Extract from *Teach it! Do it! Let's get to it!* (Goldsworthy and Holmes, ASE bookshop) used with permission.

Teaching Children in Y 3/4
how to measure forces with a Newtonmeter
how to select an appropriate Newtonmeter for the task

Using these skills in an investigation
"Which thread is strongest?"

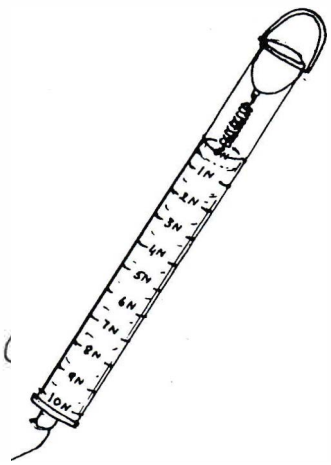
Health & Safety:

Teachers always need to risk assess practical activities for their children and defer to their health and safety advisor for the most up-to-date source of health and safety guidance. This training cannot be relied upon as source of health & safety guidance.

Before the investigation

Measuring forces with a forcemeter

In order to remind the children about forces, we first carried out some physical actions. We asked the children to turn to their next door neighbour and to give each other big pushes and pulls using their hands. Next we asked them to give each other small pushes and pulls using only their little fingers. This established that forces [pushes and pulls] can be different sizes. Next we introduced the children to the forcemeter using the 0–10 N forcemeter which has a scale going up in simple whole numbers [see below]. We described the Newtonmeter as a 'pull meter' – in other words a piece of equipment that is designed to tell you the size of a pull force. Various children were asked to pull down on the Newtonmeter with a certain force for example, "Give me a 6 Newton pull," or "Give me a little 1 Newton pull." We also showed them how to write down a measured force, i.e. 6N.



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Selecting an appropriate Newtonmeter for the task

Next we wanted the children to realise that Newtonmeters had different scales and that some were better for measuring small pulls and some were better for measuring large pulls. So that every child could see the scales at the same time, we placed the Newtonmeters on the photocopier and photocopied them. We used the resulting sheet to discuss the different scales.

We asked the children to look at the bottom number on each Newtonmeter and tell us what was the biggest pull that could be recorded on each one. We then asked the children questions such as "I want to measure the pull needed to make this little matchbox move." "Will it need a big or little pull?" Which Newtonmeter should I use?" Some of the children then went on to complete the following worksheet.

Choosing the right forcemeter

Which forcemeter should you use to move these objects?
Choose from 0 - 1 N, 0 - 2 N, 0 - 5 N, 0 - 10 N, or 0 - 25 N. ,

Object	Predict how many Newtons to make it move	Which Newtonmeter would you use?	Force needed to move it
Pencil Case	3N	0-5N A	0 2N
Shoe	3.5 N	0-5N A	1.N
Book	1.5N	0-2N D	0.4N
Box	4N	0-5N A	0 1 N
Bag	4 iN	0-5N A	4N
Door	9 N	0-10 N C	10N

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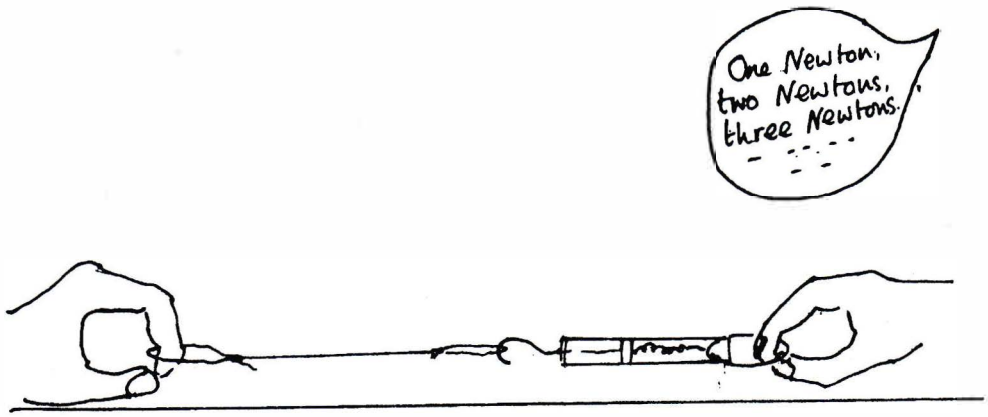
Applying the skills in the investigation

The class had been investigating properties of materials and knew that strength was an important property to consider. We told them that they could investigate the strength of some different threads by looping them over the forcemeter and pulling until the thread broke.



We showed that a similar thread, [yellow wool] needed a force of about 5N to break and asked them to say which forcemeter they would use for the investigation. As the break happened so quickly it was often difficult to determine the reading. We decided that the best strategy was for one child to call out the Newtons as the pull increased. The last mentioned value was the one given for the breaking force for the thread. We put the children into groups of four and gave each group a large table to write down their results. We told them that there were four jobs to be done, holding the Newtonmeter, pulling the thread, calling out the Newtons, and recording the result. As there were four threads to test, each child had a go at each job. All groups of children used the Newtonmeters confidently and recorded the reading correctly.

After this, the children wrote down the results on their own individual table [see below] and the class then came together for a discussion.

Which thread is the strongest?

We will change the threads

We will measure which thread is the strongest.

This is what we will do.
We will tie each thread to a forcemeter. We will pull the thread until it breaks. We will measure how much force is needed to break the threads.

Which Newtonmeter do you think we should use? -10 N

T e of thread	Force needed to break it
pink acrylic	6 N
white cotton	8 N

Which thread is the strongest?

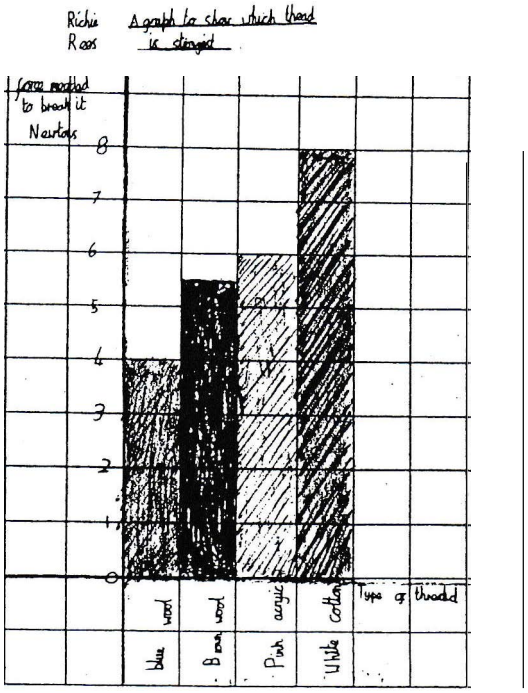
We will change the thread

We will measure which is the strongest thread

This is what we will do.
We will tie each thread to a forcemeter. We will pull the thread until it breaks. We will measure how much force is needed to break the threads.

Which Newtonmeter do you think we should use? 0 – 10 N

Type of thread	Force needed to break it
blue wool	4 N
Brown wool	4 5 N
Pink acrylic	6 N
White cotton	8 N



Although not a focus for the investigation, we went on to consider the class's results. Everyone agreed that the white cotton needed the largest force to make it break but we realised that each group had slightly different results. We considered why this might be. The children offered various suggestions such as differences in the Newtonmeters, or the way the equipment was held, or that different threads were of slightly different lengths.

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