can be used to extend students' thinking and the teacher should respond flexibly with tailored feedback to individual students and groups according to their demonstrated need.

Questions and prompts

- Why did you think Romeo said that?

- Is there anything about the language that gave you this clue?

- Could you have identified a theme to help you make your inference?

- What difference would it have made if the quote had included a different (pronoun/verb)?

- How could you have approached this task differently?

- Could you predict how (character name) would feel about this?

Progression and feedback

Examples of student work can be found on the project website.

Developing character knowledge

English exemplar 3

Writing to advise

Students investigate how to write for a specific purpose. In this instance, students produce a letter to advise.

The play 'Dracula' by David Calcutt and in particular the character Jonathan are used as a stimulus for this task.

Aims

- To understand how to write in a specific style and tone

- To apply this to your own writing.

Activity description

- Students work together to recap knowledge and generate ideas.

- Students examine a model example.

- Students use ideas developed in the first part of the lesson to produce their own piece of writing.

- Self-reflection and peer-assessment are used to identify next steps.

Mixed-attainment principles

This lesson is designed so that students can support each other in collaborative groups to share their prior learning and develop their understanding of the conventions of a particular style of writing. Differentiation by outcome and by resource are used. High expectations are modelled through showing a high quality exemplar piece of work. No limitations are set on any student's potential achievement.
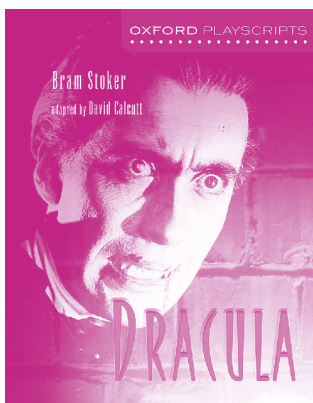
Time

1 hour, plus homework.

Resources

The following can be downloaded from the project website: **kcl.ac.uk/groupingstudents**

- Model letter

- Sentence starters (differentiated resource for students who need support)

- Progress reflection grid

TEACHER GUIDANCE

The aim of this lesson is for students to learn the conventions of a particular style of writing, then to apply this in their own work.

Support

Students work in mixed-attainment partnerships or threes to recap knowledge of the text. Students create a mind map outlining the character's problems (in this instance, Jonathan's problems). The teacher to circulate classroom, correcting factual errors and helping students explore whether some opinions show better understanding than others.

Feedback as a class and create a class mind map. Students add ideas to their own mind maps after the class discussion.

Students work collaboratively in their groups to explore ideas of what advice they could give to help Jonathan with his problems. Again, they produce a mind map and feed back to the class. The teacher circulates classroom and questions asks for explanations for suggestions.

The teacher uses random name generator here to choose students to offer class feedback, so that any member of the class can be called upon and not just volunteers.

The teacher poses question: How would you give Jonathan this advice? Give students time to think-pair-share. Teacher selects students randomly to give feedback. Make a 'class list' on the board – this will be the conventions of writing to advise and therefore students are involved in developing the success criteria for the lesson. The success criteria are shared clearly on the board so that students understand what they are aiming to achieve.

Show students a model of the start of the letter. Students label the conventions of writing to advise on a copy of a model letter. Students are able to support each other and discuss the material in their mixed attainment groupings.

Students write their own letter to Jonathan, following the conventions of writing to advise. The teacher gives out the sheet with sentence starters (see resources) to support those with low prior attainment, as assessed earlier in the lesson or in previous lessons.

Students read each other's letters and give feedback – they should imagine they are Jonathan and write down what they would think after reading this letter. They should then give 'what went well/even better if' comments based on the 'conventions of writing to advise/success criteria' displayed on the board.

Feedback/next steps

Students could use the Progress Reflection Table to assess their learning at the end of the lesson. Students should give themselves a mark out of 4 in the first box to assess how far they have accomplished each skill.

For homework, or in the next lesson, students could redraft/develop their letter based on their feedback. It would be useful for the teacher to have checked the relevance/accuracy of student feedback.

