Introduction

Suppose you were taught the game of soccer, but never put your skills to use in an actual game. In order to develop expertise in anything, we need to put our knowledge into practice. Playing a game of soccer develops a deeper understanding of our knowledge of the game and the ball-handling skills that we practised because we have to apply these knowledge and skills in messy, dynamic and unpredictable (non-routine) contexts. We have to adapt, combine, extend and even question our skills ‘in the moment’ of the game to respond to problems on the playing field that are new and not quite the same as those encountered in practice.

As we gain experience in these non-routine situations, not only do we have a better understanding of our skills and when to use them, but we gain confidence to apply them in unpredictable situations. We begin to recognise approaches that worked before in similar situations. It is the knowledge of the game, the basic skills we practise and the non-routine experiences of applying our knowledge and skills that together develop our expertise of the game.

21st century skills

Preparing students to solve complex problems requires 21st century skills, such as creative and critical thinking, collaboration and communication (www.p21.org). How do we develop 21st century skills in a mathematics classroom? Just as we need knowledge, skills and non-routine experiences to become an expert (or even competent) soccer player, these same ingredients are vital to building students’ 21st century skills, in mathematics. Students need structured practice of these skills and challenging experiences which put them into practice in non-routine mathematics-rich situations.

The focus of this article is to provide guidance on the development of classroom talk in a classroom over the year. Strategies are presented that were used by Kaye Bluett (pseudonym), an experienced Year 4 teacher, to improve five key skills of classroom talk: (1) active listening, (2) justifying and explaining ideas, (3) sharing incomplete ideas, (4) building on others’ ideas, and (5) questioning and challenging ideas.
Start with a supportive classroom environment

A classroom culture which encourages students to take intellectual risks is a critical factor to build confidence with 21st century skills (Allmond et al., 2016). Norms of accepted practices do not come about quickly, nor do they develop on their own (Webb et al., 2014; in press). Students struggle to know what, how and when to contribute to classroom discussion (Yackel & Cobb, 1996), or how to respond to peers appropriately. The development of classroom norms requires teacher guidance, positive encouragement, explicit teaching of expectations—and lots of practice.

If a teacher consistently judges student contributions as correct or incorrect, students are less likely to contribute incomplete ideas (Goos, 2004). To encourage risk-taking, the teacher could withhold judgement on students’ suggestions and elicit comments from peers (for example, strategies like hinge questions, Leahy et al., 2005). Students would then more likely offer conjectures and critique, eventually without teacher prompting.

In the beginning: Two foundational skills and four strategies

The teacher developed two foundational skills at the start of the year: active listening, and justifying and explaining to peers. Kaye Bluett used explicit strategies to help students understand the benefits of developing these skills. Kaye: “Having those strategies when things are not working .... [lets you] specifically target those elements.”

One strategy that Kaye Bluett used to develop classroom norms was to build a language structure around the practices she was expecting. She created posters with phrases to refer to during the year, such as expectations for quality ‘classroom talk’ and working collaboratively. The posters gave the class the language to explicitly talk about expectations and to identify positive examples.

<table>
<thead>
<tr>
<th>Classroom Talk</th>
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<td><strong>Active listeners</strong> reflect on others’ ideas</td>
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![Classroom posters.](image)

A second strategy Kaye used was to notice and reinforce positive examples. Kaye: “If you want classroom culture like this, you reward it!” Using students as examples to reinforce what she valued was a regular occurrence in Mrs Bluett’s class. For example, she reinforced how students were sitting when they were sharing their work with a partner.

Mrs Bluett: Now today I had two or three groups on the floor working brilliantly at classroom talk. So, congratulations to those six people. In fact, something Bill did, (then to Bill) you might want to share with everybody, what did you and your partner do for classroom talk?

Bill: Sat beside each other, and um, gives you more of an idea of the story.

Mrs Bluett: Yes, so they were sharing. And so instead of Bill sitting facing his partner, he and his partner actually sat side-by-side. ... So, when Jonah was reading, Bill could hear what he was saying but he could also see
what he was saying. So, he was actively listening, he was giving himself every opportunity to question what Jonah was saying and [being] an active contributor.

Kaye Bluett frequently used phrases such as “I like the way that students are...” when she saw good examples and she revoiced students’ contributions to develop and improve their language. Kaye went beyond discussing behaviours, and highlighted the implications of students being active listeners and confidently justifying and explaining their reasoning to peers.

**Practise, practise, practise**

Following this exchange, students were given a word problem to solve and then they presented their individual solution, evidence and representations to an assigned partner. Practising norms such as active listening and justifying and explaining reasoning was a third strategy that Kaye Bluett used in her classroom. Some student pairs sat beside each other (instead of opposite), adopting the practice validated earlier by Mrs Bluett. Shane and Ella (below), like most pairs, struggled and sat facing one another.

