Finding a need for measurement: The case of the alien’s underpants

Jenny McGuire and Katherine Evans use story to explore measurement with young children.

What would you do if you arrived at school one morning and found a giant pair of underpants hanging on the climbing frame in the playground? This was the problem that faced Jenny McGuire and her class of 6- and 7-year-old children one autumn morning. Where had the underpants come from? Who did they belong to?

The children, who had just been reading the story Alien’s love underpants (Freedman and Cort, 2007), suggested the underpants must belong to an alien, a visitor from outer space who had carelessly left them behind. On closer inspection, they found they were right. Attached to the pants was a label. It read, “If found please refer to The Alien Pant Directory to locate the owner of the pants.” (see figure 1).

The children were asked, “What did the owner of the pants look like?”

“I think they’re made out of pants and have a very big bottom”, said Amy, giggling. Alexander offered, loudly, “I think it has 11 mouths and is gooey and green and has 2, no, 5 ears.”

The children agreed with Jenny that they needed to find out who the underpants belonged to. But they had a problem. How were they going to find the owner? Sophia suggested, “We can make a map, like a treasure map to find the way to their house.” Amy wondered, “Could we take pictures of the pants and make signs and put some of the signs in space?” Jenny noticed there was a clue in the wording of the label. “What do you think the Alien Pant Directory could be?” she asked.

Simon and Charley thought it could be a bit like a pants museum where all the aliens in the world are and their pants. Jenny explained, “That’s right, the Alien Pant Directory lists all the aliens in the universe and the sizes of their pants. You see every alien has a unique pant size, so we can use that to find out which alien these pants belong to. So, we know we need to use measurement to help us, but how do we find out how big they are?”

The children suggested they would need to measure the pants to find out to whom they belonged. This was the start of the children’s week of mathematics lessons focusing on measurement. More of alien underpants later. Firstly, we will explore the context from which this sequence of lessons emerged.

How do we grow mathematicians?

Our series of lessons emerged as part of a project exploring possibilities for reimagining teaching and learning in relation to primary level mathematics. The project was a collaboration between St Andrew’s Church School in Bath, Alf Coles from the University of Bristol and the charity $5 \times 5 \times 5 = creativity$. This charity supports the development of creative pedagogy in schools and is inspired by the Reggio Emilia pre-schools.

Alf’s research into learning number (see, for example, Coles, 2014) suggested that there may often be far too empirical an emphasis in the early years of primary school mathematics. He wonders if children are more comfortable with abstract thinking than is often assumed.

Alf worked with the class once a week in the Autumn term, using tools such as the Gattegno chart and Cuisenaire (TM) rods. The aim of the work was for the children to “become mathematicians”, realising their own capabilities in terms of asking questions; noticing patterns; making conjectures; following their own lines of enquiry and exploring their own ideas and ways of recording and documenting mathematical processes. An important element of this project was the opportunity for reflection on learning, so the team met together after each session to reflect on...
the learning that was occurring for both adults and children. Through these reflective discussions, a series of principles emerged, focused on particular processes of teaching and learning that appeared to support the children in “becoming mathematicians”. These principles, which overlap each other, included:

- **Fluency**: Children need the opportunity to visit and re-visit ideas, skills and knowledge on a regular basis and in different contexts, building their confidence and fluency with particular methods and mathematical concepts.

- **Collaboration**: We strive to create a balance between collaborative and individual work. Where possible children should have choice in how they work, building the confidence and resilience to work both on their own and with others in their mathematical activities.

- **Scale**: Children need opportunities to work at different scales, not being limited by the size of their mathematics workbooks. Using the classroom as a canvas for their learning they benefit from opportunities to work on the walls and floor. Working on a large scale makes children's working processes more visible to each other, enabling them to use each other as a resource within their mathematics lessons.

- **Becoming a mathematician**: Children need regular opportunities for exploring links within their mathematical experience, through reasoning, problem solving and pattern spotting.

- **Exploration**: Children need to explore, test and apply knowledge and skills within open-ended contexts. They should have opportunities to follow their own lines of enquiry within a constrained and structured context that will inevitably involve them in practising newly acquired or taught skills.

- **Adult roles**: How are adults best used within sessions? Adults can take on many different roles, including those of teacher, collaborator and co-enquirer. These roles will change depending on the context.