The teacher then gives feedback and fills in the second column of the Progress Reflection Table.

During the activity

The teacher circulates and listens to group discussions. Factual inaccuracy is corrected, but the focus of feedback from the teacher is on asking open-ended questions and prompting for understanding.

Questions and prompts

- What advice would you give Jonathan?

- How would Jonathan feel after hearing this advice?

- Could Jonathan do anything different in this situation?

- What are the advantages or disadvantages of that idea?

- What might happen if Jonathan did not follow that advice?

Writing to advise

PROGRESSION SELF-ASSESSMENT GRID

Skill	Launching		Developing		Progressing		Mastering	
1 How well can I use appropriate language in my writing, for example the use of modal verbs?								
2 How confidently can I adapt the tone of my writing to make it suitable for different purposes?								
3 How accurately can I structure a letter?								
4 How well can I use feedback to develop my writing?								

Maths exemplar 1

Fractions

Students work in pairs/small groups to develop a range of strategies for comparing fractions. Communicating how the fractions have been classified, and why, is an essential part of the task.

Aims

- To investigate different approaches for comparing fractions.
- To develop reasoning to support strategies used.

Activity description

Students classify fractions into less than half, equal to half and more than half.

Mixed-attainment principles

This lesson is designed to provide challenge across a wide range of attainment. All the students should work from a common starting point and differentiation is achieved by outcome

Time

Up to 2 hours.

Resources

- Mini-whiteboards
- Squared paper
- Empty number lines and diagrams

Classify the following fractions into less than, equal to or more than half

$$\frac{3}{6} \qquad \frac{4}{5} \qquad \frac{3}{7} \qquad \frac{6}{8} \qquad \frac{4}{8} \qquad \frac{4}{10} \qquad \frac{2}{9} \qquad \frac{5}{11} \qquad \frac{7}{14} \qquad \frac{3}{9}$$

Less than half	Equal to half	More than half

TEACHER GUIDANCE

On first use of the activity choose a subset of the 10 fractions (some with the same denominator, one equivalent to a half and some with different denominators) to present to students, asking them to decide how to classify the fractions as equal to, less than and more than a half. It may be beneficial to allow students time to think about the fractions individually, before sharing their ideas in pairs/ small groups.

Support

Although the fractions can be compared in any way to make judgements about less than or more than a half, using diagrams and number lines can help to prevent the task becoming overly complicated. Providing pre-prepared diagrams for students to use may be helpful, although students may also benefit from the chance to produce their own diagrams as they work on the task.

Students who are struggling to get started with the list of fractions provided may be able to offer a fraction of their own:

> **Q** Give me a fraction that is not in the list. Do you know which column it goes in in the table?

They may also find it helpful to order fractions:

> **Q** Can you compare these two fractions? Where would this third fraction fit?

Encourage students to explain to each other how they are classifying the fractions. You may want to invite a student/group of students to show their working on the board, justifying their working to the rest of the class with reasoning. Ask the class to comment on the explanations given:

> **Q** What things are other students doing that you find useful? E.g. an appropriate diagram, common denominator etc.

Encourage students to generalise their results as they complete the table.

Possible extension

Find a fraction halfway between these two fractions. Can you find more fractions between these two fractions?

Next steps

Compare a fraction to a whole: Which of these fractions is nearer to 1, $\frac{5}{8}$ or $\frac{8}{5}$?

Which is bigger $\frac{x}{2}$ or $\frac{(x+3)}{5}$? Is your answer always true? How might it change?

During the activity

A common misconception when comparing fractions is for students to ignore the numerators.

For example: $\frac{3}{7} > \frac{6}{8}$ because sevenths are greater than eighths (resulting in $\frac{3}{7}$ being classified as more than a half as $\frac{6}{8}$ is greater than $\frac{4}{8}$ which is equal to a half).

Or compare the numerators and denominators independently: e.g. $\frac{5}{11} > \frac{3}{6}$ because $5 > 3$ and $11 > 6$.

