Figure 1 Objects to be tested are placed in the centre of the frame

Could using frames make science more accessible for children with special learning requirements?

Sam Kenny tries out the Primary Science for All 'Frames for Focus' approach

I work in a Tier 4 psychiatric hospital school. My class is very small, with pupils arriving in crisis due to an acute psychiatric illness, mostly psychosis and anxiety-related disorders. Their stay in hospital can vary from a few weeks to months. Unlike most schools, almost as soon as the pupils arrive, I am thinking about how I can support them to integrate back into full-time education. This generally means supporting re-engagement in teacher-directed learning and working more independently.

Science is difficult to teach, particularly as a whole-class subject in my setting, as individual pupils' needs are too diverse. On a bad day, this can make me feel very deskilled; I always thought I could do more to support engagement. So, when Sheffield Hallam University, funded by the Primary Science Teaching Trust (PSTT), offered me the opportunity to join their Primary Science for All project, using tools called *Frames for Focus* and *Wonder Cupboards* to help with the engagement of special educational needs pupils in science, I was keen to join.

How it works

Fast-forward nearly two years. I found that putting a frame (in my case a paper A3 frame) around an object or objects seems to help focus attention on the object or objects, for example when testing which materials might float or sink (Figure 1). If the objects are placed in a frame it automatically sets the boundary and focuses attention on those objects. Children know this is all they are working on. For those who are quite rigid in their learning and do not like open-ended investigations, this seems to reduce anxiety and help engagement.

By adding instructions in each corner, the frame becomes a tool to help organise the pupils' learning. Therefore, as well as indicating what the lesson will be focusing on, the frame provides a boundary to the investigation, making it 'closed', with instructions naturally 'chunking' the lesson into four sequenced tasks (one for each corner of the frame). The frame then directs the order of the tasks.

This has had two benefits:

- **For children who are chaotic and jump straight into an investigation, the frame provides a sequenced methodology to carry out an investigation.**
- **For children with limited concentration, the frame helps them remain engaged for longer. By saying, '*only two more*', I can focus children's attention back to the lesson. If a child is really struggling, I can say '*just try and finish this task and we can come back and finish the others later*'. The 'chunked' tasks provide a natural place to pause.**

One measure of success is engagement through completion of the tasks set out in the frame. The frame allows pupils to see what success will look like by knowing what they have to do, that is finishing the four parts of the frame. Starting and finishing a piece of work increases self-esteem and encourages pupils to feel better about themselves as learners. To support success, I have personalised the frames to incorporate individual needs and interests. This includes differentiating the work and the language and using motivational pictures that build-up upon completion of each task (Figure 2).

In addition, for those

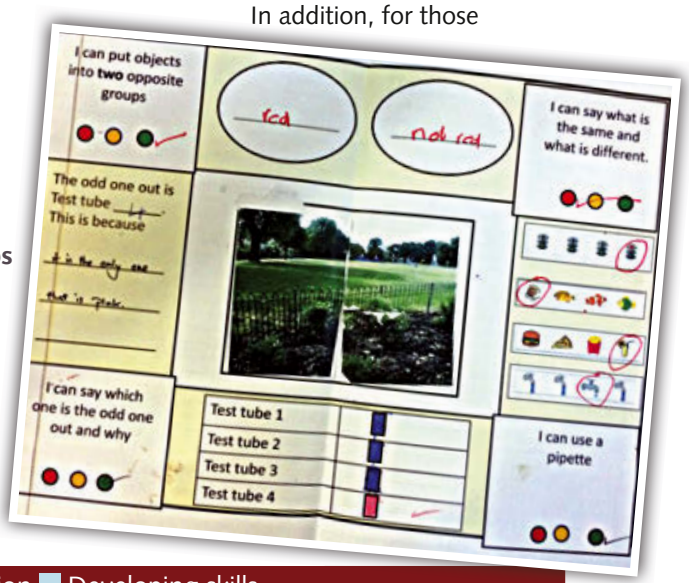

Figure 2 One part of the motivational picture is given on completion of each task

