‘ORCHESTRATING THE END’ OF MATHEMATICS LESSONS

Jill Cheeseman

Drawing mathematics lessons to a close is important with current approaches to mathematics education. This is difficult to do well because it involves much more than simply restating the mathematics addressed. Children are often encouraged to reflect on their learning and to explain or describe their strategic thinking. The end of the session also offers the opportunity for teaching after children have had some experience with a mathematical concept. Ideas can be drawn together explicitly to help children to see the purpose of the session. This paper draws from work in the Early Numeracy Research Project as well as from current work to discuss ending mathematics lessons.

Introduction

I was trying to think about why the end of the lesson is so important and why it is so difficult to do well. I think that the skill required is to ‘think on your feet’ to some extent to build what the children offer into a coherent whole, while at the same time keeping in mind a clear sense of the mathematical purpose of the day. I currently favour the metaphor of ‘orchestrating the end’ because it implies that there is a symphony to be heard if everyone plays their ‘part’.

Why focus on the lesson endings?

Mathematics teaching and learning has changed. In recent times mathematics lessons have become more complex in character and diverse in style. When
I was a child the style was quite straightforward and usually the same each day. My mathematics teachers explained some mathematics to the class and demonstrated a technique which students then used to complete a set of exercises. The answers were corrected and more examples were set as homework.

Today there is much less expository teaching and children are expected to behave as young mathematicians. Teachers set up learning opportunities with ‘rich tasks’ and expect children to grapple with the mathematical ideas that are presented in these tasks. Individual children respond differently to problems and teachers encourage a range of strategic thinking by students. Teachers know that solution paths to the same task are often different. Often teachers move around the classroom questioning individuals and groups about their thinking and engaging children in mathematical discussion. There is a need to bring the whole session together at some stage. With younger children this usually happens at the end of the lesson.

**Focusing on the end of lessons: Research project experience**

Most teachers are very skilled at introducing a task and having children engage with the mathematics they have selected for the day. They are also very skilled at monitoring, questioning, explaining, and generally teaching children by supporting their thinking as they engage with a task. However, when it comes to pulling the mathematics lesson together at the end of the session some teachers feel less than confident about their skills.

As a part of the overall professional development program in the Early Numeracy Research Project* (ENRP) the project team considered the design and implementation of effective mathematics teaching and learning. Elements such as ‘Starter sessions’, ‘Grouping for instruction’ and ‘Orchestrating the ends of lessons’ were the focus of workshops, discussion and analysis. One of the professional development cluster meetings focused on drawing mathematics lessons to a close. An anecdote from the classroom was used to stimulate a discussion about the purposes and essential features of this part of a lesson. The anecdote that was used appears later entitled ‘How many chocolates?’

After a conversation about the lesson described above, two additional questions were used to focus further discussion. These were, “Why do we get the children together at the end of a mathematics lesson?” and, “What are some of the features of a good ending to a lesson?”
A STORY FROM THE CLASSROOM

How many chocolates?

The teacher constructed some boxes which could hold 24 ‘chocolates’.

The teacher held up the box in one hand and a sample chocolate in the other. The students were asked to estimate how many chocolates would be in the box and to write it down.

The children were told, “Soon I will give you an empty box and three chocolates. How could you work out how many chocolates would be needed to fill the box?” The students in groups then discussed how they would go about solving the task.

The groups of students were then given their box and three chocolates, and invited to implement their method.

The point of the activity is basically to illustrate the multiplicative nature of the problem. In other words, even though it is possible to solve the problem by an additive method, by simply estimating and counting up the chocolates, a more efficient way is to work out the number of rows and the number in each row and to multiply.

During the conduct of the activity the teacher noted a particular child who was using a calculator to work out the answer.

The reason for choosing that student was to focus discussion on the mathematical point.

The student was then asked to explain to the class how she went about solving the problem. She explained how she had worked out there were four in each row, and how she worked out that there were six rows, and that she then multiplied using the calculator.

The teacher asked her why did she choose to multiply. She said that there are four groups of six.

Another student volunteered the information that it could also be thought of as six groups of four. There were other students who said there are two ways of doing the same thing.