Whilst students work there is opportunity to provide prompts that enable students working at different levels to move forward, as well as identifying and addressing these common misconceptions.

Questions and prompts

When students are working with the fractions it is important not to provide them with a strategy for sorting/ordering them. The activity is well suited to formative assessment, enabling students to discuss their understanding and decide how to move forward. Encourage students to use a range of strategies for comparing and classifying the fractions, building on their existing knowledge.

Ask questions about the students' strategies, such as:

- How might you express this fraction in words?

- Could you express it in any other way?

- Could you make a drawing to represent it?

- What is the 'same' and what is 'different' for these fractions?

Encourage students to explain their reasoning both to you and each other:

- How do you know if one fraction is bigger than the other?

- Which notation can you use to compare fractions?

- What is a good strategy for ordering a list of fractions?

- Can you convince a friend/someone who disagrees that you are correct in your conjecture?

PLANNING FOR PROGRESSION

The table is designed to plan for a range of outcomes. It will also help support differentiated formative feedback. Examples of student work are available on the project website.

Representing Identification of mathematical aspects, choices about constraints and freedoms.	**Analysing** Logic of approach, identification and classification of fractions.	**Interpreting and Evaluating** Generalisations based on findings.	**Communicating and Reflecting** Discussion of results, effective communication.
Use diagrams to represent fractions as $\frac{1}{2}, 50\%, 0.5$ E.g. 0 1	Begin to sort some fractions equivalent to a half into correct column.	Make simple observations/ conjectures (not necessarily correct). E.g. The bigger the denominator the smaller the fraction.	Describe a strategy for ordering two fractions.
Represent fractions with numerator greater than 1. E.g. $\frac{3}{4}, \frac{5}{8}, \frac{4}{10}$	Compare fractions with the same denominator to classify fractions. E.g. Compare $\frac{5}{8}$ with $\frac{1}{8}$ to establish $\frac{5}{8}$ is more than half.	Offer conjectures with supporting examples.	Explain why two fractions are equivalent using visual representations.
Represent fractions with denominators that are neither multiples of 2 nor 5. E.g. $\frac{3}{7}$	Compare fractions with different denominators to classify fractions. E.g. $\frac{4}{5}$ and $\frac{1}{8}$	Uses counter-examples to disprove a conjecture. E.g. Difference between numerator/ denominator: $\frac{4}{5} > \frac{5}{9}$ as $7 - 4 < 9 - 5$. Counter example: $\frac{9}{10} \neq \frac{1}{2}$ even though $9 - 1 = 10 - 2 = 8$	Explain how a method for comparing two fractions can be generalised to compare *any* two fractions.
Change a given fraction to an equivalent fraction. E.g. $\frac{3}{7} = /$	Classify given fractions as being less than, more than or equal to a half.	Generalise about why a conjecture is valid or invalid. E.g. Interpret results for why the numerator/ denominator difference method breaks down.	Discuss how two methods for comparing fractions are similar/different.

Maths exemplar 2

Averages

Whilst applying their knowledge of averages, students describe possible data sets given information on the mode, median and mean.

Whilst applying their knowledge of averages, students describe possible data sets given information on the mode, median and mean. All students have the opportunity to reason, whether this be why a particular data set meets a given criteria or how they know they have found all the sets for which the averages are true.

Aims

- To deepen understanding of mean, median and mode.
- To develop strategies for finding all possible sets of numbers satisfying a given criteria.

Activity description

Students calculate the mean, median and mode for a data set, creating sets of positive whole numbers to match given averages.

Mixed-attainment principles

This lesson is designed to provide challenge across a wide range of attainment. All the students should work from a common starting point and differentiation is achieved by outcome.

Time

1 hour + subsequent lesson(s) to extend the task.

Resources

- Individual mini-whiteboards could be useful.
- Access to multilink cubes may provide a useful visual aid.
- You may want to display prompts on PowerPoint etc.

Give a set of five positive whole numbers with a mode of 3, median of 3 and mean of 4.

Can you find all the possible sets that satisfy these conditions?