Key words: Hospital school | Progression | Developing skills

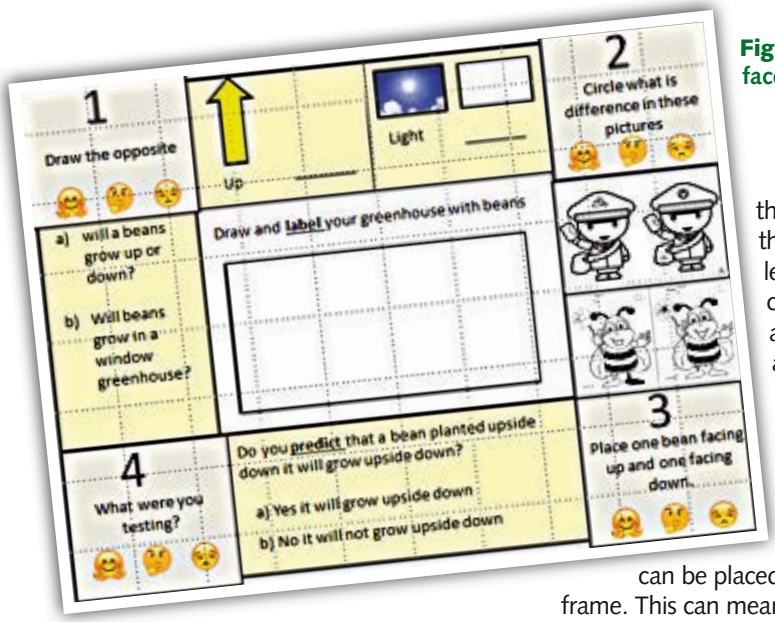

Figure 3 Using smiley faces after each task

children who find following verbal instructions difficult, I have found that having a repetitive format can lessen the need for verbal instructions. This reduces anxiety about what to do, which helps with engagement and allows children to work more independently.

The main benefits of the frames

In my class setting, the major benefits of the frames have been that they:

- **support personalised learning;**
- **allow a child to work individually at their own pace.**

Each child gets their own frame so they can work at a pace that suits them, while all doing the same topic. If they are having a difficult day, the disruption to the learning of others is now much less. As a result, I feel less deskilled.

There is still the difficult balance between when and when not to use the frames. Using the frames in all lessons can be counterproductive as they lose their appeal. The children become 'framed out'. I tend to use them just for science, in particular lessons where something can be placed in the centre of the frame. This can mean having frames of different sizes.

Self-assessment

Another area where the frames might help is in pupil self-assessment of individual tasks. After going to a workshop on Teacher Assessment in Primary Science (TAPS) developed by Bath Spa University, I added smiley faces to the frames (Figures 1and 3). Above the smiley faces I added an '*I can …*' statement.

Although the pupil assessment provides useful information, I am mindful it might not always be recording pupil assessment of their learning. When a child circles a smiley face, does it mean they understood the lesson, found it unthreatening or wanted to please me? Equally, if they circle a sad face, does it mean I might have to go over the work again, show how they felt about themselves as learners or how they felt about me trying to get them to do a lesson? It perhaps highlights the tension between what I am trying to assess and what a pupil might want.

An organisational tool

Although the frames can help focus attention, sequence tasks and reduce anxiety, thereby aiding engagement, gradually I have come to see the frames as more of an organisational tool from which other strategies can be employed. For example, the frames easily support a kinaesthetic approach to teaching science. This approach is less anxiety provoking and for children who come from a Moderate Learning Difficulties (MLD) background is quite familiar.

Similarly, for those pupils who need to be in control, often driven by a fear of failure, the frames can be linked to a '*this first … then*' approach. The frames allow a pupil to see what they have to complete before they can have a reward. I have found this helps them follow teacher-directed learning. By doing the work they gradually become more prepared to make mistakes and 'have a go'.