The teacher then explained to the students that one way to work out the answer was to consider the number of rows and the number in each row and think of them as groups and so the answer can be found by multiplying.

Idea for discussion

Why did the teacher select only one student to report back? Why was the work of only one student focussed on in the lesson discussion?
Ideas from teacher-participants were summarised and compared with a few ideas drawn together by the university research team. Both sets of ideas are listed below.

**Purposes: Why do we get the children together at the end of a mathematics lesson?**

Some of the reasons for drawing a lesson together are to:

- gather evidence for a general finding, a conclusion or solution;
- summarise the work of the day;
- illustrate the central or important ideas with work samples;
- return to the purpose of the lesson and clarify for the students the aim;
- raise a general point from different activities;
- raise possibilities for future mathematical thinking.

The following is a summary of teachers’ ideas from cluster meetings. They said the purpose of gathering children together at the end of a lesson is to:

- review the focus of the session;
- share common discoveries;
- celebrate children’s learning in terms of; completion, polish and good mathematical ideas;
- report back;
- summarise and draw to a conclusion;
- learn from each other and examine thinking (including learning from errors);
- discuss different solutions;
- take ideas further to extend thinking;
- use the natural language of children to explain the mathematics;
- have children think and analyse the mathematics of the session and think about and articulate how they work things out;
- reinforce mathematical ideas;
- use as a teaching and learning time;
- use as reflection time when children think about what they have done and learned;
- enable children to learn from each other;
- provide opportunities to assess student learning; and
- allow for teacher evaluation of session effectiveness.
Features
The project team considered that good lesson endings:

• focus on the mathematical learning and may explicitly address the ‘big mathematical idea’ of the session;
• develop with students a sense of completion; and
• are short and targeted.

Teachers in cluster meetings considered that good lesson endings:

• interest children;
• develop mathematical understandings;
• build positive attitudes are enjoyable and engage children;
• challenge and raise new challenges;
• address different mathematical learning needs within the class;
• are quick and to the point;
• offer insights;
• go beyond the mathematics of the day;
• reiterate the purpose of the mathematics session; and
• give positive feedback for good ideas.

It is interesting to look at the ideas contributed by teachers here as they serve to emphasise the importance of the ending of a lesson. They also show the complexity of drawing a mathematics session to a meaningful conclusion.

Some useful teaching strategies to ‘cut to the chase’
Two teaching strategies that came from ENRP classrooms were presented at the same cluster meeting for general consideration and to stimulate teachers to share techniques that they use. These two strategies appear below.

1. As a preliminary statement to a sharing session one project teacher said, “I don’t want you to tell us what you did today, because we all saw that – tell us what you learned today.”

2. In another classroom a project teacher kept a book. It was plain paper bound together. After reporting results of the morning’s findings, the children decided which few ‘important ideas’ they wanted to write in their book. The teacher modelled the first important idea then wrote a couple of others suggested by her children.

ENRP Project teachers were asked to try these techniques as a way of drawing their lessons together if they were new to them. They were also encouraged to compile and document a collection of other useful techniques.
A variety of closure techniques was thought to be more interesting than using the same strategy every day.

**Research findings**

Case studies of effective early numeracy teachers in the ENRP (Clarke et al., 2002; Sullivan & McDonough, 2002) showed that while they used a variety of lesson structures, there were 14 common features in their practice. One of the common characteristics of these effective teachers was that they drew out key mathematical ideas during and/or towards the end of the lesson. For example,

> Throughout one of the lessons observed, Ms Grade 1 focused the children’s attention on key ideas related to measuring length. She focused on strategies for comparing lengths and starting points for measuring. At the end of the lesson, she asked the children to explain what they had learnt about measuring, and what they needed to remember about measuring. She also connected measuring lengths to identifying the properties of various shapes, and word-stems such as centi, tri and bi. (Clarke, Cheeseman, Gervasoni, Gronn, Horne, McDonough, Montgomery, Roche, Sullivan, Clarke, & Rowley, 2002 p. 90)

This extract paints a picture of the substantial teaching and learning opportunities that occur at the end of lessons. It also alerts us to the fact that drawing the class together to focus on the mathematics at hand can happen during the session as well as at the end of it.