Shane: Then I wrote the grasshopper jumps one third each time, so it only needs to jump 12 times. The beetle has to jump 15 times and then I drew the grasshopper how it’s got, um, three quarters, I mean three—one third. And then with the beetle I wrote that it had one quarter.

Ella: I really like—
Shane: (interrupting)—and I wrote that the grasshopper was gonna win.
Ella: I really like all your information about it.
Shane: Mmm and we're done!

Ella practised active listening and tried to provide Shane with positive feedback. While Shane explained his reasoning, his final words (“we're done!”) indicated that he was not interested in hearing Ella’s solution. This pair, therefore, showed signs of emerging practices that could be built upon. As the teacher rotated between groups to listen to and give feedback on students’ progress, she paused the class occasionally to remind them that she expected everyone to be contributing and building on positive behaviours that she saw. A fourth strategy used by Kaye Bluett was regular reminders of expected norms.

As students’ skills improved, Kaye explicitly taught them how to present work to others and how to be an audience by giving them examples of prompts to learn how they might ask questions of their peers as an audience member.

- Tell us more about ...
- I agree/disagree with ... because ...
- Did you consider ...
- What convinced you that this was the answer?

Initially, students simply parroted the prompts at peers without much thought. Although clearly not the desired approach, these early, stilted attempts were important opportunities for building norms of classroom talk:

- They legitimised the practice of questioning peers and anticipating critique when sharing solutions and ideas, not typically norms in mathematics classrooms.
- The prompts assisted students in getting over the difficulty of breaching the silence following a presentation, lowering the risk needed to pose a question.
- Finally, student efforts provided a starting point from which the teacher could identify and reinforce positive examples of progress.
The examples given showed four important strategies that Kaye Bluett used in Term 1 to begin to build students’ skills in active listening and justifying and explaining to peers.

1. Explicitly teaching language to support norms, using posters and revoicing to assist with progress;
2. Noticing, sharing and reinforcing positive examples exhibited by students;
3. Providing lots and lots of targeted practice; and
4. Reminding students regularly of expectations.

Next, we show the progress of the class by mid-year, building on the first two skills (active listening, justifying/explaining to peers) with three more skills.

Maintaining and improving norms: Building more complex skills

Kaye Bluett taught these skills of classroom talk across all subjects, not just mathematics. After the first term, she identified where students were still struggling. “For me, the one that I think needs further development is this intellectual risk-taking and the sharing of incomplete ideas. … So, I guess that’s where I really want to keep pushing.”

In Term 2, students were addressing a mathematical inquiry in which they created the best path for a ‘walking school bus’. Students generated directions from their house to the school in Google maps, then went outside to create a physical representation of their collated class data. Mrs Bluett wanted them to go beyond their first idea of simply splitting the class into two groups: living close and far from school. She also wanted to maintain and improve their developing norms in classroom talk. In the exchange below, the teacher illustrated for students what it means to build on others’ ideas, a complex skill.

![Figure 2. Representation of class data.](image)

Mrs Bluett: What is the typical distance that students in [this class] live from school? If I look at the way that Chloe has organised our data can we answer that question now?

Chloe: Yes. (Pause) Not exactly.

Mrs Bluett: If I ask people how far they live from school, what would I expect the answer to be from what we’ve just seen here? Jinny?

Jinny: Maybe we should put the groups into 0.1 or 1 [km] sets. If we mix them all together it will be harder to organise.

Mrs Bluett: All right, at the moment can I say that students in [this class] typically live less than five kilometres from the school? …

Chloe: Yes you could!
Mrs Bluett: ...Why could I say it?
Chris: Because there’s more people in this [<5km] group.
Mrs Bluett: (Summarising) So I can say students in [our class] typically live less than five kilometres from the school. But Jinny is saying that I can make my answer better. Jinny wants us to make the answer better by doing what?
Jinny: By putting the 0.1 to 1 [km] people in a group.
Mrs Bluett: (To the class) Why would we want to do that? Doesn't this show us now? If we do what Jinny says, what will that help us see?
Chloe: That maybe a whole lot of this chunk is only 0.1 and that a lot of other people are three to four, or just under 5 [km]. ... What about the people who are just over, like 5.1? Like the two over there.
Mrs Bluett: I like what you're saying. This arrangement isn't really showing us how spread out it is. It is showing that anyone in here (pointing to the over 5 km group) can be between 5 and 12 kilometres.

Mrs Bluett reminded students of the question and acknowledged Chloe’s contribution as a starting point. She used the question again to prompt students to challenge and/or build on Chloe’s initial idea. Rather than be the only one to evaluate students’ responses, she encouraged others to respond as well. She rephrased the question and asked them to collectively debate if the current arrangement in two groups would allow them to answer the question, and if Jinny’s suggestion would improve their solution.