- **Ways of learning**: Children need to be exposed to concrete, pictorial and abstract representations of ideas and concepts at all times.

- **Choice**: Offering children a sense of choice can be powerful. This may include how to access a problem and how to represent ideas and findings. Some parts of a session may be more prescriptive involving discrete teaching, but this can be balanced with elements of choice for the children.

- **Provocations**: The first session in a series can be about “finding the spark”, using a particular provocation to get the children excited about something before starting to teach specific skills and knowledge. This spark can create a real desire to learn and apply skills. This may be achieved by connecting mathematics with other areas of the curriculum, for example, integrating the arts or literacy into planning for mathematics.

So, returning to alien underpants, we can explore these principles in action. The following transcripts and images are taken from across a week, as the children pursued their enquiry, solving the problem of who to return the mysterious pants to. Each of the extracts below illustrates one or more principles in action, demonstrating how they supported and enhanced children's learning in this context.

### Session 1: Exploring measurement

The children set about working out who the underpants belonged to. They decided to measure the pants in order to match them with their owner in the Alien Pant Directory. They discussed their ideas about measurement.

**Sam**: It’s counting up the size of an object.

**Jasmine**: You don’t just have to measure upwards you can measure to the side as well.

**Charley**: You have to use objects and see how long or short things are and that can give you the exact size.

**Sarah**: You could use a tape measure or ruler or something not meant to do it like the birthday balloons or school council badges.

**Freddie**: You could use yourself, you could lie down and ask your friend to measure you.

Jenny explained they were going to explore measuring the pants using all sorts of different things. She challenged the class to use different objects to find out as much information as they could about the size of the pants and suggested the children record their findings on the walls and tables, which had been covered in paper, so that they could share what they were noticing with the whole class (see figure 2).
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At the end of the session, the children described what they had discovered.

Ali: I found out the leg was 139 cubes long.

Jo: I used the very long ruler and it was 27 length.

Sophie: It was 7 long at the top … 7 starfish long.

Jenny wrote the children’s measurements on a pair of pants she had drawn on the board. Looking at the collections of measurements, she said to the children, “I’ve spotted a problem. We have lots of different numbers and measurements for the same thing. Why do you think that might be a problem?” Charley replied, “You might have different centimetres and lengths and then you won’t know which one to pick.” Building on Charley’s answer, Jenny explained that, based on what the children had discovered through their explorations, the next step would be to explore ways of standardising their measuring.

Session 2: Measuring consistently

The second session provided the opportunity to explore measurement using a standardised unit. The children explored using rulers as tools for consistent measurement. They worked in pairs to measure parts of their bodies, discussing what they were noticing about the rulers as they did so.

Sam: I spotted that ruler has 2 sets of numbers.

Sophie: The bottom set are inches, it only goes up to 12 and you can’t fit as many numbers in because there is more space between them. The other set has more numbers but smaller spaces and they are millimetres and centimetres.

Jenny asked the children to experiment with standardised measurement, estimating and measuring the height and width of a series of aliens to the nearest centimetre (see figure 3). The children experimented with finding measurements for the height and width of different sized and shaped aliens. As they measured, they were encouraged to talk about what they were noticing. Measuring the purple alien, Euan looked at the numbers and lines on his ruler. Measuring the height, he said, “It’s closer to 5 than to 6 so I’m going to say it’s 5cm.” When he measured the width he said, “I’m doing it at the widest part.” Measuring the green alien, Euan remarked, “It’s tricky to measure because it’s a curve. I think I’m going to measure just above on the straight bit.”

Session 3: Making learning visible

The third session in this sequence was introduced as “Alien wash-day”. The children were told that the aliens had delivered lots more pairs of pants, which needed to be pegged onto the washing line to dry. To peg out the washing, the children would need to use their knowledge of measurement and their new understanding of using standard units.

The children were invited to populate the room with number sentences, made by measuring pairs of pants, recording their width and showing which was bigger, which was smaller or whether they were the same (see figure 4).
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As the children worked, they observed and explored what the others around them were doing, pegging their work on the washing lines so that others could use it as a resource for their own learning. Once all of the alien pants had been hung up, the children began to make their own. Tommy made one big pair of pants and one tiny pair. He described what he had made, “I’ve made a tiny pair of pants, only 1cm.”