**Recommendations**

The management style described in *Early Numeracy in the Classroom* (Department of Education, Employment and Training, 2001, pp. 36–40) shows a ‘daily numeracy block’ composed of a ‘whole class focus’ a ‘small group focus’ and ‘whole class share time’. It is the last section of the program outline that is of interest here. The whole class share time is elaborated in the following way:

> As the numeracy hour concludes, students are brought together for approximately ten minutes for whole class share time. They are encouraged to reflect upon and articulate the mathematics of the session and to celebrate the learning.
The teacher can use this opportunity to make explicit the mathematics used, and to encourage students to share their mathematical thinking. Student sharing can highlight various strategies used and emphasise connections between mathematical ideas that students have been exploring. It is also a chance to discuss problems that may be challenging students’ existing skills and understandings. (DEET p. 39)

When you read this document the lasting impression is one of sharing and it all seems quite easy to do. A close examination of the elements referred to – articulating thinking, highlighting strategic thinking, emphasising connections and so on – hints at a greater complexity.

**Sharing time or plenary or what?**

I think we must be careful in referring to the end of the mathematics lesson as a ‘sharing time’ even in casual conversation as the phrase clearly underplays the complexity and importance of this part of the session.

Sharing implies everyone contributing something. This may not be the case, certainly at the end of a lesson where it would be unwieldy for every child in the class to report.

Fleetingly children may share their work by simultaneously showing it to each other in a ‘sitting circle’ or forming work samples into the pages of a class book. The book is then read to the whole class as a summary of the session. However it is rare for every child to have the chance to ‘share’ on a single day.

Often teachers select individuals to describe their mathematical thinking so that with two or three speakers a range of strategic approaches to a task can be covered.

Maybe the end should be called ‘selected report back’.

Sharing also has the sense of children recounting what they did during the lesson. This is of much less interest than the mathematical learning that has taken place. The shaping and modelling of reflections on learning is far more complex and is best described by such words as ‘explaining’, ‘showing’, ‘justifying’ and ‘demonstrating’. Maybe this part of the lesson should be called ‘explaining time’.

In the United Kingdom curriculum developers refer to the end of the lesson as ‘the plenary’ to suggest a completion of the session. While it sounds more heavyweight than ‘sharing time’ it still is not quite the right term for me.
In conclusion

Whichever way it is expressed the critical issue is to think about drawing mathematics lessons to a close in the most effective and interesting manner. It is difficult to do well and quite complicated because it involves much more than simply restating the mathematics. It encourages children to reflect on their learning and to explain or describe their strategic thinking. The end of the session gives the opportunity for teaching after children have had some experience with a mathematical concept. It can draw ideas together and help children to see the purpose of the session.

Deciding how to conclude the lesson requires forethought and planning but it also requires some last minute modification during the lesson. These adjustments are made after watching children and listening to their
mathematical thinking so that their ideas can be incorporated into the wrap-up. Basically it involves using elements of children’s thinking to focus on the intended mathematical learning of the session.

Maybe it is because I have a fantasy about standing in front of a wonderful orchestra of skilled musicians and leading them to produce magnificent music that I like the metaphor of ‘orchestrating the end’ of a lesson. As with all metaphors it is not wise to push it too far but the idea appeals to me. It conjures for me a picture of an enjoyable, wonderful creation that is contributed to by all the ‘players’. It also appreciates that individuals contribute in different ways and that watching and listening to each other is important. The conductor knows exactly how she wants the music to sound and with practice the musicians can play all sorts of beautiful music.

Enough of the metaphor! Bringing mathematics sessions to a conclusion is an important complex and creative teaching skill.

Notes

* Early Numeracy Research Project (ENRP) was supported by the Department of Education, Employment and Training, the Catholic Education Office (Melbourne), and the Association of Independent Schools Victoria. Project Team: Doug Clarke, Jill Cheeseman, Ann Gervasoni, Donna Gronn, Marj Horne, Andrea McDonough, Pam Montgomery, and Anne Roche (Australian Catholic University), Peter Sullivan (La Trobe University), Barbara Clarke and Glenn Rowley (Monash University)

References