Mode = 3

Median = 3

Mean = 4

TEACHER GUIDANCE

For most of this activity, students should work in pairs/small groups. You should encourage discussion. At points in the activity it may be helpful to ask the students to work individually.

Support

You may want to offer an initial task where students calculate the mean, median and mode of a given set of numbers, as an opportunity to assess prior knowledge or discuss definitions.

When working on the activity, students might find it helpful to focus on the given criteria separately, building up to finding a data set that satisfies all three conditions, for example:

Q Can you give a set of five positive whole numbers with a mode of 3?

Q Can you give a set of five positive whole numbers with a mean of 4?

Q Can you give a set of five positive whole numbers with a mode of 3 *and* a mean of 4?

Asking for several (or all of the) solutions to each question will help students to see that there are a number of possibilities even within these simplified cases.

Encourage students to describe out loud how they are creating their examples.

Excluding bimodal cases there are 11 possible sets of five positive whole numbers that satisfy all three conditions. Spending time prior to the lesson finding these sets will help you to give support to students as they work on the task.

We advise that you do not tell students the number of possible sets, to give them the opportunity to come up with a satisfying, convincing argument that all possibilities have been found.

Possible extension

When students have a convincing reason why they have all the sets, you may want to change the problem. E.g. what happens if there are six numbers?

Next steps

As well as extending the task, there are a number of related questions that could be posed:

- Can you find a set of conditions with only one possible solution?

- Choose values for the mean, median and mode. Which values provide a good challenge and which don't?

- Can you find a set where mean = median = mode = range? Can you describe all the sets?

Further extensions can also be found at **nrich.maths.org/11281** and **donsteward.blogspot.co.uk/2012/02/small-data-set-problems.html**

Averages

Averages

During the activity

Encourage students to articulate their strategies.

- How have you chosen these numbers?

- Are there any things you have noticed that will help you look for more sets?

As support, you may want to ask students to share useful strategies on a common board. These may include, for example:

- Write them in order

- Write them in order, putting 3 in the middle

- At least two 3s

- _ , 3, 3, _ , _ or _ , _ , 3, 3, _

- Must add up to 20

- Find all the sets with two 3s

- Find all the sets with three 3s

- Find all the sets with four 3s

Some students may come up with repeated solutions and should be encouraged to check for repeats, noticing this is an important step.

When working on the task, students may ask questions of whether zero is allowed or if bimodal sets such as {1, 1, 3, 3, 12} are allowed. These are good areas for discussion.

Access to multilink cubes may provide students with a concrete visual aid to get a sense of the different ways in which each average estimates the centre of the data. For example, students may use the cubes to model five positive integers with a mean of 4 (total: 20) before adapting this model to find data sets satisfying the given conditions for mean and median, or for mean and mode.

Questions and prompts

The following questions may be useful in working towards students providing a convincing argument that they have found all possible data sets satisfying the given conditions. These are based on John Mason's levels of thinking mathematically (Mason et al., 1982): convincing yourself, convincing a friend and convincing a sceptic:

- Can you convince yourself you have all sets?

- Can you convince someone who agrees with you that you have all sets?

- Can you convince someone who will ask the difficult questions that you have all sets? It may be helpful to reorder your solutions to make it more convincing.

PLANNING FOR PROGRESSION

The table is designed to plan for a range of outcomes. It will also help support differentiated formative feedback. Examples of student work are available on the project website.