Mrs Bluett modelled a positive way to respond to ideas (“I like what you are saying”), co-constructed a solution process with the class and summarised how Chloe and Jinny’s suggestions challenged the original solution to the problem (splitting the class into two groups). With these actions, the teacher created an environment where students felt comfortable to take intellectual risks to share their emerging, incomplete ideas.

**Putting it all together: Independent classroom talk**

By the end of the year, students had mostly become independent in carrying out classroom talk, both with the whole class and in small groups. They were fluent in active listening and justifying their ideas. They had grown in confidence to share incomplete ideas and to build on the ideas of others. Finally, they were beginning to challenge their peers’ ideas, providing constructive feedback.

The class were addressing the inquiry question, “How long does it take to read a book?” (addressing ACMSP095, ACMSP096 and ACMSP097 in the Australian Curriculum: Mathematics). Through class discussion, they reformulated (mathematised) the question to one that would allow for mathematical investigation: “What is the typical time it takes for a Year 4 student to read a [chapter] book?” In the investigation, students worked in groups to record how long it took to read a chapter from a collection of chapter books, scaling the time up to the entire book, placing these times on a number line and then using this distribution to estimate a typical range of times it takes to read a whole book.

Students shared a draft of their findings with another group to seek feedback to improve their analysis, communication and representations. In this excerpt, Wes and Shane (Group 1) were offering feedback to Jake, Jonah and Emma (Group 2). The students were huddled around a draft poster and an iPad with a table of Group 2’s data (e.g., reader, name of book, number of chapters, time).
Wes: Can I give you feedback now? For your table, I was maybe wondering like, you could write, like be a bit more specific, like time to read a chapter and then like … total time reading the book in minutes or something. Because I don't really know what you're talking about.

Jake: I don't even get it [what we wrote]! (Mocking themselves for not showing this information.)...

Wes: But it was really good describing. On your diagram here, I really like how you made your answers [data] into colours and put it on [a graph], it really is easier [to read] now. …Um, what's like the pattern in your data? (A question the teacher often asked)

Jake: Um (pause while thinking)

Wes: Like range, spread. (Trying to clarify his question to support Jake)

Jonah: There. (Points at range of data in graph)

Jake: Well that's the range, but there's really like no shape because...

Jonah: ... because it just goes straight, a straight line...

Jake: Yeah there's no clump

Jonah: And that's the atypical data value (pointing to an outlier), that's kind of atypical (pointing to another point with a smaller gap from the main clump).

Shane: Put some borders in between the...

Wes: And you've got it really nicely set out.

Shane: Yeah, it's really nice, but put...barriers where most of the data is... because I can't see where it's bunched.

Wes and Shane provided genuine, specific feedback on how their peers could improve their presentation by constructively challenging the ideas presented in the poster. Wes’ language was respectful in telling the group that there wasn't enough detail to “know what you're talking about”. Jake's light-hearted response showed that he did not find Wes’ feedback a personal criticism. They also gave positive feedback on what their peers had done well, recognising the importance of both kinds of feedback. The students used vocabulary they had learned to describe distributions of data on a dot plot (range, spread, shape, clump, atypical) and ways to show an interval to estimate the answer (borders or barriers around “where most of the data is”).

While not all groups demonstrated this quality of exchange, most groups were functioning in a similar fashion independently, with the teacher rotating between groups. The students did not start the year with these norms of interaction, but through persistent and targeted scaffolding, they clearly improved over the year.

**Conclusion**

Whole class discussions like those illustrated in this article did not occur by happenstance. Mrs Bluett explicitly worked to extend students' developing practices to become norms by giving them opportunities to practise active listening, explaining and justifying to peers, and expecting there to be more than one way to do a problem. She consistently modelled her expectations, co-constructing and reinforcing more advanced practices when students were ready, such as sharing incomplete ideas, respectfully challenging suggestions, and building on the ideas of others, all of which required greater intellectual risk-taking. Kaye recognised that students had made progress in active listening and justifying in Term 1, but still needed further work in intellectual risk-taking.
Through the year, she gave them more opportunities to practise sharing and building on others’ ideas.

In summary, Mrs Bluett focused on five critical strategies over the year:

1. active listening;
2. justifying and explaining to peers;
3. sharing incomplete ideas;
4. building on the ideas of others; and
5. questioning and challenging ideas.

She began with the first two, which were foundational, by engaging in the following strategies in Term 1:

- Building a classroom language for what was expected (for example, with posters and restating students’ ideas or actions in terms of the language)
- Acknowledging positive examples of progress, often having students telling their peers what they did, to show she valued their efforts
- Lots of opportunities to practise
- Regular reinforcement and reminders

As students gained confidence, the teacher encouraged them to take intellectual risks and showed students how these skills helped them learn.

These excerpts from the beginning, middle and end of the year reminds us that productive classroom talk is not created quickly. In order to build towards the independence, there was explicit support undertaken by the teacher. Her commitment to scaffold students was critical for developing productive norms of classroom talk in her classroom.

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References