**Session 4: Becoming a mathematician**

The final day of these sessions introduced the children to the Alien Pant Directory (see figure 5). This was the opportunity to revisit and use the knowledge and skills the children had developed throughout the week to solve the problem of who the giant pants belonged to.

The children saw how the Alien Pant Directory listed all the different aliens along with their height, the width of their pants and the width of their pant buttons. On the tables around the classroom there were lots of different pants for the children to measure and to match to the aliens in the directory. Once they had done this, they could have a go at measuring the giant pair of pants they had found in the playground to see if they could discover which alien they belonged to.

At the end of the session, the children worked together to agree on a final set of measurements for the giant alien underpants. Measuring with a combination of metre sticks and 30cm rulers they collaborated to find measurements for the width and height of the pants and the width of the button. Having taken their final measurements, and compared them to the Alien Pant Directory, the children agreed that the giant pants must belong to Moo. To check if they were right, Jenny asked the children to call Moo’s name and see if he responded. Beginning with a whisper and gradually getting louder the children called Moo into the classroom. When Moo appeared, performed by a teaching assistant, the children excitedly told him they had found his pants. Jenny explained to Moo, “We used the Alien Pant Directory to track you down. Do you know if these pants belong to you?”

Jenny asked two of the children to help Moo try on the pants, which they discovered fitted perfectly, giving themselves a big cheer and round of applause (see figure 6).
Reflections on ways of working

At the end of the year Jenny met with Alf to reflect on the year and what she had or had not found useful in her teaching. She commented that amongst the most powerful of the principles had been collaboration and scale, in terms of making children’s work constantly visible to each other. The article ends with Miss McGuire’s words from an audio recording of that meeting, looking back at the principles and what she had derived from the project.

“The impact on the children has been that they just talk a lot about maths. ... The conversations they are having are quite natural now. We haven’t now had to scaffold that conversation as we did at the beginning of the year. My perception is that sometimes, for some of my middle [attaining] children, having that little boost of being able to talk to someone about something seems to have really supported them. It’s something they seem drawn to … it seems to have built their confidence in maths.

Even in the exploration part you can already see them talking more, sharing information, seeing things, so already that process of collaboration has started. For me, the exploration was really important, collaboration, scale of things and all linking into becoming a mathematician, talking about maths and working through it. The work that we did with the Gattegno chart, spotting patterns, I do really feel that pushed my higher attaining children. They were shouting out about the patterns they’d spotted. They’re just getting so excited when they make those interconnections and they can see things working for them and they can see that they can apply it further and further and work with bigger and bigger numbers. They’re getting really excited about it, the pattern spotting in particular.

The element of choice is really clear. Some of them do choose to work by themselves, but some choose to work with others and you can see the support, the scaffolding that gives less confident children. It was interesting to see who was drawn to different methods. It was also interesting in some ways to see the limitations of the concrete materials, because for some children they knew that they had to separate the piles to work out the fractions, but in some cases it was the inaccuracy of the counting, which meant they were let down at the last moment almost. In a really simple way, I can see that keeping all of these options open all of the time, they might be drawn quicker to the abstract if they find they’re frustrated by the fact that they’re not getting it from the concrete.

I was constantly dipping into the principles and trying to get them present. I feel the children really responded well to it and I see a shift in the way that I teach. I think with the packed curriculum, there always is a pressure to get to the objective as quick as you can. It was quite a learning curve for me to give that time to the process. The tasks that we set were exploration and they were play, but they were carefully crafted so that we could find some information out. I think that’s the difference, you’re setting something so you know where you’re going with it. It’s a really valuable part of the assessment process.

My perception of it [children presenting their ideas] is that it really picks up the early years principles that assessment is watching what’s happening and responding quickly. I suppose where the work is so visible and the conversations are so rich, as opposed to working quietly in your books, it gives me so much more time actually to assess as I’m going”.

Discussing the work explored with Alf across the year, in particular the work with the Gattegno chart, Jenny commented that working with these strategies had a noticeable effect on her “lower-attaining” children. She reflected on an example of a child who, with the support of the Gattegno chart, was able to divide numbers confidently by 10.

“When she was able to divide by ten, that was a huge moment for me as a teacher. It was a wake up for me to remember never to put a ceiling on things, to keep it open. If you’d said to me would she be able to divide by ten I’d have said no … whereas she really took it and ran with it, where sometimes she can find simple calculations difficult. It was really good for me as a practitioner to see that and remember that”.

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References


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