Plenary – or just ponder?

Tom Francome and Colin Foster ask if a plenary is always necessary.

'Think-pair-share' (Lyman, 1981) continues to be a popular model for structuring mathematics classroom discourse. First, the teacher offers some kind of prompt or question for students to think about individually. Then, pairs of students discuss their ideas, comparing, clarifying, and questioning together. Finally, the teacher invites students to share their discussions with the whole class, often described as a plenary. This could either focus on 'the answer' or use a more open and possibly less-threatening, "What did your pair talk about?" kind of question. The pair discussion can also increase the confidence and subsequent participation of shyer students (Mundelsee & Jurkowski, 2021). The idea behind think-pair-share is that it scaffolds the contribution: the share is that much richer for the brief bit of silent thinking time and the opportunity to try out and refine thoughts with a peer before putting the ideas into the public forum. The pair discussion allows the teacher to eavesdrop on discussions and listen out for ideas that might be particularly valuable for wider hearing. This enables teachers to sequence potential contributions in an appropriate order, to enable a range of pupil voices to be heard contributing intelligently to the classroom discourse. In addition, the think and pair phases benefit from the accountability that anyone might subsequently be called on to share.

We like 'think-pair-share', and we often use it. However, we have been thinking about how sometimes tasks seem to work better as just a think, what we like to call a 'ponder' and sometimes as just a think-pair, with no share. Sometimes going all the way through to share seems to bring some disadvantages. We recognise that it may feel incomplete to ask a question and then not give at least some of the students a chance to share their thoughts with everyone. The teacher is likely to be curious what the students have been thinking and/or talking about, although, of course, the teacher can listen in on some of the pair-talk as they circulate. So, it can be very tempting to include some time for sharing; it is easy to assume that sharing is caring, and so sharing must be a positive thing. So why would we truncate the process before the sharing for any reason other than lack of time? But, we think there are sometimes good reasons for not sharing.

Whether it is beneficial or not to include share seems to us to depend on the purposes behind asking the question. For example, a possible question that might motivate some work on fractions could be: 'Which is bigger, $\frac{4}{7}$ or $\frac{5}{9}$?' We like this problem, because the two fractions are close and quite difficult to compare using basic intuition alone, so the question provokes a need to devise some kind of method. The question might be viewed as closed, since there is just one correct answer ($\frac{4}{7}$), but of course the intention is for students to offer several different ways of comparing the fractions and convincing others. So, the question behind the question, "In what ways might you compare the sizes of this pair of fractions – or any pair of fractions?", is certainly open. You might like to pause to consider different ways of responding, before reading on.

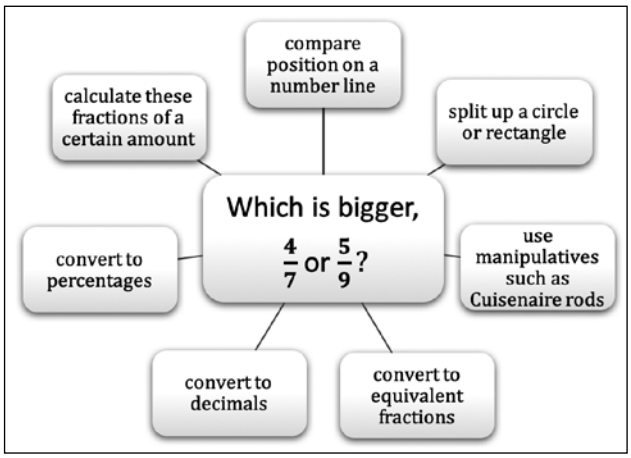

Figure 1. Possible ways to determine which of $\frac{4}{7}$ or $\frac{5}{9}$ is bigger.

If this question were being used in a context of revision, then the teacher might be able to assume that all the students would have previously met a range of relevant methods, and so they might choose to use the entirety of think-pair-share, to draw on and validate what students already know and explore connections among the different methods. They might collect suggestions of different methods on a shared board (see Figure 1) and encourage students to compare and contrast these. They might ask

questions such as:

- Which method do you find easiest/hardest to understand? Why?
- Which method do you find easiest/hardest/quickest to do? Why?
- How might this change if the pair of fractions to be compared were different?
- Can you devise a pair of fractions for which each method would be optimal?