Representing Choices about what to investigate and how to represent the information.	**Analysing** Logic of approach, accuracy of results.	**Interpreting and Evaluating** Identification of patterns and generalisations.	**Communicating and Reflecting** Quality of the descriptions of both methods and outcomes.
Create a set of numbers meeting one condition: More 3s than anything else $\{\_,\_,3,\_,\_\}$ Sum to 20	Find *an* average of a set of numbers. E.g. $\{5, 7, 2, 7, 3\}$	Use *a* strategy to find a set of numbers satisfying a given condition. E.g. Mostly 3s	Use a definition of mean, median, or mode to answer a question.
Generate a set of numbers meeting all three conditions about mean, median and mode. E.g. $\{3, 3, 3, 4, 7\}$	Find (all of) mean, median and mode of a set of numbers. E.g. $\{2, 5, 1, 7, 2\}$	Use a combination of strategies to find several results satisfying given conditions. E.g. Add up to 20 $\_, 3, 3, 3, \_$ etc.	Articulate why ordering the numbers within a set is a helpful method.
Find more than one set of numbers to meet the given conditions.	Generate a set of numbers given conditions about mean, median and mode. E.g. mode = 3, median = 3, mean = 4: $\{1, 3, 3, 3, 10\}$	Explain why some patterns cannot work. E.g. $\{\_,\_,3,3,3\}$ where the 1st and 2nd positions are less than 3.	Communicate strategies clearly and succinctly. Understand irregularities about averages, e.g.: Bimodal $\{1, 1, 3, 3, 12\}$ Median between two numbers.
Systematically change one number to find all possible sets: E.g. $\{2, 3, 3, 3, 9\}$ and $\{3, 3, 3, 3, 8\}$	Find all the sets systematically that satisfy given conditions.	Use strategies to be confident all possible solutions have been found, eliminating repeats.	Communicate a convincing argument that you have all sets that satisfy given conditions.

Averages

Maths exemplar 3

Expression cards

Whilst developing fluency and reasoning, students work informally on many key objectives for algebra.

Mixed-attainment groups can work at increasingly complex and sophisticated levels, with all students having opportunity to conjecture and generalise.

Aims

- To be confident with algebraic notation and substituting into expressions.
- To develop strategies for solving equations and inequalities.

Activity description

- Students order expressions for a given value of x, changing the value of x to make conjectures about the order.
- Students choose two expressions and find a value of x that makes them equal/one expression greater/less than the other.

Mixed-attainment principles

This lesson is designed to provide challenge across a wide range of attainment. All the students should work from a common starting point and differentiation is achieved by outcome.

Time

1 hour + subsequent lesson(s) to extend the task.

Resources

Each small group of students will need a set of cards, each showing an algebraic expression. (You could prepare specific cards based on prior learning/misconceptions or students could generate their own).

This lesson activity is based on the ideas of Prestage & Perks (2005), adapted from their work on algebra using *What's in the Bag?*

x	$x+2$	$x+5$	$2x$	$3x$	$-x$	$2x-1$	$2x+1$
$2x+3$	$2x-3$	$3x+2$	$3x+1$	$3x+3$	$3(x+3)$	$3(x+1)$	$2(x+1)$
$2x+2$	x^2	$2x^2$	$(2x)^2$	$5-x$	$10-x$	$7-x$	$8-x$
$x-8$	$x/2$	$1/x$	$x-4$	$x-1$	$5x$	$2(x+3)$	$2(x-1)$

Expression cards

TEACHER GUIDANCE

The aim of this activity is for students to work in pairs/small groups to develop ways to determine when algebraic expressions are equal.

Support

Give out a subset of the expression cards and ask students to order them for a particular value, say $x = 7$. Students will need to interpret formal notation e.g. $2x$ and x^2, including order of operations e.g. $2(x + 3)$ and $2x + 3$ as they substitute into algebraic expressions, providing an opportunity for formative assessment. Students should support each other in ordering the cards, helping each other to overcome any difficulties.

Once students have established an order, they can be encouraged to change the value of x to see the effect this has on the order. This creates lots of opportunity for substitution and you may choose to start with a very small subset of cards so students can begin conjecturing about the order sooner.

x	$x+2$	$x+5$	$2x$

A small set of cards like x, $x + 2$, $x + 5$, $2x$ can provoke interesting conjectures such as '$x + 5$ is always three more than $x + 2$' but also affords opportunities for questions about the possible position of $2x$:

1 Can you find a value of x that changes the order?

2 Can you find a value of x where $2x$ is in each of the numbered positions 1 to 4?

$\boxed{1}\ \boxed{x}\ \boxed{2}\ \boxed{x+2}\ \boxed{3}\ \boxed{x+5}\ \boxed{4}$
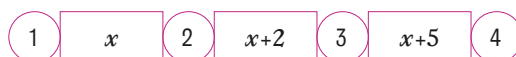
Students should be given the opportunity to share their conjectures about the order and whether any expressions have the same value. They may go on to select two cards and try to work out when each expression takes the same value.