The spin-offs

Lastly, the project has inspired many useful spin-offs. Although many of these spin-offs led to dead ends in my frame designs, each one has given me additional information. The two most useful, outlined below, have been:

- **how to sequence progression in learning;**
- **how to measure engagement.**

With an ever-changing cohort of pupils, I find it is too easy to overestimate conceptual understanding or become complacent and just do what I did last time. Equally, it is easy to assume lack of engagement is purely because the pupils are ill.

Spin-off 1: Mapping progression

I have a lot of pupils who, for many different reasons, can be too anxious to take part in a lesson. If the work looks too hard or they think it will be too hard, it can be rejected. I wanted the frames to provoke as little anxiety as possible. They should start with what a pupil can do now, not what they could do before they became ill. Ideally, I wanted a child to be able to achieve about three-quarters of the work, with only the last quarter being more challenging. This also allows for a degree of 'over-learning', which can help those who suffer with short-term

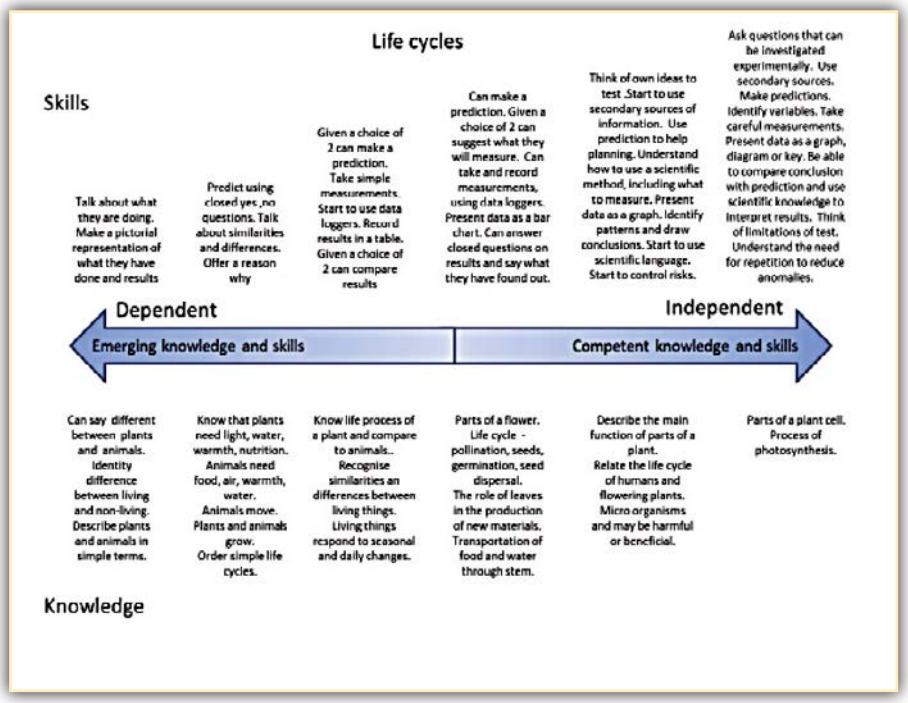

Figure 4 Assessing conceptual progression against dependency within a topic

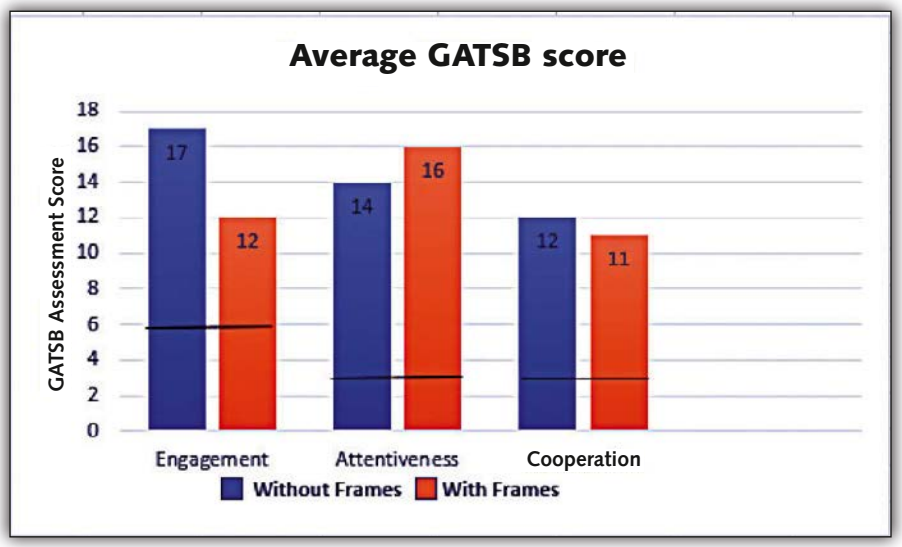

Figure 5 Engagement results using GATSB scoring comparing lessons with and without using frames. The black lines are the average score for year 4 (age 8–9) pupils. Above the line shows lack of engagement, attentiveness and cooperation.

memory difficulties. To map conceptual progression in key science topics I used *Connecting Steps* produced by BSquared and linked it to level of dependency as a learner (Figure 4). This has helped me gauge where my pupils are at as learners, which in a hospital setting can change as medication regimes change.

Mapping learning progression is very useful in terms of thinking where to pitch a lesson and what will come next. Yet, I found it too prescriptive following the format of three tasks that they already know and one task that is new, when teaching science. This format worked very well in maths, which tends to be discrete tasks each linked to the same theme. In science, when using the frame, a lesson is sequenced into four tasks that are all connected to complete the lesson. I found linking the frames to a more kinaesthetic approach much more useful and achievable.

Spin-off 2: What causes lack of engagement?

In an attempt to measure engagement with and without the frames over a month, I became interested in why some children struggled to engage in science lessons. An obvious answer was their illnesses, but I wanted to know what specific areas of engagement they found difficult.