However, if the scenario is not one of revision but of introducing these ideas for (possibly) the first time, we think that our use of think-pair-share would be different, and we might deliberately not share. If the students, to the best of our knowledge, have not previously been taught these methods, or only some of them have, or at least we are not assuming that they have, then allowing answers to this kind of question to be given publicly risks advantaging students who are already advantaged and further disadvantaging those who are not (the 'Matthew Effect', see Rigney, 2010). The student who happens to know something from somewhere other than this class gets to contribute it, while others, through no fault of theirs, do not. If this sort of thing happens repeatedly, we would be concerned that students would begin to assume roles of 'ones who know' and 'ones who don't know', the latter group feeling ignorant, and everyone embedding unhelpful stereotypes.

Sometimes, it is suggested that this is not a problem, and that the 'ones who know' can upskill the others by sharing their thoughts. However, we think this is not an optimal way to operate, and not just because of reinforcing unhelpful discourses of ability. Each of the methods in Figure 1 is something that we would want to teach every student, and so we would want to plan in some detail how we might introduce these ideas, through carefully chosen tasks and examples, and the order in which we would do so. If, instead, we allow these methods all to be introduced at once in one big class discussion, this could be quite overwhelming and some students' first exposure to these ideas will be a peer's attempt to explain a half-remembered/formed idea. As experienced teachers, we do not feel that our own off the cuff spontaneous explanations are generally of as high a standard as we would wish, so we are reluctant to allow students' hastily-constructed explanations to dominate, in the name of spontaneity. Instead of racing through all these ideas in one lively plenary, we would rather take them one at a time in a planned way, and we think this is fairer on students who tend to find mathematics hard or for whom English is an additional language. So, is there any point in having a share on this question if our response to each idea suggested is going to be to say that we will come back to it over the next few lessons?

So, if share is not always optimal, why bother with think and/or pair? In this scenario, we would still use a think, and possibly a pair as well. It is often assumed that the main purpose of questioning students is for the teacher to formatively assess them. However, we think that often the main benefit of questioning is frequently more for the learner. There is good evidence from cognitive science for the 'pretest effect' (Richland, Kornell, and Kao, 2009; Little and Bjork, 2016). This refers to students learning more after being tested, even when the questions cover material that they have not yet been taught and, consequently, get wrong, provided that the teaching that follows offers the answers. This is a surprising effect and contradicts the popular notion that, "You can't fatten a pig by weighing it". So, a think just by itself (without a pair or share) might prime students for what is to come and improve the learning that is about to take place, even if no one else hears the student's thoughts. Even if the student has no idea, this is not necessarily a bad thing at this stage. It might create a headache for which the aspirin, that is the subsequent teaching, is the perfect remedy (Meyer, 2015). Not every question needs to be answered immediately. It is OK to leave questions hanging, even beyond a single lesson (Foster, 2020).

However, an obvious risk with a standalone think is that it becomes merely a pause, and no thinking takes place, or at least not on the desired prompt. One solution to this could be to ask students to write down their answers, perhaps on mini-whiteboards, although not necessarily to hold up for others to see, or as formative assessment, but simply to focus their attention where we need it. Another possibility is to do think-pair and stop there, and this is a model we like a lot. Pair time can aid self-assessment; for example, students might recognise that equivalent fractions could be used, but not be able to select an appropriate common denominator. Or they might know what to do but cannot explain it. Explaining to a peer (or trying to) may bring in the 'self-explanation effect' (Bisra et al., 2018), and prompt students to generalise beyond the particular pair of fractions given and make conjectures and consider why they might be true. This could be more likely if prompted by a peer. But we think that none of this requires the

share phase, and that often classroom discourse can be more effective without that.

We recognise that sometimes think-pair-share is used at least partly to promote engagement and motivation and to break up the pace of a lesson, and just a silent think may not meet these objectives. However, many of these same benefits can often be obtained with just a think-pair, and this avoids allowing answers being aired that might spoil things for those who are not there yet, or make some students feel less adequate. And truncating before the share allows the teacher more control over how important ideas will be sequenced and introduced in the subsequent teaching. Classroom techniques that promote thinking and dialogue are critical for developing mathematicians. We think it is worth considering whether a ponder is sometimes preferable to a plenary.

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Tom Francome is a Senior Fellow in the Department of Mathematics Education at Loughborough University. T.J.Francome@lboro.ac.uk, @TFrancome

Colin Foster is a Reader in the Department of Mathematics Education at Loughborough University. c.foster@lboro.ac.uk, www.foster77.co.uk, @colinfoster77