Possible extension

As well as students having the opportunity to solve equations created from the expressions cards, the solution of inequalities can also be explored. For example, when is $3x + 2$ bigger than $2x + 3$? etc.

Feedback/next steps

Which is bigger $3x$ or $x + 3$? This is a good question to ask in order to assess students. You could set this for homework and have students present their argument or they could write their response on an 'exit card' (small piece of paper where they record their response and hand to you at the end). You can then use this to make decisions about tasks or groupings in the following lesson(s).

During the activity

Whilst students work there is opportunity to provide prompts that enable students working at different levels to move forward, as well as identifying and addressing common misconceptions. Students often use letters in algebra without understanding their meaning, believing that:

- a letter stands for one particular number
- letters can only stand for whole numbers

Such misconceptions often arise when students generalise from a restricted range of examples. This lesson builds on students' knowledge of substitution to reconsider such interpretations.

Questions and prompts

- How do you order the expressions?

- Is the order always the same?

- Can you find a set of expressions that always have the same order?

- When is this expression bigger/smaller than that expression? What does that tell you about how to make them the same?

- These expressions have the same value; is this always the case?

Algebraic expressions are a good context to practice arithmetic:

- What happens if the variable is negative, fractional, decimal?

An alternative way of presenting the problem could be to ask which expressions are always, sometimes or never the same:

- Are these two expressions always, never or sometimes the same? If they are sometimes the same, give examples of when the first is bigger, the second is bigger, they have equal value

- Can you find pairs of expressions that are always the same? What do they have in common? Can you predict other pairs that might be the same? Look for ways that students are being organised and systematic in their work e.g. $x = 1$, $x = 2$, $x = 3$, ...; using a table

- What different representations are useful? (tables of values?)

Graphs can be drawn to decide which of several expressions is biggest. Create a 'need' otherwise there's too much information:

- (Choose subset of cards) When is each expression the biggest?

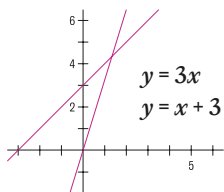- When is $3(x + 3)$ bigger/smaller/same as x^2 ?

One way mathematicians try to 'see' the relationship is to draw graphs, $y = 3(x + 3)$ and $y = x^2$.

- Choose x, what is y? Encourage students to be systematic when plotting points

- Where does it cross over? (from being smaller to bigger) i.e. where is it the same? Give the coordinate when they're the same (Support: axes pre-drawn to hand out, tables to fill in)

PLANNING FOR PROGRESSION

The table is designed to plan for a range of outcomes. It will also help support differentiated formative feedback. Examples of student work are available on the project website.

Representing Choices about what to investigate and how to represent the information	**Analysing** Logic of approach, accuracy of results	**Interpreting and Evaluating** Identification of patterns and generalisations	**Communicating and Reflecting** Quality of the descriptions of both methods and outcomes
Substitute values in for x and find value of expressions: $x = 7$ so $2x + 1 = 15$	Correct order of operations: $3x + 1$ $x \rightarrow x3 \rightarrow +1$	Substitute into expressions and order them from smallest to biggest.	Record ordered expressions in a way that shows thinking clearly.
Choose a value of x and try it with more complicated expressions: $x^2, (3x)^2, 3x^2$ or operations: $\dfrac{5x+7}{2}$ -1	Systematically pick values of x ($= 1, 2, 3, ...$) and notice patterns. Collect results in a table.	Offer conjectures with supporting examples: $x+2$ is always bigger than x. If x is odd, $x + 7$ is even. $2x$ is always even.	Communicate conjectures clearly and reference evidence.
Show two expressions can be equivalent for a specific value of x: $x + 8 = 2x + 3$ when $x = 5$	Consider integer and rational values using trial and improvement to narrow in on where two expressions are equal: $4x + 2$ and $14 - x$ are equal when x is between 2 and 3.	Conjecture about equivalent expressions: $3(x + 1)$ is always the same as $3x + 3$	Present a convincing argument that two expressions are equivalent or related in some way. Describe how they are finding when two expressions are equal.
Represent expressions on a graph and see key points: $y = 3x$ $y = x + 3$	Develop strategies to find values of x that make two expressions equal without using trial and improvement: $2x + 1 = 3x - 2$ $1 = x - 2$ $3 = x$	Conjecture that includes conditions: $2x^2$ is the largest expression when x is greater than 3 otherwise other expressions are larger.	Use graphical and/or tabular representations to describe boundary conditions: $3x > x + 3$ when $x > 1.5$ but $3x < x + 3$ when $x < 1.5$