Children and parents are asked what subjects they like at school on admission into hospital. Science is one of the most popular. Although they often have patchy knowledge of science topics as a result of informal learning, they are curious and really enjoy the hands-on aspects of investigations. Many of the children have quite specialised vocabulary and amazing memories for facts when they start at our school, implying they do have the ability to learn, even informally.

To unpick further why these children might struggle to engage in science lessons, I measured engagement in lessons over a month using Glutting and Oakland's (1993) *Guide to the assessment of test session behavior* (GATSB). The findings suggested most of these children lacked an ability to persist with a task and gave up easily (lacked resilience), lacked confidence, and had an inflexible approach to their learning.

I measured engagement in four lessons, two lessons using the frames and two without. The results did show a slight increase in engagement when using the frames (Figure 5). During this period, however, some of the children had medication changes that had a major impact on how they presented in class. One boy suddenly became much more impulsive, controlling and less willing to follow teacher direction and complete work. Although the GATSB showed a slight increase in engagement when using the frames compared to not using them, there were too many variables to regard this as significant, such as:

- **the topic;**
- **how the work is presented;**
- **medical treatment by the hospital;**
- **other strategies used to support engagement.**

Overall, there has been a greater engagement in science lessons. The GATSB results suggest that the frames by themselves are not enough; they need other supporting strategies. The frames are a very useful organisational tool I use with other strategies to support engagement and learning.

Have frames worked?

In my setting, The frames have been very useful. They have:

- **focused attention on what is going to be taught;**
- **set a boundary for what is going to be covered;**
- **chunked and sequenced a lesson into four manageable tasks;**
- **allowed pupils to work individually at their own pace;**
- **allowed for some pupil self-assessment of their learning;**
- **supported other strategies to help engagement in science.**

Frames in conjunction with other strategies have resulted in greater engagement in teacher-directed learning. Although all the different variables that affect a lesson cannot be separated, using a 'Readiness for reintegration scale' developed by McSherry (2001) indicates that all my pupils have improved.

What next?

I would like to capture the child's voice, as they are the ones using the frames. Do they feel that the frames and supporting strategies are making engagement in science easier and if so how?

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