Section 3
Appendices

Appendix A

Further reading and other resources

Best Practice in Grouping Students project website
http://www.kcl.ac.uk/groupingstudents

More training materials, teaching exemplars, samples of student work and further information relating to the Best Practice in Grouping Students project.

General

What Makes Great Teaching? Review of the Underpinning Research
Robert Coe, Cesare Aloisi, Steve Higgins & Lee Elliot Major
http://www.suttontrust.com/wp-content/uploads/2014/10/What-makes-great-teaching-FINAL-4.11.14.pdf

A review of over 200 pieces of research. The report identifies six aspects of teaching with the strongest evidence of raising attainment.

Education Endowment Foundation Teaching and Learning Toolkit
https://educationendowmentfoundation.org.uk/toolkit/toolkit-a-z/

Clearly presented, evidence-based guidance on raising the attainment of disadvantaged students.

Teacher Development Trust
http://tdtrust.org/

A teacher-led charity that aims to improve educational outcomes for children through high quality professional development for teachers.

Redefining Fair: How To Plan, Assess, And Grade For Excellence In Mixed-Ability Classrooms
Damian Cooper

A book presenting strategies for differentiation in mixed-attainment classrooms.

Mindset: How You Can Fulfil Your Potential
Carol Dweck

A readable introductory book about the concept of mindset and how to use it.

Visible Learning for Teachers: Maximizing Impact on Learning
John Hattie

An accessible book, summarising research into educational practices with high levels of impact on student learning.

The Expert Learner: Challenging the Myth of Ability
Gordon Stobart

A clear and enjoyable book, debunking the notion of 'ability.'

English

English and Media Centre

http://www.englishandmedia.co.uk

Independent educational charity supporting secondary and FE English and media studies teachers.

Let's Think in English

http://www.letsthinkinenglish.org/

A cognitive acceleration programme designed to help students develop reasoning skills vital for secondary English.

Teaching Shakespeare

Rex Gibson

A book recommended by our pilot schools as containing practical ideas for teaching Shakespeare to mixed-attainment groups.

English Inside the Black Box

Bethan Marshall and Dylan Wiliam

A guide to Assessment for Learning in the English classroom.

Maths

GAIM (Graded Assessment in Mathematics)

http://www.nationalstemcentre.org.uk/elibrary/collection/61/graded-assessment-in-mathematics-gaim

Teacher assessment scheme for secondary maths. GAIM encourages learning through problem solving and investigations.

Improving Learning in Mathematics

http://www.nationalstemcentre.org.uk/elibrary/collection/282/improving-learning-in-mathematics

Resources promoting an active learning approach to maths.

Mathematical Thinking with Lower-Attaining Pupils

Liz Woodham

http://www.atm.org.uk/write/MediaUploads/Journals/MT208/Non-Member/ATM-MT208-41-45.pdf

An article explaining how Nrich resources can be used with lower-attaining students.

Mathematics Inside the Black Box

Jeremy Hodgen and Dylan Wiliam

A guide to Assessment for Learning in the maths classroom.

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